

# **SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

**Three Years- Six Semesters Bachelor's Degree Programme**

**3 Years B.Sc. /4 Year B.Sc. (Hons) & 4 Year B.Sc. (Hons with Research) Programme**



*Faculty of*  
*Science and Technology*  
*(Science Group)*

Subject: **ELECTRONICS**  
(Semesters I and II)

**Effective from Academic Year 2026-27**  
**(As per Uniform NEP 2020)**

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**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
**FACULTY: Science and Technology**  
**Subject: ELECTRONICS**  
**Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)**  
**Three Years / Four Years - (Six/ Eight Semesters) Bachelor Degree Programme**

**Examination, Evaluation and Assessment Scheme**

| Vertical No. | The Vertical               | Mode of Examination & Evaluation Assessment | Theory                                                                                                                                                                                                                                                                    |           |                  |           |           | Theory (Total) |           | Practical |           |                  |           |           |           | Practical (Total) |  |
|--------------|----------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|-----------|-----------|----------------|-----------|-----------|-----------|------------------|-----------|-----------|-----------|-------------------|--|
|              |                            |                                             | External                                                                                                                                                                                                                                                                  |           |                  | Internal  |           |                |           | External  |           |                  | Internal  |           |           |                   |  |
|              |                            |                                             | Max Marks                                                                                                                                                                                                                                                                 | Min Marks | Durati on (Hrs.) | Max Marks | Min Marks | Max Marks      | Min Marks | Max Marks | Min Marks | Durati on (Hrs.) | Max Marks | Min Marks | Max Marks | Min Marks         |  |
| A            | Major                      | External & Internal                         | 30                                                                                                                                                                                                                                                                        | 9         | 2                | 20        | 6         | 50             | 20        | 25        | 10        | 4                | 25        | 10        | 50        | 20                |  |
|              | IKS Major Specific         |                                             | 30                                                                                                                                                                                                                                                                        | 9         | 2                | 20        | 6         | 50             | 20        | --        | --        |                  | --        | --        | --        | --                |  |
| B            | Minor                      |                                             | 30                                                                                                                                                                                                                                                                        | 9         | 2                | 20        | 6         | 50             | 20        | 25        | 10        | 4                | 25        | 10        | 50        | 20                |  |
| C            | Generic/ Open Elective     |                                             | 30                                                                                                                                                                                                                                                                        | 9         | 2                | 20        | 6         | 50             | 20        | --        | --        |                  | --        | --        | --        | --                |  |
| D            | VSC                        | Internal                                    | ---                                                                                                                                                                                                                                                                       | ---       |                  |           |           |                |           | --        | --        |                  | 50        | 20        | 50        | 20                |  |
|              | SEC                        | Internal                                    | ---                                                                                                                                                                                                                                                                       | ---       |                  |           |           |                |           | --        | --        |                  | 50        | 20        | 50        | 20                |  |
| F            | Internship/ Apprenticeship | Internal                                    | Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately |           |                  |           |           |                |           |           |           |                  |           |           |           |                   |  |
|              | FP/CEP                     |                                             |                                                                                                                                                                                                                                                                           |           |                  |           |           |                |           |           |           |                  |           |           |           |                   |  |
|              | CC                         |                                             |                                                                                                                                                                                                                                                                           |           |                  |           |           |                |           |           |           |                  |           |           |           |                   |  |

**Internal Assessment for Theory/ Practical/ Laboratory:**

All the internal assessments should be conducted on the basis of Continuous Assessment Tests (CAT).

***Continuous Assessment Tests (CAT):***

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

- Three CAT each of 10 Marks (Theory) and 10 Marks (Practical).
  - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
  - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
  - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days. .
- Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.
- Total Performance in CAT (i.e.40 %) shall be based on the best two out of three in CAT examinations
- Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

**External Assessment for Practical (Major/ Minor Lab):**

- Practical Performance : 20 Marks
- Viva-Voce : 05 Marks
- **Total** : **25 Marks**
- Duration of Examination : 04 Hrs.

**Internal Assessment for Practical (Major/ Minor Lab):**

- Internal Assessment based on CAT : 15 Marks
- Record Book : 10 Marks
- **Total** : **25 Marks**

**Internal Assessment for Practical (SEC/ VSC Lab):**

- Internal Assessment based on CAT : 20 Marks
- Record Book : 10 Marks
- Attendance : 10 Marks
- 10 MCQ/short Question : 10 Marks
- **Total** : **50 Marks**
- Duration of End Semester Examination: 04 Hrs.

*Note: The external assessments of theory courses will be conducted in accordance with the guidelines issued by the SGBA University.*

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

**FACULTY: Science and Technology**

**Subject: ELECTRONICS**

**Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)**

**Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme**

**FIRST YEAR: Level 4.5 - SEMESTER – I (T & L Credit Scheme)**

| Mode of Teaching                                           | Vertical Number | The Vertical                                                     | Type of Course   | Course Code | Course Name                                                                                                                           | Credits   | Workload (Hrs/Week) | Vertical Workload (Hrs/Week) |
|------------------------------------------------------------|-----------------|------------------------------------------------------------------|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------|------------------------------|
| Classroom Teaching / Lab Work (Practical)/ Outdoor / Field | a.              | Major (Electronics)                                              | Theory1          | 113201      | Fundamental of Electronics                                                                                                            | 2         | 2                   | 6                            |
|                                                            |                 |                                                                  | Lab/ Practical 1 | 113202      | Practical based on Major Theory 1                                                                                                     | 2         | 4                   |                              |
|                                                            | b.              | Minor (Other subject in combination with Electronics)            | Theory 1         | 113201      | Fundamental of Electronics                                                                                                            | 2         | 2                   | 6                            |
|                                                            |                 |                                                                  | Lab/ Practical 1 | 113202      | Practical based on Minor Theory 1                                                                                                     | 2         | 4                   |                              |
|                                                            | c.              | Generic/ Open Elective (Other than Science & Technology faculty) | Theory 1         | 113203      | CCTV Installation and Maintenance                                                                                                     | 2         | 2                   | 4                            |
|                                                            |                 |                                                                  | Theory 2         | 113204      | E-Waste Management                                                                                                                    | 2         | 2                   |                              |
|                                                            | d.              | VSC                                                              | ----             | ----        | ----                                                                                                                                  | ---       | ---                 | 4                            |
|                                                            |                 | SEC                                                              | Lab/ Practical 2 | 113205      | Skill Oriented Practical on Major Electronics                                                                                         | 2         | 4                   |                              |
|                                                            | e.              | AEC - English                                                    | Theory           | -           | --                                                                                                                                    | 1         | 1                   | 6                            |
|                                                            |                 | AEC –MIL                                                         | Theory           | -           | --                                                                                                                                    | 1         | 1                   |                              |
|                                                            |                 | IKS-Generic                                                      | Theory           | -           | --                                                                                                                                    | 2         | 2                   |                              |
|                                                            |                 | VEC                                                              | Theory           | -           | --                                                                                                                                    | 2         | 2                   |                              |
|                                                            | f.              | iii) CC                                                          | Outdoor          | -           | Course on Health & Wellness, Yoga Education, Sports, Fitness, Cultural Activities, NSS/ NCC & Fine/ Applied/ Visual/ Performing Arts. | 2         | 4                   | 4                            |
|                                                            |                 | <b>TOTAL</b>                                                     |                  |             |                                                                                                                                       | <b>22</b> | <b>30</b>           | <b>30</b>                    |

## Major / Minor Theory 1 - Fundamentals of Electronics

| Level | Semester | Course Code | Course Name                 | Credits | Teaching Hours | Exam Duration | Max Marks |
|-------|----------|-------------|-----------------------------|---------|----------------|---------------|-----------|
| 4.5   | I        | 113201      | Fundamentals of Electronics | 2       | 30             | 2 Hrs         | 30        |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          |                                    |                                                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>Read, understand and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li> <li>To give need-based education in Electronics of the highest quality at the undergraduate level.</li> <li>Use Information Communication Technology to gather knowledge.</li> <li>Impart skills required to gather information from resources.</li> <li>Equip students in methodology related to electronic circuits, devices and systems.</li> </ul>                                                                                                                                             |                          |                                    |                                                                                                                                                  |
| <b>Course Outcome:</b>    | <p>After successful completion of the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>Identify electronic components and ICs.</li> <li>Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li> <li>Apply research-based knowledge to design and conduct experiments.</li> <li>Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li> <li>Utilize the basic knowledge in Electronics science.</li> <li>Apply Electronics knowledge in their day-to-day life.</li> </ul> |                          |                                    |                                                                                                                                                  |
| <b>Unit</b>               | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Workload Allotted</b> | <b>Weightage of Marks Allotted</b> | <b>Incorporation of Pedagogies</b>                                                                                                               |
| <b>Unit I</b>             | <b>Basic Electronic components</b><br>Introduction to Resistors, Capacitors, Inductors, Transformers, Switches, Battery, Fuses, Printed Circuit Boards, Relays.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8 Hrs                    | 8 Marks                            | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable is expected. |
| <b>Unit II</b>            | <b>Network theorems</b><br>Concept of ideal dc voltage and current source, KVL, KCL, Thevenin's, Norton's, Maximum power transfer, Millman's theorem (statement, proof, simple numerical application for dc only).                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7 Hrs                    | 7 Marks                            |                                                                                                                                                  |
| <b>Unit III</b>           | <b>Analog measuring instruments</b><br>Principles of voltmeter, ammeter, ohmmeter, Multirange DC voltmeter, ohm per volt rating, loading effect, Multirange DC Ammeter, Series & shunt type ohmmeter, Multimeter (uses & drawback) CRO Block diagram & explanation, CRT construction & working, uses of CRO (measurement of frequency, amplitude & phase.)                                                                                                                                                                                                                                                                                                       | 8 Hrs                    | 8 Marks                            |                                                                                                                                                  |
| <b>Unit IV</b>            | <b>Basics of Digital Instruments</b><br>Functional block diagram, applications, advantages and limitations of: Digital voltmeter, Digital ammeter, Digital multimeter, Digital clampmeter,                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 7 Hrs                    | 7 Marks                            |                                                                                                                                                  |

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
|                         | Digital storage oscilloscope, and Digital LCR meter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |
| <b>References:</b>      | <ul style="list-style-type: none"> <li>• Basic Electronics by B. L. Thereja (S. Chand and Company)</li> <li>• Digital and Analog Technique by Navneet, Kale and Gokhale</li> <li>• Element of electronics by Bagde and Singh (S. Chand and Company)</li> <li>• Principles of electronics by V. K. Mehta</li> <li>• Introduction to digital electronics by Mohinder Singh</li> <li>• Electrical and electronics measurement and Instrumentation by A. K. Sawhney</li> <li>• Text book of Electrical Technology by B. L. Thereja</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |
| <b>Model Questions:</b> | <p><b>MCQs for Internal Assessment.</b></p> <ol style="list-style-type: none"> <li>Unit of Resistance is-----<br/>a) Volt    b) Ohm    c) Ampere    d) Watt</li> <li>In colour code system tolerance of gold colour is----<br/>a) 1%    b) 5%    c) 10%    d) 20%</li> <li>Unit of inductance is -----<br/>a) Ohm    b) Watt    c) Henry    d) Volt</li> <li>KCL stands for----<br/>a) Kelvin Current Law    b) Kirchoffs Current Law    c) Kelvin Capacitance Law    d) Kirchoffs Capacitance Law</li> <li>KVL stands for-----<br/>a) Kelvin Voltage Law    b) Kirchoffs Value Law    c) Kelvin Value Law    d) Kirchoffs Voltage Law</li> <li>Voltmeter is always connected in----- in circuit<br/>a) Series    b) Parallel    c) Both a and b    d) None</li> <li>Ammeter is always connected in----- in circuit<br/>a) Series    b) Parallel    c) Both a and b    d) None</li> <li>CRO is not used to measure----<br/>a) Volt    b) Current    c) Velocity    d) Frequency</li> </ol> <p><b>Short answer Type</b></p> <ol style="list-style-type: none"> <li>Name the active and passive components used in electronic circuit.</li> <li>Write function of capacitor.</li> <li>Write Kirchoff's laws.</li> <li>What is Ideal current source?</li> <li>What is loading effect?</li> <li>Write application of CRO.</li> <li>What is function of Multimeter?</li> <li>Explain how voltmeter connected in circuit.</li> </ol> <p><b>Long answer type :</b></p> <ol style="list-style-type: none"> <li>Explain colour coding of Resistor.</li> <li>State and explain Maximum power transfer theorem.</li> <li>Explain construction and working of CRT.</li> <li>Explain how voltage and frequency are measured by using CRO.</li> </ol> |  |  |  |

## Major/ Minor Lab / Practical –1: Practical on Fundamentals of Electronics

| Level | Semester | Course Code | Course Name                    | Credits | Teaching Hours | Exam Duration | Max Marks |
|-------|----------|-------------|--------------------------------|---------|----------------|---------------|-----------|
| 4.5   | I        | 113202      | Practical based on Theory<br>1 | 2       | 60             | 4 Hrs         | 50        |

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab/<br/>Practical 1</b> | <b>List of Experiments</b><br>1. To calculate value of unknown Resistance of given Resistor using Resistor color code system.<br>2. To study and verify Kirchoff's voltage law.<br>3. To study and verify Kirchoff's current law.<br>4. To study and verify Thevenin's Theorem.<br>5. To study and verify Norton's Theorem.<br>6. To study and verify Maximum Power transfer Theorem.<br>7. To study and verify Millman's Theorem.<br>8. To study Voltmeter for the measurement of unknown voltage.<br>9. To study Ammeter for the measurement of unknown current.<br>10. To study CRO for the measurement of Unknown frequency.<br>11. To study CRO for the measurement of Amplitude.<br>12. To study Lissajous pattern for the measurement of frequency.<br>13. To study Lissajous pattern for the measurement of phase.<br>14. To study Digital multimeter for the measurement of Voltage, Current and Resistance. |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Note :

- Students during lab hours shall have to perform at least 10 experiments, however students shall have to perform one experiment at the time of examination.



**FOR BASKET (GOEC-1): For Students of Sem-I of the program other than Science & Technology Faculty.**

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Course Name                       | Credits | Teaching Hours | Exam Duration | Max Marks |
|---------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------|----------------|---------------|-----------|
| 4.5                       | I        | 113203                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CCTV Installation and Maintenance | 2       | 30             | 2 Hrs         | 30        |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>To know about security system and its importance.</li> <li>To understand and interpret electrical/electronic circuits of CCTV.</li> <li>To provide the knowledge about the various cables.</li> <li>To provide the knowledge about the various CCTV cameras.</li> <li>Impart skills required to installation and maintenance of CCTV system.</li> </ul>                                                                                 |                                   |         |                |               |           |
| <b>Course Outcomes:</b>   |          | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"> <li>Identify electronic components and circuits related to CCTV.</li> <li>Identify and analyze different cables and their interconnections.</li> <li>Identify and analyze different cameras and their interconnections</li> <li>Utilize the knowledge of CCTV software and its installations.</li> <li>Troubleshooting and maintenance of CCTV systems.</li> </ul> |                                   |         |                |               |           |

| Unit        | Contents                                                                                                                                                                                                                                                                                                                                            | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                                                     |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit I      | <b>Introducing CCTV</b><br>Introduction to Closed Circuit Television (CCTV) Technology, Block diagram of CCTV, Basic components of an analogue CCTV system, Transmission Medium, recording units (DVR), Power supply unit, Assembling a basic analogue CCTV system.                                                                                 | 8 Hrs.            | 8 Marks                     | • While teaching CCTV Installation and Maintenance, the suitable pedagogical strategies should be adapted.<br>• These strategies include both Troubleshooting and maintenance of CCTV systems.<br>• Process of using CCTV Installation and Maintenance using Both physically and virtual tools. |
| Unit II     | <b>Cables used in CCTV Installation</b><br>Types of Cable, Construction of Coaxial cable, Construction of Ethernet cable, Construction of network cable, Construction of Fiber-optic cable, advantages and disadvantages of the cables.                                                                                                             | 7 Hrs.            | 7 Marks                     |                                                                                                                                                                                                                                                                                                 |
| Unit III    | <b>Types of CCTV Cameras and Installation</b><br>Dome Camera, Bullet Type Camera, C-Mount Camera, Day/Night Camera, Infrared/Night Vision CCTV Camera, Varifocal Cameras, Wireless Cameras, Installing the Camera, Checking the Camera Functions.                                                                                                   | 8 Hrs.            | 8 Marks                     |                                                                                                                                                                                                                                                                                                 |
| Unit IV     | <b>Tools and Maintenance</b><br>Multimeter: Analogue and Digital, cable stripper, Soldering gun, Desoldering Pump.<br>Installation Software, Connecting to Your Smartphone, Using Web Services, Potential Risk, Watching CCTV camera on Mobile and Laptop.                                                                                          | 7 Hrs.            | 7 Marks                     |                                                                                                                                                                                                                                                                                                 |
| References: | <ul style="list-style-type: none"><li>• CCTV Surveillance by Herman Kruegle, Released March 2011. Publisher(s): Elsevier Science ISBN: 9780080468181</li><li>• CCTV Handbook by Thomas Hill</li><li>• Participant's Guide for CCTV Installation Technician (ELEQ Book 4605) Kindle Edition</li><li>• CCTV Cameras Training by M.J. Ansari</li></ul> |                   |                             |                                                                                                                                                                                                                                                                                                 |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Model Questions:</b></p> | <p><b>MCQs for Internal Assessment;</b></p> <ol style="list-style-type: none"> <li>1. CCTV Stands for</li> <li>2. Closed circuit television b) Circuit capacitor television c) Community circuit television d) closed capacitor telephone</li> <li>3. In which country the first CCTV system introduced</li> <li>4. India b) China c) Germany d) U.S.A.</li> <li>5. Resolution is</li> <li>6. color of an image b) the size of an image c) no. of pixel d) none of these</li> <li>7. Pixel derived from the word</li> <li>8. Picture element b) Picture elegant c) Picture emerge d) None of these</li> </ol> <p><b>Short answer type</b></p> <ol style="list-style-type: none"> <li>1. What is CCTV?</li> <li>2. Write application of CCTV.</li> <li>3. What is DVR?</li> <li>4. Classify various Cameras used in CCTV</li> <li>5. Classify various Cables used in CCTV</li> <li>6. What is the use of Multimeter?</li> </ol> <p><b>Long answer type</b></p> <ol style="list-style-type: none"> <li>1. Draw the Block diagram of CCTV and Explain</li> <li>2. Explain the Any three cables used in CCTV</li> <li>3. Explain various cameras used in CCTV.</li> <li>4. Explain tools used in CCTV installation.</li> </ol> |
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**FOR BASKET (GOEC-2) : For Students of Sem-I of the program other than that of Science & Technology Faculty**

| Level              | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Course Code | Course Name        | Credits                     | Teaching Hours                                         | Exam Duration | Max Marks |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|-----------------------------|--------------------------------------------------------|---------------|-----------|
| 4.5                | I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 113204      | E-waste Management | 2                           | 30                                                     | 2 Hrs         | 30        |
| Course Objectives: | <ul style="list-style-type: none"><li>List the effects of e-waste on environment and health.</li><li>Discuss the need and requirements of the e-waste management</li><li>Make awareness of e-waste and e-waste management in society.</li></ul>                                                                                                                                                                                                                                                                                                   |             |                    |                             |                                                        |               |           |
| Course Outcomes:   | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"><li>Identify the physical and chemical composition of waste</li><li>Know about the environmental impacts of e-waste.</li><li>Apply various concept learned under e-waste management hierarchy</li><li>Distinguished the role of various national and internal act and laws applicable for e-waste management and handling.</li><li>Analyze the e – waste management measures proposed under national and global legislations</li></ul> |             |                    |                             |                                                        |               |           |
| Unit               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             | Workload Allotted  | Weightage of Marks Allotted | Incorporation of Pedagogies                            |               |           |
| Unit I             | <b>Introduction to E-Waste Management:</b><br>Definition and types of e-waste, Current e-waste scenario in India and the world, Environmental and health hazards of e-waste, Regulatory framework for e-waste management in India, Scope of the course.                                                                                                                                                                                                                                                                                           |             | 7 Hrs              | 8 Marks                     | The suitable pedagogical strategies should be adopted. |               |           |
| Unit II            | <b>E-Waste Collection, Segregation and Recycling:</b><br>Collection and transportation of e-waste, Segregation of e-waste based on material type, Importance of proper segregation, Hands-on practice on e-waste segregation. Recycling technologies for different types of e-waste, advantages, and limitations of different recycling technologies, Environmental impact of recycling technologies                                                                                                                                              |             | 8 Hrs              | 8 Marks                     |                                                        |               |           |
| Unit III           | <b>E-Waste Management Strategies:</b><br>Extended Producer Responsibility (EPR), Reverse logistics for e- waste management, Innovative e-waste management practices, Importance of public awareness and outreach.                                                                                                                                                                                                                                                                                                                                 |             | 7 Hrs              | 7 Marks                     |                                                        |               |           |
| Unit IV            | <b>E-Waste Management and Sustainable Development:</b><br>The link between e-waste management and sustainable development goals, Role of e-waste management in achieving a circular economy, Business opportunities in e-waste management, Prospects of e-waste management in India.                                                                                                                                                                                                                                                              |             | 8 Hrs              | 7 Marks                     |                                                        |               |           |
| References:        | <ul style="list-style-type: none"><li>E-waste: implications, regulations, and management in India and current global best practices”, Johri R., TERI Press, New Delhi</li><li>Electronic Waste – 1<sup>st</sup> Edition (Toxicology and Public Health Issues), Fowler B. 2017Elsevier</li><li>Electronic Waste Management. Science, Hester R.E., and Harrison R.M. 2009</li></ul>                                                                                                                                                                 |             |                    |                             |                                                        |               |           |

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| <p><b>Model Questions:</b></p> | <p><b>MCQs for Internal Assessment;</b></p> <ol style="list-style-type: none"> <li>1. ----- element/s is/are cause of e-waste.<br/>a. Lead b. Cadmium c. Beryllium d. All of the above</li> <li>2.-----are the main contributors of the e-waste in the world.<br/>Refrigerators/freezers, washing machines, dishwashers<br/>Small household appliances (toasters, coffee makers, irons, hairdryers)<br/>Personal computers, telephones, mobile phones, laptops, printers, scanners, photocopiers<br/>Gas cylinder, chimneys &amp; home appliances</li> <li>3. Which one of the following is an example of e-waste?<br/>a. Nuclear wastes, medical wastes, toxic industrial wastes, etc.<br/>b. Plastic bags, cardboard boxes, corroded metals, etc.<br/>c. Beverage cans, packaged boxes, plastic bottles, etc.<br/>d. Sensors, alarms, sirens, TV, etc.</li> <li>4. ----- produces the most e-waste per year.<br/>a) India b. China c. USA d. France</li> </ol> <p><b>Short answer type questions</b></p> <ol style="list-style-type: none"> <li>1. State various types of waste.</li> <li>2. What is E-waste?</li> <li>3. State the common electronics devices that leads to E-waste Pollution.</li> <li>4. Which E-waste is not recyclable?</li> <li>5. What happens to the e-waste after it has been recycled?</li> </ol> <p><b>Long answer type questions</b></p> <ol style="list-style-type: none"> <li>1. What is the impact of E-waste on environment?</li> <li>2. Explain harmful effect of E-Waste on human being.</li> <li>3. Explain the process how to reduce E-Waste pollution.</li> <li>4. Explain one of the methods to recycle E-waste</li> <li>5. Why recycling of E-waste is important, explain brief.</li> </ol> |
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**Lab / Practical –2: Skill based practical on Major-Electronics**

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Course Name                                | Credits | Teaching Hours | Exam Duration | Max Marks |
|---------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------|----------------|---------------|-----------|
| 4.5                       | I        | 113205                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Skill based practical on Major-Electronics | 2       | 60             | 4 Hrs         | 50        |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>To reduce the unemployment by providing self- employment schemes.</li> <li>To make the students skilled technician.</li> <li>To reduce the mismatch between the demand and supply of skill man-power.</li> <li>To develop attitudes, knowledge, and skills for entrepreneurship and self-employment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                            |         |                |               |           |
| <b>Course Outcomes:</b>   |          | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"> <li>Apply their practical knowledge/ hands on training in the workplace.</li> <li>It fulfills the demand of industry.</li> <li>It develops skilled technician.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            |         |                |               |           |
| <b>Lab/ Practical 2</b>   |          | <b>List of Experiments:</b> <ol style="list-style-type: none"> <li>Identify the values of Resistor (Color Code), Capacitor and Inductor from Circuit Board.</li> <li>Identify the values of Resistor, Capacitor and Inductor in their Series &amp; Parallel combination from Circuit Board.</li> <li>Identify various PCB used in electronic Circuit.</li> <li>To prepare / design PCB for simple electronics circuits.</li> <li>Identify the faults of Resistor, capacitor on circuit board by using Analog and Digital Multimeter</li> <li>Test Diode, Transistor and Capacitor on circuit board by using Analog and Digital Multimeter</li> <li>Study and to test various design of switches and Relays.</li> <li>Soldering and desoldering of various components.</li> <li>Study of analog multimeter for various measurements.</li> <li>Use of Digital Clampmeter for various measurements.</li> <li>Use of Digital LCR meter for various measurements.</li> <li>Use of Digital Storage Oscilloscope for amplitude, frequency and phase measurements.</li> </ol> |                                            |         |                |               |           |

**Note: Mode of Examination: Internal (There is no External Examination)**

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
**FACULTY: Science and Technology**  
**Subject: ELECTRONICS**  
**Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)**  
**Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme**

**FIRST YEAR: Level 4.5 - SEMESTER – II (T & L Credit Scheme)**

| Mode of Teaching                                          | Vertical Number | The Vertical                                                     | Type of Course   | Course Code | Course Name                                                                                                                           | Credits   | Workload (Hrs/ Week) | Vertical Workload (Hrs/ Week) |
|-----------------------------------------------------------|-----------------|------------------------------------------------------------------|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------|-------------------------------|
| Classroom Teaching /Lab Work (Practical)/ Outdoor / Field | a.              | Major (Electronics)                                              | Theory 2         | 113206      | Semiconductor Devices                                                                                                                 | 2         | 2                    | 6                             |
|                                                           |                 |                                                                  | Lab/ Practical 3 | 113207      | Practical based on Major Theory 2                                                                                                     | 2         | 4                    |                               |
|                                                           | b.              | Minor (Other subject in combination with Electronics)            | Theory 2         | 113206      | Semiconductor Devices                                                                                                                 | 2         | 2                    | 6                             |
|                                                           |                 |                                                                  | Lab/ Practical 3 | 113207      | Practical based on Minor Theory 2                                                                                                     | 2         | 4                    |                               |
|                                                           | c.              | Generic/ Open Elective (Other than Science & Technology faculty) | Theory 3         | 113208      | Maintenance & Troubleshooting of Electronic Applications                                                                              | 2         | 2                    | 4                             |
|                                                           |                 |                                                                  | Theory 4         | 113209      | Computer Hardware & Maintenance                                                                                                       | 2         | 2                    |                               |
|                                                           | d.              | VSC                                                              | Lab/ Practical 4 | 113210      | Advanced Practical on Major Theory 2                                                                                                  | 2         | 4                    | 8                             |
|                                                           |                 | SEC                                                              | Lab/ Practical 5 | 113211      | Skill Oriented Practical on Major Electronics                                                                                         | 2         | 4                    |                               |
|                                                           | e.              | AEC - English                                                    | Theory           | -           |                                                                                                                                       | 1         | 1                    | 4                             |
|                                                           |                 | AEC –MIL                                                         | Theory           | -           |                                                                                                                                       | 1         | 1                    |                               |
|                                                           |                 | VEC                                                              | Theory           | -           |                                                                                                                                       | 2         | 2                    |                               |
|                                                           | f.              | iii) CC                                                          | Outdoor          | -           | Course on Health & Wellness, Yoga Education, Sports, Fitness, Cultural Activities, NSS/ NCC & Fine/ Applied/ Visual/ Performing Arts. | 2         | 4                    | 4                             |
|                                                           |                 | <b>TOTAL</b>                                                     |                  |             |                                                                                                                                       | <b>22</b> | <b>32</b>            | <b>32</b>                     |

## Major / Minor Theory 2 – Semiconductor Devices

| Level                                            | Semester                                                                                                                                                                                                                                                                                                                                                                                                             | Course Code | Course Name           | Credits           | Teaching Hours              | Exam Duration                                                                                                                                                                             | Max Mark |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|-------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4.5                                              | II                                                                                                                                                                                                                                                                                                                                                                                                                   | 113206      | Semiconductor Devices | 2                 | 30                          | 2 Hrs                                                                                                                                                                                     | 30       |
| Course Objectives                                | <ul style="list-style-type: none"><li>To provide understanding about building and design of power supply.</li><li>To provide knowledge about junction transistors and its applications in circuits.</li><li>To provide understanding about optoelectronics devices and their uses.</li><li>To provide knowledge of Integrated circuits and its fabrications.</li></ul>                                               |             |                       |                   |                             |                                                                                                                                                                                           |          |
| Course Outcomes                                  | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"><li>Student will be able to design and build power supply.</li><li>Design various circuits using various transistors.</li><li>Able to make various applications of optoelectronics devices.</li><li>Will acquire the knowledge about integration of electronics components for IC fabrication.</li></ul>  |             |                       |                   |                             |                                                                                                                                                                                           |          |
| Unit System                                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                             |             |                       | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                               |          |
| Unit I                                           | Semiconductor Diodes and Rectifiers<br>Operation and characteristics of PN junction diode, Avalanche and Zener breakdown mechanisms, Zener diode as voltage regulator, Half wave and full wave rectifiers (ripple factor, efficiency and PIV ratings), C, L and $\Pi$ filters.                                                                                                                                       |             |                       | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of semiconductor devices and its applications (physically and/or virtually), wherever applicable. Process of IC fabrication using virtual tools. |          |
| Unit II                                          | Junction transistors<br>NPN and PNP transistor (construction and working), CB, CE & CC configurations, leakage currents, Input and output characteristics of CE mode, Relation between $\alpha$ and $\beta$ , Construction, working and characteristics of UJT, FET and MOSFET.                                                                                                                                      |             |                       | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                           |          |
| Unit III                                         | Optoelectronics devices<br>Construction, working & characteristics of LDR, LED, Photodiode, Phototransistor and Photovoltaic cell (Solar cell).                                                                                                                                                                                                                                                                      |             |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                           |          |
| Unit IV                                          | Integrated Circuits<br>Introduction to IC technology, Advantages and disadvantages, Classification of ICs, Scale of integration up to $V^2$ LSI, Basic steps in fabrication of monolithic ICs, Fabrication of resistor, diode & transistor. Basic concept of Embedded systems                                                                                                                                        |             |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                           |          |
| References                                       | 1. Digital and analog technique by Navneet, Kale and Gokhale (Kitab mahal prakashan)<br>2. Introduction to digital electronics by Mohinder Singh<br>3. Digital principle and application by Malvino and Leach<br>4. Modern digital electronics by R. P. Jain<br>5. Pulse, digital and switching waveforms by Millman and Taub<br>6. Principle of electronics by V.K.Mehta<br>7. Basics of electronics by B.L.Thereja |             |                       |                   |                             |                                                                                                                                                                                           |          |
| Model questions for theory external examination. |                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                       |                   |                             |                                                                                                                                                                                           |          |
| MCQ for Internal Assessment                      | MCQs for Internal Assessment;<br>1. The half wave rectifier circuits use ----<br>a) One diode b) Two diode c) Three diode d) Four diode                                                                                                                                                                                                                                                                              |             |                       |                   |                             |                                                                                                                                                                                           |          |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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|                               | <p>2. Ripple factor of full wave rectifier is -----<br/> a) 50.4% b) 20% c) 48.2% d) 47.2%</p> <p>3. The Zener diode is frequently used as -----<br/> a) Regulator b) Rectifier c) Amplifier d) Oscillator</p> <p>4. The number of P-N junctions in BJT is -----<br/> a) Three b) Two c) One d) None</p> <p>5. The FET is ---- device<br/> (a) Bipolar (b) Unipolar (c) Monopolar (d) None of these</p> <p>6. IC stands for _____.<br/> (a) Integrated circuit (b) Ionization current<br/> (c) Inverse current (d) Integrated current</p> <p>7. ---- cannot be fabricated in an IC.<br/> (a) Transistors (b) Diodes (c) Resistors (d) Inductors</p> <p>8. The LED emits light only when it is in ---- biased.<br/> (a) forward (b) reverse (c) inverse (d) none.</p> |
| <b>Short answer questions</b> | <p><b>Short answer type</b></p> <ol style="list-style-type: none"> <li>1. What is biasing of diode?</li> <li>2. Write application of diodes.</li> <li>3. Draw symbol of LED and LDR.</li> <li>4. Explain principle of Phototransistor.</li> <li>5. Write scale of integration of IC's.</li> <li>6. Write steps of fabrication of monolithic IC's.</li> <li>7. What is SSI?</li> <li>8. What is rectifier?</li> </ol>                                                                                                                                                                                                                                                                                                                                                 |
| <b>Long answer questions</b>  | <p><b>Long answer type</b></p> <ol style="list-style-type: none"> <li>1. Explain construction and working of half wave rectifier circuit.</li> <li>2. Explain construction and working of NPN transistor.</li> <li>3. Explain construction and working of Phototransistor.</li> <li>4. Explain fabrication of diode in IC.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                |



**Major & Minor Lab / Practical – 3: Practical based on Semiconductor Devices**

| Level | Semester | Course Code | Course Name                              | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|------------------------------------------|---------|----------------|---------------|----------|
| 4.5   | II       | 113207      | Practical based on Semiconductor Devices | 2       | 60             | 4 Hrs         | 50       |

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| <b>Lab/<br/>Practical 3</b> | <b>Perform at least ten experiments.</b><br><br>1. To study VI characteristics of PN junction diode under forward bias mode.<br>2. To study VI characteristics of PN junction diode under reverse bias mode.<br>3. To study half wave rectifier.<br>4. To study full wave centre tapped rectifier.<br>5. To study full wave bridge rectifier.<br>6. To study C, L and $\Pi$ filters.<br>7. To study input and output characteristics of transistor in CE mode.<br>8. To study input and output characteristics of transistor in CB mode.<br>10. To study output and transfer characteristics of FET and derive FET parameters.<br>11. To study output and transfer characteristics of MOSFET.<br>12. Study of LDR.<br>13. Study of LED.<br>14. Study of UJT. |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments, however students shall have to perform one experiment at the time of examination.

**GOEC-3: For the students of Sem-II of the program of other than that of Science & technology faculty.**

| Level             | Semester                                                                                                                                                                                                                                                                                                                                              | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Course Name                                              | Credits | Teaching Hours    | Exam Duration               | Max Mark                                                                                                                                                                                                                                                                                                                                                         |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------|-------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.5               | II                                                                                                                                                                                                                                                                                                                                                    | 113208                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Maintenance and troubleshooting of Electronic Appliances | 2       | 30                | 2 Hrs                       | 30                                                                                                                                                                                                                                                                                                                                                               |
| Course Objectives |                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"><li>• This practical-based course complements the theoretical knowledge of electrical and electronics maintenance with hands-on activities.</li><li>• To provide theoretical knowledge to real-world electrical and electronic scenarios with safety.</li><li>• Also to provide knowledge to real-world electrical and electronic maintenance of general electronic appliances.</li><li>• To demonstrate proficiency in troubleshooting using tools and equipment as well as its maintenance.</li><li>• To provide knowledge for troubleshooting and repairing of common electrical and electronic faults.</li></ul>                                                                                                     |                                                          |         |                   |                             |                                                                                                                                                                                                                                                                                                                                                                  |
| Course Outcomes   |                                                                                                                                                                                                                                                                                                                                                       | <p>After learning the course, the students will be able to:</p> <ul style="list-style-type: none"><li>• Demonstrate a fundamental understanding of electrical and electronic principles, laws, circuit analysis, and semiconductor behavior.</li><li>• Demonstrate proficiency in PCB tracing, diagnostics and repairs.</li><li>• Develop effective troubleshooting techniques and a systematic approach to diagnose and rectify electrical and electronic faults.</li><li>• Develop expertise in repair and assembly of Electric irons, Electric kettles, Fan regulators, Mobile chargers, LED bulbs, LED Tubelight, Electric boards &amp; Electronic kits.</li><li>• Develop to design various power supplies required for different purposes.</li></ul> |                                                          |         |                   |                             |                                                                                                                                                                                                                                                                                                                                                                  |
| Unit System       | Contents                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |         | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                                                                                                                      |
| Unit I            | Safety precautions for operator and appliances:<br>Safety signs, messages and warnings; Use of Personnel Protective Equipment (PPE); Preventive measures and First aids; Identifying Phase, Neutral and Earth on sockets and Appliances; Identifying Voltage, Current and Power rating of Appliances; Study of Installation process and User manuals. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |         | 8 Hrs             | 8 Marks                     | While teaching Electronics as a complete subject, classical and contemporary innovations pedagogies are to use, for integration into the Teaching, Learning, and Evaluation processes. Technology based pedagogy should involve use of advance electronic tools, instruments, media and other available e-resources to enhance the students learning experience. |
| Unit II           | Connection tracing and fault finding of appliances:<br>Tracing of connections from AC mains supply, Tracing of Power Supply section, Tracing of Intermediate and Output section, Section wise testing of electronic components and ICs, Tracing and fixing of actual faults, Common faults in general appliances.                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |         | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                  |
| Unit III          | Testing and troubleshooting of various power supply:<br>Rectifiers: Half-wave and Full-wave Rectifiers; Block diagram of Regulated power supply; IC 78XX and 79XX series of voltage regulators; IC 723 as voltage regulators; Fixed and variable power supply using IC 317.                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |         | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                                                                                                                  |
| Unit IV           | Repair and replacement of electronic parts:<br>Identification and testing of various electronic components, Working and repair of : Electric Irons, Electric Kettles, Fan Regulators, Mobile chargers, LED Bulbs, LED Tube lights, Electric Boards & Electronic Kits.                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |         | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                  |
|                   | Books:                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                          |         |                   |                             |                                                                                                                                                                                                                                                                                                                                                                  |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>References</b>                                       | <ul style="list-style-type: none"> <li>Shashi Sinha, Handbook of Repair &amp; Maintenance of Domestic Electronics appliances, IBP Publications</li> <li>Doug Lowe, Electronics – All in one for Dummies, third Edition.</li> <li>Institution of Engineering and Technology, Guide to Electrical Maintenance, 2nd Edition, IET.</li> <li>K. Mittal, Electronic Mechanic: 3 in 1, Computech Publication</li> <li>Horowitz &amp; Hill, The Art of Electronics; Cambridge University Press, 3rd edition, 2015</li> <li>Mark I. Montrose, PCB Design Techniques for EMC Compliance: A Handbook for Designers, Wiley-IEEE Press, 2000.</li> </ul> <p><b>E-resources:</b></p> <ul style="list-style-type: none"> <li>NPTEL - Basic Electrical Circuits, Prof. Nagendra Krishnapura, IIT Madras</li> <li>NPTEL - Power Electronics, Prof. G. Bhuvaneswari, IIT Delhi</li> <li>Coursera - Introduction to Electronics, <a href="https://www.coursera.org/learn/electronics">https://www.coursera.org/learn/electronics</a></li> </ul>                                                                                                                                                                                                                                  |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>MCQs for Internal Assessment</b>                     | <p><b>MCQs for Internal Assessment:</b></p> <ol style="list-style-type: none"> <li>Equipment operating instructions are             <ol style="list-style-type: none"> <li>for new employee</li> <li>only guidelines</li> <li>specific steps to follow every time</li> <li>none of above.</li> </ol> </li> <li>The only step that keep you safe consistently is             <ol style="list-style-type: none"> <li>personal protective equipment</li> <li>your supervisor</li> <li>obeying all warning signs</li> <li>your altitude</li> </ol> </li> <li>In which type of fault, zero sequence currents do not exist,             <ol style="list-style-type: none"> <li>Ig, IIg, IIIg</li> <li>line- line to ground</li> <li>line to ground</li> <li>line to line</li> </ol> </li> <li>Which test is conducted by keeping the power supply on in power supply unit in troubleshooting of power supply unit?             <ol style="list-style-type: none"> <li>cold</li> <li>hot</li> <li>continuity</li> <li>impedance</li> </ol> </li> <li>Which material can be used up a temperature of 130 degree celcius             <ol style="list-style-type: none"> <li>mica</li> <li>cotton</li> <li>synthetic resin</li> <li>all of these</li> </ol> </li> </ol> |
| <b>Short answer questions</b>                           | <p><b>Short answer type:</b></p> <ol style="list-style-type: none"> <li>What are the safety precautions in handling electrical appliances?</li> <li>What are the 5 electrical safety rules?</li> <li>How are appliances connected?</li> <li>How do appliances work with electricity?</li> <li>How do you test DC MCB?</li> <li>How do you troubleshoot a power supply?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Long answer questions</b>                            | <p><b>Long answer type :</b></p> <ol style="list-style-type: none"> <li>Explain working of half wave rectifier.</li> <li>Draw block diagram of regulated power supply.</li> <li>Explain Pins of IC 78XX, 79XX.</li> <li>How to trace connections from AC mains to Power supply?</li> <li>What is safety signs used for?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

**GOEC-4 : For the students of Sem-II of the program of other than that of science & technology faculty.**

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Course Name                       | Credits | Teaching Hours    | Exam Duration               | Max Mark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------|-------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.5                       | II       | 113209                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Computer Hardware and Maintenance | 2       | 30                | 2 Hrs                       | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>To introduce students to various peripherals of computers.</li> <li>To make students acquainted with the electronic parts, and hardware &amp; software tools.</li> <li>To develop practical skills required for computers software maintenance.</li> <li>To learn formatting, troubleshooting and proper maintenance of Computer systems.</li> </ul>                                                                            |                                   |         |                   |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Outcomes:</b>   |          | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"> <li>Identify software components, symbols &amp; footprints</li> <li>Demonstrate various input and output devices and their workings.</li> <li>Apply practical knowledge and skills regarding software installations.</li> <li>Maintenance and updating of system software.</li> <li>Troubleshooting and proper maintenance of Computer systems.</li> </ul> |                                   |         |                   |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Unit System               |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |         | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Unit I</b>             |          | <b>Fundamental of Computers</b><br>Block diagram of computer system, need, features, characteristics; application areas of computers. Evolution of computers; Classifications of computer systems, Types of computers, types of processors block diagram, working, features, chipset, components                                                                                                                                                                       |                                   |         | 8 Hrs             | 8 Marks                     | While teaching Electronics as a complete subject, the suitable pedagogical strategies should be adapted. These strategies include both classical and contemporary innovations, for integration into the Teaching, Learning, and Evaluation processes. Technology based pedagogy should involve use of advance electronic tools, instruments, media and other available e-resources to enhance the students learning experience. Along with theoretical and practical teaching methods; enquiry based, problem based, project based, simulation and field work based methods will be accepted to enhance comprehension of the course contents. |
| <b>Unit II</b>            |          | <b>Parts of Computer</b><br>Computer Hardware, Software and Peripheral devices; Various Input and Output devices and their workings; Various Cables, Connectors and Ports on Motherboard, SMPS, connectors, slots, ports, classification of motherboard, concept of PCB, types of motherboards.                                                                                                                                                                        |                                   |         | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Unit III</b>           |          | <b>Memory used in Computer</b><br>Definition, features, types of memory, memory hierarchy; Primary memory: RAM, ROM; Concept of cache memory; Secondary memory: floppy disk, hard disk, CD, DVD, pen drive, memory card, external memory.                                                                                                                                                                                                                              |                                   |         | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Unit IV</b>            |          | <b>System Booting and Operating System Software Installations</b><br>Booting process of computer system; Operating System and its functions; Various types of Operating System; Installation process of Operating System software. General purpose and Special purpose software's; Installation of programs and software's; Setting of Display, Sound and Control panel properties, Installation of MS Office, Antivirus, Printer and Peripheral software's.           |                                   |         | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>References:</b>                                      | <ul style="list-style-type: none"> <li>• Computer Fundamentals, P. K. Sinha, BPB Publications, Sixth Edition.</li> <li>• Introduction to Information Technology, V. Rajaraman, PHI, Second Edition.</li> <li>• Fundamental of Information Technology, Chetan Shrivastava, Kalyani Publishers.</li> <li>• James Bernstein, “Building your own computer made easy: Step by step guide”; 2021 Edition.</li> <li>• How to build a PC: A step by step guide; Off the Bux, Kindle Edition -2023.</li> <li>• Stanislaw Jarzabek; Effective Software Maintenance and Evolution;</li> <li>• Thomas M. Pigoski; Practical Software Maintenance; Edition -1; Wiley Publications.</li> <li>• Scott Muellers; Upgrading and Repairing PCs; 22<sup>nd</sup> Edition.</li> </ul>                                                                         |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>MCQs for Internal Assessment</b>                     | <p><b>MCQ for internal assessment</b></p> <ol style="list-style-type: none"> <li>Any physical components of a computer system that we can see and touch is<br/>a) Software    b) Peripheral device    c) Hardware    d) CPU</li> <li>The System that contains the most vital part of the personal computer is called<br/>a) CPU    b) BIOS chip    c) Motherboard    d) Monitor</li> <li>Which of the following is called as the brain of the computer?<br/>a) Motherboard b) RAM    c) CPU    d) BIOS chip</li> <li>Central processing unit in a computer consists of which major component?<br/>a) Arithmetic logic unit and control unit    b) Control unit    c) Registers<br/>d) ALU, control unit and Registers</li> <li>Which of the following is not hardware?<br/>Processor chip    b) Printer    c) Mouse    d) Java</li> </ol> |
| <b>Short answer questions</b>                           | <p><b>Short answer type</b></p> <ol style="list-style-type: none"> <li>What are the characteristics of computer?</li> <li>Explain the features of microprocessor.</li> <li>Explain the features of memory.</li> <li>Characteristics of input devices.</li> <li>What is printer? Explain its feature.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Long answer questions</b>                            | <p><b>Long answer type</b></p> <ol style="list-style-type: none"> <li>What is computer? Draw and explain the block diagram of computer.</li> <li>Draw the block diagram and explain the feature of microprocessor.</li> <li>Differentiate between RAM and ROM Memory.</li> <li>What is motherboard? Explain the different classification of motherboard.</li> <li>Explain the concept of Concept of computer assembling and disassembling.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                     |

### Vocational Skill Course 1: Lab/ Practical 4: Advanced Practical on Major Theory Semiconductor Devices

| Level                     | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Course Code | Course Name                          | Credits | Teaching Hours | Exam Duration | Max Mark |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------|---------|----------------|---------------|----------|
| 4.5                       | II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 113210      | Advanced Practical on Major Theory 2 | 2       | 60             | 4 Hrs         | 50       |
| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>To reduce the unemployment by providing self-employment schemes.</li> <li>To make the students skilled technician.</li> <li>To reduce the mismatch between the demand and supply of skill man-power.</li> <li>To develop attitudes, knowledge, and skills for entrepreneurship and self-employment.</li> </ul>                                                                                                                                                                                                                                                                                                      |             |                                      |         |                |               |          |
| <b>Course Outcomes:</b>   | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"> <li>Apply their practical knowledge/ hands on training in the workplace.</li> <li>It fulfills the demand of industry.</li> <li>It develops skilled technician.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                      |             |                                      |         |                |               |          |
| <b>Lab/ Practical 4</b>   | <b>List of Experiments:</b><br><b>(Design of following circuits on Bread Board.)</b> <ol style="list-style-type: none"> <li>To study characteristics of LDR.</li> <li>To study characteristics of LED.</li> <li>To study characteristics of Photodiode.</li> <li>To study characteristics of Phototransistor.</li> <li>To study Photovoltaic cell.</li> <li>To study UJT.</li> <li>To study Zener diode characteristics.</li> <li>To study line and load regulation using zener diode.</li> <li>To study UJT as relaxation oscillator.</li> <li>To calculate bandgap energy of LED.</li> <li>Identification and Testing of Integrated circuits.</li> </ol> |             |                                      |         |                |               |          |

**Note :**

- Students during lab hours shall have to perform at least 10 experiments, however students shall have to perform one experiment at the time of examination.
- Mode of Examination: Internal (There is no External Examination)**

### Skill Enhancement Course 1: Lab/ Practical 5: Skill Oriented Practical on Major- Electronics

| Level                     | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Course Code | Course Name                           | Credits | Teaching Hours | Exam Duration | Max Mark |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------|---------|----------------|---------------|----------|
| 4.5                       | II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 113211      | Design & construction of Power supply | 2       | 60             | 4 Hrs         | 50       |
| <b>Course Objectives:</b> | <p>This course aims at enabling students:</p> <ul style="list-style-type: none"> <li>To provide working knowledge for the identification and testing of components.</li> <li>To impart Comprehensive understanding of the fundamentals of electronic rectifier circuits.</li> <li>To provide hands on experience for conceptual understanding of power supply circuits.</li> <li>To provide knowledge of various electronics regulators and related components, ICs and equipment.</li> <li>To provide the knowledge about designing, building and troubleshooting of various power supply circuits.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |                                       |         |                |               |          |
| <b>Course Outcomes:</b>   | <p>After learning the course, the students will be able to:</p> <ul style="list-style-type: none"> <li>Demonstrate the testing and analysis of electronic components by performing different experiments.</li> <li>Demonstrate input and output measurements by performing different experiments.</li> <li>Demonstrate the working of various power supply circuits.</li> <li>Design and analysis of various electronics regulators and related circuits.</li> <li>Develop expertise in repair, assembly and designing single, dual and SMPS power supply.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                                       |         |                |               |          |
| <b>Unit System</b>        | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |                                       |         |                |               |          |
|                           | <p><b>Perform any 10 experiments from the following list.</b><br/> <b>List of Experiments:</b></p> <ol style="list-style-type: none"> <li>Identification and testing of various types of Diodes for short, open and rating specifications.</li> <li>Identification and testing of various types of Transistors for short, open and rating specifications.</li> <li>Identification and testing of various types of Transformers for short, open and rating specifications.</li> <li>Testing of various diodes and transistors on the circuit board.</li> <li>Construction and testing of Half-wave rectifier circuits.</li> <li>Construction and testing of Full-wave rectifier circuits.</li> <li>To study the Zener diode as a voltage regulator.</li> <li>Construction and testing of Positive voltage regulator.</li> <li>Construction and testing of Negative voltage regulator. To calculate percentage Line regulation of regulated power supply.</li> <li>To calculate percentage Load regulation of regulated power supply.</li> <li>To design and construct variable voltage regulated power supply.</li> <li>Tracing and fault finding of a given power supply.</li> <li>To design and construct regulated voltage power supply using IC 317.</li> <li>To study various modes of Switching Mode Power Supply (SMPS).</li> </ol> |             |                                       |         |                |               |          |

**Note: Mode of Examination: Internal (There is no External Examination)**

# **SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

**Three Years- Six Semesters Bachelor's Degree Programme**

**3 Years B.Sc. /4 Year B.Sc. (Hons) & 4 Year B.Sc. (Hons with Research) Programme**



*Faculty of*  
*Science and Technology*  
*(Science Group)*

Subject: **ELECTRONICS**  
(Semesters III and IV)

**Effective from Academic Year 2026-27**  
**(As per Uniform NEP 2020)**



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**FACULTY: Science and Technology**  
**Subject: ELECTRONICS**  
**Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)**  
**Three Years / Four Years - (Six/ Eight Semesters) Bachelor Degree Programme**

**Examination, Evaluation and Assessment Scheme**

| Vertical No. | The Vertical                  | Mode of Examination & Evaluation Assessment | Theory                                                                                                                                                                                                                                                                    |               |                    |               |               | Theory (Total) |               | Practical     |               |                    |               |               |               | Practical (Total) |  |
|--------------|-------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|---------------|---------------|----------------|---------------|---------------|---------------|--------------------|---------------|---------------|---------------|-------------------|--|
|              |                               |                                             | External                                                                                                                                                                                                                                                                  |               |                    | Internal      |               |                |               | External      |               |                    | Internal      |               |               |                   |  |
|              |                               |                                             | Max Mark<br>s                                                                                                                                                                                                                                                             | Min Mark<br>s | Duration<br>(Hrs.) | Max Mark<br>s | Min Mark<br>s | Max Mark<br>s  | Min Mark<br>s | Max Mark<br>s | Min Mark<br>s | Duration<br>(Hrs.) | Max Mark<br>s | Min Mark<br>s | Max Mark<br>s | Min Mark<br>s     |  |
| A            | Major                         | External & Internal                         | 30                                                                                                                                                                                                                                                                        | 9             | 2                  | 20            | 6             | 50             | 20            | 25            | 10            | 4                  | 25            | 10            | 50            | 20                |  |
|              | IKS Major Specific            |                                             | 30                                                                                                                                                                                                                                                                        | 9             | 2                  | 20            | 6             | 50             | 20            | --            | --            |                    | --            | --            | --            | --                |  |
| B            | Minor                         |                                             | 30                                                                                                                                                                                                                                                                        | 9             | 2                  | 20            | 6             | 50             | 20            | 25            | 10            | 4                  | 25            | 10            | 50            | 20                |  |
| C            | Generic/<br>Open Elective     |                                             | 30                                                                                                                                                                                                                                                                        | 9             | 2                  | 20            | 6             | 50             | 20            | --            | --            |                    | --            | --            | --            | --                |  |
| D            | VSC                           | Internal                                    | ---                                                                                                                                                                                                                                                                       | ---           |                    |               |               |                |               | --            | --            |                    | 50            | 20            | 50            | 20                |  |
|              | SEC                           | Internal                                    | ---                                                                                                                                                                                                                                                                       | ---           |                    |               |               |                |               | --            | --            |                    | 50            | 20            | 50            | 20                |  |
| F            | Internship/<br>Apprenticeship | Internal                                    | Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately |               |                    |               |               |                |               |               |               |                    |               |               |               |                   |  |
|              | FP/CES                        |                                             |                                                                                                                                                                                                                                                                           |               |                    |               |               |                |               |               |               |                    |               |               |               |                   |  |
|              | CC                            |                                             |                                                                                                                                                                                                                                                                           |               |                    |               |               |                |               |               |               |                    |               |               |               |                   |  |

**Internal Assessment for Theory/ Practical/ Laboratory:**

All the internal assessments should be conducted on the basis of Continuous Assessment Tests (CAT).

***Continuous Assessment Tests (CAT):***

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

- v. Three CAT each of 10 Marks (Theory) and 10 Marks (Practical).
  - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
  - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
  - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days. .
- vi. Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.
- vii. Total Performance in CAT (i.e.40 %) shall be based on the best two out of three in CAT examinations
- viii. Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

**External Assessment for Practical (Major/ Minor Lab):**

- Practical Performance : 20 Marks
- Viva-Voce : 05 Marks
- **Total** : **25 Marks**
- Duration of Examination : 04 Hrs.

**Internal Assessment for Practical (Major/ Minor Lab):**

- Internal Assessment based on CAT : 15 Marks
- Record Book : 10 Marks
- **Total** : **25 Marks**

**Internal Assessment for Practical (SEC/ VSC Lab):**

- Internal Assessment based on CAT : 20 Marks
- Record Book : 10 Marks
- Attendance : 10 Marks
- 10 MCQ/short Question : 10 Marks
- **Total** : **50 Marks**
- Duration of End Semester Examination: 04 Hrs.

**Evaluation and Assessment for FP/CES:**

- Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)
- Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)
- Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks)
- **Total 50 Marks**

*Note: The external assessments of theory courses will be conducted in accordance with the guidelines issued by the SGBA University.*

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
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**Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme**

**SECOND YEAR: Level 5.0 - SEMESTER – III (T & L Credit Scheme)**

| Mode of Teaching                                                           | Ver. No | The Vertical           | Type of Course              | Course Code | Course Name                                                      | Credits   | Workload (Hrs/Week) | Vertical Workload (Hrs/Week) |
|----------------------------------------------------------------------------|---------|------------------------|-----------------------------|-------------|------------------------------------------------------------------|-----------|---------------------|------------------------------|
| Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/ Online/ Hybrid | a.      | Major                  | Electronics Theory 3        | 113212      | Electronic Devices and Circuits- I                               | 2         | 2                   | 10                           |
|                                                                            |         |                        | Electronics Theory 4        | 113213      | Digital Techniques- I                                            | 2         | 2                   |                              |
|                                                                            |         |                        | Electronics Lab/Practical-6 | 113215      | Practical based on Theory 3 & 4                                  | 2         | 4                   |                              |
|                                                                            |         | IKS - SS               | IKS-Electronics Theory      | 113214      | Evolution of Number System in Ancient India                      | 2         | 2                   |                              |
|                                                                            | b.      | Minor                  | Electronics Theory 3        | 113216      | Electronic Circuits and Digital Techniques- I                    | 2         | 2                   | 6                            |
|                                                                            |         |                        | Electronics Lab/Practical-7 | 113217      | Practical based on Electronic Circuits and Digital Techniques- I | 2         | 4                   |                              |
|                                                                            | c.      | Generic/ Open Elective | Electronics Theory 5        | 113218      | Solar Power Plant Installation and Maintenance                   | 2         | 2                   | 2                            |
|                                                                            | d.      | VSC                    | Lab/Practical-8             | 113219      | Advanced Practical on Major Electronics                          | 2         | 4                   | 4                            |
|                                                                            | e.      | FP/ CES                | Project                     | 113220      | Field Project / CE Services on Electronics                       | 2         | 4                   | 8                            |
|                                                                            |         | CC                     | Outdoor                     |             |                                                                  | 2         | 4                   |                              |
|                                                                            |         | <b>TOTAL</b>           |                             |             |                                                                  | <b>20</b> | <b>30</b>           | <b>30</b>                    |

### Major Theory 3 – Electronic Devices and Circuits- I

| Level                     | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Course Code | Course Name                        | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                       | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 113212      | Electronic Devices and Circuits- I | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>Read, understand, and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li> <li>To give need-based education in Electronics of the highest quality at the undergraduate level.</li> <li>Use Information Communication Technology to gather knowledge.</li> <li>Impart skills required to gather information from resources.</li> <li>Equip students in methodology related to electronic circuits, devices and systems.</li> </ul>                                                                                                                        |             |                                    |                   |                             |                                                                                                                                      |          |
| <b>Course Outcomes:</b>   | <p><b>After completing the course, the student will</b></p> <ul style="list-style-type: none"> <li>Identify electronic components and ICs.</li> <li>Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li> <li>Apply research-based knowledge to design and conduct experiments.</li> <li>Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li> <li>Utilize the basic knowledge in Electronics science.</li> <li>Apply Electronics knowledge in their day-to-day life.</li> </ul> |             |                                    |                   |                             |                                                                                                                                      |          |
| Unit System               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                                    | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| <b>Unit I</b>             | <b>Hybrid-parameters &amp; Cascaded amplifiers:</b><br>Hybrid-parameters, Transistor equivalent circuit of CE, CB and CC, Analysis of small signal CE amplifier. Concept of cascaded amplifier, Types of coupling, RC Coupled Amplifier, Direct Coupled amplifier, Transformer Coupled amplifier and Single Tuned amplifier.                                                                                                                                                                                                                                                                                                                 |             |                                    | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| <b>Unit II</b>            | <b>Power Amplifier:</b><br>Classification of power amplifier, Class A, Class B, Class C and Class AB amplifiers. Construction, working and efficiency of Class A - transformer coupled amplifier and Class-B Push-pull amplifier, Crossover Distortion, Complementary symmetry Class-B Push-pull amplifier.                                                                                                                                                                                                                                                                                                                                  |             |                                    | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| <b>Unit III</b>           | <b>Feedback Amplifiers and Oscillators:</b><br>Concept of feedback, Feedback theory, Positive and Negative feedback, Advantage of negative feedback, Physical idea of feedback amplifier: Block diagram only, Concept of oscillator, Basic elements of oscillator, Barkhausen Criteria of oscillation, Concept of tank circuit. RC oscillator: Phase shift and Wein bridge oscillator, LC oscillator: Colpitts and Hartley oscillator and Crystal oscillator.                                                                                                                                                                                |             |                                    | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| <b>Unit IV</b>            | <b>Timer and Phase Locked Loop:</b><br>Functional block diagram of IC-555, Applications of IC 555: Astable, Bistable and Monostable multivibrators, Construction, working and time period of each. Functional block diagram of PLL IC-565, Concept of Capture range and Lock range, Pull in time, Electrical Characteristics.                                                                                                                                                                                                                                                                                                                |             |                                    | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>References:</b>                                      | 1. Integrated Electronics by Millman Halkias<br>2. Principles of Electronics by V. K. Mehta<br>3. Elements of Electronics by Bagde and Singh<br>4. Linear Integrated Circuits by Ramakant Gaikwad<br>5. Basic Electronics by B. L. Theraja (S. Chand and Company)                                                                                                                                                                                                                                                                                                                             |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>MCQs for Internal Assessment:</b>                    | 1. Hybrid means .....<br>a ) Mixed    b) Combination    c) Added    d) None<br>2. For a transistor number of h-parameters are:<br>a) 2    b) 3    c) 4    d) 1<br>The maximum overall efficiency of transformer coupled Class A power amplifier is.<br>a) 78%    b) 50%    c) 60%    d) 90%<br>4. Phase shift oscillator use _____ circuits.<br>a) Tuned    (b) LC    (c) RC    (d) All above<br>5. One of the following is not an oscillator<br>Colpitts    b) Wein-bridge    c) Push pull    d) Hartley<br>6. IC555 is called as _____<br>a) Timer    b) amplifier    c) counter    d) None |
| <b>Short answer questions</b>                           | 1. Name various types of Power Amplifier.<br>2. Classify the types of Coupling.<br>3. Write concept of Cascaded Amplifier.<br>4. Write Concept of Tank Circuit.<br>5. Write Barkhausen Criteria of Oscillation.<br>6. State applications of IC 555.<br>7. What is PLL?<br>8. Explain Lock in range.                                                                                                                                                                                                                                                                                           |
| <b>Long answer questions</b>                            | 1. Draw Hybrid equivalent circuit diagram of CE amplifier and explain.<br>2. Explain Class-A amplifier with its efficiency.<br>3. Explain construction and working of Hartley Oscillator<br>4. Explain construction and working of IC 555 as Astable Multivibrator.                                                                                                                                                                                                                                                                                                                           |

## Major Theory 4 – Digital Techniques- I

| Level                                            | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Course Code | Course Name           | Credits           | Teaching Hours              | Exam Duration                                                                                                                                                                             | Max Mark |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|-------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                                              | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 113213      | Digital Techniques- I | 2                 | 30                          | 2 Hrs                                                                                                                                                                                     | 30       |
| Course Objectives:                               | <ul style="list-style-type: none"><li>To provide understanding about number systems.</li><li>To provide knowledge about Logic Gates &amp; Boolean Laws.</li><li>To provide knowledge about digital ICs and its applications in the circuits.</li><li>To provide knowledge of Logic families.</li></ul>                                                                                                                                                                                |             |                       |                   |                             |                                                                                                                                                                                           |          |
| Course Outcomes:                                 | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>Student will be able to understand about number systems.</li><li>Design various circuits using Logic Gates &amp; Boolean Laws.</li><li>Able to make various applications of digital ICs.</li><li>Will acquire the knowledge about Logic families and its characteristics.</li></ul>                                                                                                        |             |                       |                   |                             |                                                                                                                                                                                           |          |
| Unit System                                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                       | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                               |          |
| Unit I                                           | Binary Arithmetic:<br>Binary, Octal & Hexadecimal number system and their inter conversion, Binary arithmetic: Addition and Subtraction using 1's & 2's compliments, Multiplication & Division. Binary codes: 8421 BCD, Excess-3 & Gray code.                                                                                                                                                                                                                                         |             |                       | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of semiconductor devices and its applications (physically and/or virtually), wherever applicable. Process of IC fabrication using virtual tools. |          |
| Unit II                                          | Logic Gates:<br>Definition and truth tables of NOT, OR, AND, NAND, NOR gates. EX-NOR & EX-OR gates, Universal gates, Designing of Basic gates using NAND and NOR gates, Half adder, Full adder, 4-bit binary full adder.                                                                                                                                                                                                                                                              |             |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                           |          |
| Unit III                                         | Boolean Algebra:<br>Boolean laws, De-morgan's theorem, Simplification of Boolean equations using Boolean algebra, Fundamental Products & Sum terms, K-maps: 2, 3, 4 variables.                                                                                                                                                                                                                                                                                                        |             |                       | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                           |          |
| Unit IV                                          | Logic Families:<br>Classification of logic families, Characteristics of logic families: Fan-in, Fan-out, Noise immunity, Prorogation delay, Power dissipation; DTL, TTL & CMOS logic.                                                                                                                                                                                                                                                                                                 |             |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                           |          |
| References:                                      | 1. Digital and analog technique by Navneet, Kale and Gokhale (Kitab mahal prakashan)<br>2. Introduction to digital electronics by Mohinder Singh<br>3. Digital principle and application by Malvino and Leach<br>4. Modern digital electronics by R. P. Jain<br>5. Pulse, digital and switching waveforms by Millman and Taub<br>6. Principle of electronics by V. K. Mehta<br>7. Basics of electronics by B. L. Theraja<br>8. Digital principle and application by Malvino and Leach |             |                       |                   |                             |                                                                                                                                                                                           |          |
| Model questions for theory external examination. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                       |                   |                             |                                                                                                                                                                                           |          |
| MCQs for Internal Assessment:                    | 1. The base of octal number system is:<br>(a) 2 (b) 4 (c) 8 (d) 16<br>2. The base of Hexadecimal number system is:<br>(a) 1 2 (b) 4 (c) 8 (d) 16<br>3.1's complement of 0101 is:<br>(a) 1111 (b) 1100 (c) 1010 (d) None<br>4. The Boolean equation of OR gate is :                                                                                                                                                                                                                    |             |                       |                   |                             |                                                                                                                                                                                           |          |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>(a) <math>A + B</math> (b) <math>AB</math> (c) <math>AB</math> (d) <math>A + B</math></p> <p>5. According to Boolean law : <math>A + 1 = ?</math><br/> (a) 1 (b) A (c) 0 (d) <math>A'</math></p> <p>6. IC stands for _____.<br/> (a) Integrated circuit (b) Ionization current<br/> (c) Inverse current (d) Integrated current</p> <p>7. _____ cannot be fabricated in an IC.<br/> (a) Transistors (b) Diodes (c) Resistors (d) Inductors</p> <p>8. The LED emits light only when it is in _____ biased.<br/> (a) forward (b) reverse (c) inverse (d) none.</p> |
| <b>Short answer questions</b> | <ol style="list-style-type: none"> <li>What is Number system?</li> <li>Define Decimal Number system.</li> <li>Draw the symbol of Basic gates.</li> <li>Define Universal gates.</li> <li>Write scale of integration of IC's.</li> <li>Write steps of fabrication of monolithic IC's.</li> <li>What is SSI?</li> <li>State De-Morgans Theorem.</li> </ol>                                                                                                                                                                                                            |
| <b>Long answer questions</b>  | <ol style="list-style-type: none"> <li>Explain 8421 BCD code and Excess-3 code.</li> <li>Write symbol, truth table and Boolean equation of Basic gates.</li> <li>State and prove De-Morgans theorems.</li> <li>Explain fabrication of diode in IC.</li> <li>Explain characteristics of logic families.</li> </ol>                                                                                                                                                                                                                                                  |



## IKS Electronics Theory: Evolution of Number System in Ancient India

| Level                                            | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                               | Course Name                                       | Credits | Teaching Hours    | Exam Duration               | Max Mark                                                                                     |
|--------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------|-------------------|-----------------------------|----------------------------------------------------------------------------------------------|
| 5.0                                              | III      | 113214                                                                                                                                                                                                                                                                                                                                                                                                                                                    | IKS - Evolution of Number System in Ancient India | 2       | 30                | 2 Hrs                       | 30                                                                                           |
| Course Objectives:                               |          | <ul style="list-style-type: none"><li>To understand the key features of Indian Numeral System.</li><li>Appreciate the key role India has played in advancement of Science &amp; technology.</li><li>To Understand how measures for time, length and weight were used in Ancient India.</li><li>To identify the roots of modern-day binary system.</li></ul>                                                                                               |                                                   |         |                   |                             |                                                                                              |
| Course Outcomes:                                 |          | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>Student will come to know about key features of Indian Numeral System.</li><li>Student will know about role India played in advancement of Science &amp; technology.</li><li>Student will understand how measures for time, length and weight were used in Ancient India.</li><li>Student will come to know about roots of modern-day binary system.</li></ul> |                                                   |         |                   |                             |                                                                                              |
| Unit System                                      |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                   |         | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                  |
| Unit I                                           |          | Gautama-Buddha on Number System, Historical Evidence, Silent features of the Indian numeral system and the concept of Zero and its importance.                                                                                                                                                                                                                                                                                                            |                                                   |         | 8 Hrs             | 8 Marks                     | Classroom teaching.<br>Visit to historical places.<br>Demo of ancient units of measurements. |
| Unit II                                          |          | Large Numbers and their representation, place value of numerals and Decimal System.                                                                                                                                                                                                                                                                                                                                                                       |                                                   |         | 7 Hrs             | 7 Marks                     |                                                                                              |
| Unit III                                         |          | Measurements for time, distance and weight, Notion of Paramanu, Measures for length, Measures for time and Measures for weight.                                                                                                                                                                                                                                                                                                                           |                                                   |         | 8 Hrs             | 8 Marks                     |                                                                                              |
| Unit IV                                          |          | Pingala and the Binary System, Identification of the Laghu and Guru as per Rules of Chandra Sastra, Eight Ganas Defined by Pingala and Laghus & Gurus in the Phrase.                                                                                                                                                                                                                                                                                      |                                                   |         | 7 Hrs             | 7 Marks                     |                                                                                              |
| References:                                      |          | Introduction to Indian knowledge System- Concepts and Applications by Mahadevan, B. Bhat, Vinayak Rajat, Narendra, Narendra Pavana R. N.                                                                                                                                                                                                                                                                                                                  |                                                   |         |                   |                             |                                                                                              |
| Model questions for theory external examination. |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                   |         |                   |                             |                                                                                              |
| MCQs for Internal Assessment:                    |          | <b>Who is credited with treating zero as a number and providing arithmetic rules for it?</b><br>a) Aryabhata<br>b) Bhaskara<br>c) <b>Brahmagupta</b><br>d) Pingala<br><b>Which text mentions numbers up to in a conversation with Buddha?</b><br>a) <b>Lalitavistara Sutra</b><br>b) Arthashastra<br>c) Lilavati<br>d) Yajurveda<br><b>In Pingala's Chhandasastra, what is the 'Laghu' symbol?</b><br>a) --<br>b) U<br>c) 0<br>d) 1                       |                                                   |         |                   |                             |                                                                                              |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------|-----------|------------|-------------|------|------------|-------|------------|--------|-------------|---------|-----------|--------|------------------|---------------|
|                               | <p><b>What is the earliest recorded use of a dot to represent zero?</b></p> <p>a) <b>Bakhshali Manuscript</b><br/> b) Gwalior Inscription<br/> c) Arthashastra<br/> d) Romaka Siddhanta</p> <p><b>What does 'Paramanu' represent?</b></p> <p>a) A measurement of time<br/> b) A measurement of weight<br/> c) <b>The smallest indivisible particle</b><br/> d) A type of poetic meter</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| <b>Short answer questions</b> | <ol style="list-style-type: none"> <li>When was the concept of zero discovered in India? What is its special significance?</li> <li>What are the uses of a word or letter in numeral system?</li> <li>Why is a bhūta-samkhyā system called so?</li> <li>Identify the numbers represented by the bhūta-samkhyā system in the following cases:(a) rama-chandra-guna-nanda-rtu-padāḥ (b) guna-adri-tri-veda-nayana-bhujangāḥ (c) pūrṇa-kha-śāstra-gruha-nanda-riṣi-vedāḥ</li> <li>What is a binary cycle? Can you develop a binary cycle of length four and identify all possible binary words of length four?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| <b>Long answer questions</b>  | <ol style="list-style-type: none"> <li>List down the key inferences that one can make about the Indian Mathematical tradition based on historical evidence.</li> <li>What are the advantages of the Indian numeral system over the Roman numerals? Explain with the help of a few examples.</li> <li>What are the key characteristics of a place-value system of numerals? How is it advantageous?</li> <li>What do you understand by the term 'decimal system'? Where did it originate and what are its advantages?</li> <li>Fill up the table below with correct answers. <table border="1"> <tbody> <tr> <td>1 Nādikā =</td><td>Nimeṣa</td></tr> <tr> <td>1 Dhanus=</td><td>Dhanumustī</td></tr> <tr> <td>10 Laghus =</td><td>Lava</td></tr> <tr> <td>5 Bhāras =</td><td>Karṣa</td></tr> <tr> <td>1 Goruta =</td><td>Dhanus</td></tr> <tr> <td>20 Maśakas=</td><td>Sarṣapa</td></tr> <tr> <td>1 Muhūrta</td><td>Kāsthā</td></tr> <tr> <td>1 Anguli - parva</td><td>Likṣā - rajas</td></tr> </tbody> </table> </li> <li>What are the differences between the katapayadi system and bhūta-samkhyā systems?</li> </ol> | 1 Nādikā = | Nimeṣa | 1 Dhanus= | Dhanumustī | 10 Laghus = | Lava | 5 Bhāras = | Karṣa | 1 Goruta = | Dhanus | 20 Maśakas= | Sarṣapa | 1 Muhūrta | Kāsthā | 1 Anguli - parva | Likṣā - rajas |
| 1 Nādikā =                    | Nimeṣa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 1 Dhanus=                     | Dhanumustī                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 10 Laghus =                   | Lava                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 5 Bhāras =                    | Karṣa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 1 Goruta =                    | Dhanus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 20 Maśakas=                   | Sarṣapa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 1 Muhūrta                     | Kāsthā                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |
| 1 Anguli - parva              | Likṣā - rajas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |        |           |            |             |      |            |       |            |        |             |         |           |        |                  |               |

### Lab / Practical – 6: Practical based on Major Theory Papers 3 & 4

| Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Semester | Course Code                                                                                                                                                                                                                     | Course Name                           | Credits | Teaching Hours | Exam Duration | Max Mark |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------|----------------|---------------|----------|
| 5.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III      | 113215                                                                                                                                                                                                                          | Practical based on Major Theory 3 & 4 | 2       | 60             | 4 Hrs         | 50       |
| Course Objectives:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          | <ul style="list-style-type: none"><li>Develop skills amongst the students.</li><li>Identify the analog and digital electronic circuits.</li></ul>                                                                               |                                       |         |                |               |          |
| Course Outcomes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>Students will be able to identify the analog and digital electronic circuits.</li><li>Develop skills amongst the students.</li></ul> |                                       |         |                |               |          |
| <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |                                                                                                                                                                                                                                 |                                       |         |                |               |          |
| <ol style="list-style-type: none"><li>Study of CE Amplifier.</li><li>Study of CB Amplifier.</li><li>Study of Class B Push-pull Power Amplifier.</li><li>Study of RC Phase Shift Oscillator.</li><li>Study of Wein Bridge Oscillator.</li><li>Study of IC-555 as Astable Multivibrator.</li><li>Study of IC-555 as Monostable Multivibrator.</li><li>Study of IC-555 as Bistable Multivibrator.</li><li>Identification and Verification of Logic gates.</li><li>Identification and Verification of Universal gates.</li><li>Construct and study of Ex-OR gate using Basic gates.</li><li>Construct and study of Ex-NOR gate using Basic gates.</li><li>Construction and verification of De-Morgans Theorems.</li><li>Construct &amp; study of Half Adder.</li><li>Construct &amp; study of Full Adder</li><li>Construction and Study of IC-7483 as 4-bit parallel Adder.</li></ol> |          |                                                                                                                                                                                                                                 |                                       |         |                |               |          |

**Note :** Students shall have to perform at least 10 experiments out of 16 prescribed as below:

### Minor Theory 3 – Electronic Circuits and Digital Techniques- I

| Level              | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Course Name                                   | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|--------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                | III      | 113216                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Electronic Circuits and Digital Techniques- I | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| Course Objectives: |          | <ul style="list-style-type: none"><li>Read, understand and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li><li>To give need-based education in Electronics of the highest quality at the undergraduate level.</li><li>Use Information Digital Technology to gather knowledge.</li><li>Impart skills required to gather information from resources.</li><li>Equip students in methodology related to electronic circuits, devices and systems.</li></ul>                                                                                                                       |                                               |                   |                             |                                                                                                                                      |          |
| Course Outcomes:   |          | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>Identify electronic components and ICs.</li><li>Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li><li>Apply research-based knowledge to design and conduct experiments.</li><li>Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li><li>Utilize the basic knowledge in Electronics science.</li><li>Apply Electronics knowledge in their day-to-day life.</li></ul> |                                               |                   |                             |                                                                                                                                      |          |
| Unit System        |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                               | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| Unit I             |          | <b>Hybrid-parameters &amp; Cascaded Amplifiers:</b><br>Hybrid-parameters, Transistor equivalent circuit of CE, CB and CC, Analysis of small signal CE amplifier. Concept of cascaded amplifier, Types of coupling, RC Coupled Amplifier, Direct Coupled amplifier, Transformer Coupled amplifier and Single Tuned amplifier.                                                                                                                                                                                                                                                                                                   |                                               | 8 Hrs.            | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| Unit II            |          | <b>Feedback Amplifier and Timer:</b><br>Concept of feedback, Feedback theory, Positive and negative feedback, Advantage of negative feedback, Physical idea of feedback amplifier: Block diagram only.<br>Functional block diagram of IC-555, Applications of IC-555: Astable, Bistable and Monostable multivibrators, Construction, working and time period of each.                                                                                                                                                                                                                                                          |                                               | 7 Hrs.            | 7 Marks                     |                                                                                                                                      |          |
| Unit III           |          | <b>Binary Arithmetic:</b><br>Binary, Octal & Hexadecimal number system and their inter conversion, Binary arithmetic Addition and Subtraction using 1's & 2's compliments, Multiplication & Division. Binary codes: 8421 BCD, Excess-3 & Gray code.                                                                                                                                                                                                                                                                                                                                                                            |                                               | 8 Hrs.            | 8 Marks                     |                                                                                                                                      |          |
| Unit IV            |          | <b>Logic Gates:</b><br>Definition and truth tables of NOT, OR, AND, NAND, NOR gates. EX-NOR & EX-OR gates, Universal gates, Designing of Basic gates using NAND and NOR gates, Half adder, Full adder, 4-bit binary full adder.                                                                                                                                                                                                                                                                                                                                                                                                |                                               | 7 Hrs.            | 7 Marks                     |                                                                                                                                      |          |
| References:        |          | 1. Principles of electronics by V. K. Mehta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                               |                   |                             |                                                                                                                                      |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | 2. Elements of electronics by Bagde and Singh<br>3. Basic electronics by B. L. Theraja (S. Chand and Company)<br>4. Digital and analog techniques by Navneet, Kale and Gokhale (Kitab mahal prakashan)<br>5. Introduction to digital electronics by Mohinder Singh<br>6. Digital principles and applications by Malvino and Leach<br>7. Modern digital electronics by R. P. Jain                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>MCQs for Internal Assessment:</b>                    | 1. Cross over distortion occurred in ...power amplifier<br>Class A (b) Push pull (c) Class C (d) None of the above<br>2. Class B push pull power amplifier consist of ..... transistor<br>(a) 3 (b) 2 (c) 1 (d) 4<br>3. Center tap transformer is needed in ..... Class B power amplifier<br>(a) Transformer coupled (b) Push pull (c) Coupled (d) None of the above<br>4. The base of Hexadecimal number system is:<br>(a) 2 (b) 4 (c) 8 (d) 16<br>5. The base of Binary number system is:<br>2 (b) 4 (c) 8 (d) 16<br>6. 1's complement of 0111 is:<br>(a) 1111 (b) 1100 (c) 1010 (d) None<br>7. The Boolean equation of AND gate is:<br>(a) $A+B$ (b) $AB$ (c) $AB$ (d) $A+B$<br>8. According to Boolean law: $A + 1 = ?$<br>(a) 1 (b) A (c) 0 (d) $A'$ |
| <b>Short answer questions</b>                           | 1. Classify Power Amplifiers.<br>2. What is mean by Hybrid?<br>3. Write pin No. Of IC555.<br>4. How Many Pins IC 555?<br>5. Which gates are the Basic gates?<br>6. Define number System.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Long answer questions</b>                            | 1. Draw the hybrid equivalent circuit of CE and Explain.<br>2. Explain construction and working of CB and Explain.<br>3. Explain construction and working of CC and Explain.<br>4. Draw the symbol, truth table and Boolean equation of NAND and NOR gates.<br>5. Define Number system? Also define Decimal, Binary, Octal and Hexadecimal number system.                                                                                                                                                                                                                                                                                                                                                                                                 |

### Minor Lab / Practical – 7: Electronic Circuits and Digital Techniques- I

| Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Semester | Course Code                                                                                                                                                                   | Course Name                                                | Credits | Teaching Hours | Exam Duration | Max Mark |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------|----------------|---------------|----------|
| 5.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | III      | 113217                                                                                                                                                                        | Practical on Electronic Circuits and Digital Techniques- I | 2       | 60             | 4 Hrs         | 50       |
| Course Objectives:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          | Develop skills amongst the students.<br>Identify the analog and digital electronic circuits.                                                                                  |                                                            |         |                |               |          |
| Course Outcomes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          | <b>After completing the course, the student will</b><br>Students will be able to identify the analog and digital electronic circuits.<br>Develop skills amongst the students. |                                                            |         |                |               |          |
| Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |                                                                                                                                                                               |                                                            |         |                |               |          |
| 1. Study of CE Amplifier.<br>2. Study of CB Amplifier.<br>3. Study of Class B Push-pull Power Amplifier.<br>4. Study of RC Phase Shift Oscillator.<br>5. Study of Wein Bridge Oscillator.<br>6. Study of IC-555 as Astable Multivibrator.<br>7. Study of IC-555 as Monostable Multivibrator.<br>8. Study of IC-555 as Bistable Multivibrator.<br>9. Identification and Verification of Logic gates.<br>10. Identification and Verification of Universal gates.<br>11. Construct and study Ex-OR gate using Basic gates.<br>12. Construct and study Ex-NOR gate using Basic gates.<br>13. Construction and verification of De Morgans Theorems.<br>14. Construct & study of Half Adder.<br>15. Construct & study of full Adder<br>16. Construction and Study of IC 7483 as a 4-bit parallel Adder. |          |                                                                                                                                                                               |                                                            |         |                |               |          |

**Note :** Students shall have to perform at least 10 experiments from prescribed list:

## GOEC Theory 5: Solar Power Plant Installation and Maintenance

| Level              | Semester                                                                                                                                                                                                                                                                             | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Course Name                                    | Credits           | Teaching Hours              | Exam Duration                                                                                                                                                                                                                                                                                                                                                          | Max Mark |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                | III                                                                                                                                                                                                                                                                                  | 113218                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Solar Power Plant Installation and Maintenance | 2                 | 30                          | 2 Hrs                                                                                                                                                                                                                                                                                                                                                                  | 30       |
| Course Objectives: |                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>To introduce students to various resources of renewable energy</li><li>To make students acquainted with the working principle of photovoltaic cell.</li><li>To develop practical skills required for installation and interfacing of solar panels.</li><li>4. To learn troubleshooting, repairing and proper maintenance of solar photovoltaic systems.</li></ul>                                                                                                                                                    |                                                |                   |                             |                                                                                                                                                                                                                                                                                                                                                                        |          |
| Course Outcomes:   |                                                                                                                                                                                                                                                                                      | After the completion of the course, students will be able to: <ul style="list-style-type: none"><li>Identify and testing of photovoltaic cells and related components</li><li>Demonstrate various input and output running loads of devices, ratings and estimations.</li><li>Apply practical knowledge and skills regarding installation and interfacing of solar panels.</li><li>Time to time maintenance and updating of solar photovoltaic systems.</li><li>Troubleshooting, repairing and proper maintenance of solar photovoltaic systems.</li></ul> |                                                |                   |                             |                                                                                                                                                                                                                                                                                                                                                                        |          |
| Unit System        | Contents                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                                                                                                                            |          |
| Unit I             | Need of renewable and sustainable energy; Various resources of renewable energy; Working principle of photovoltaic cell; Monocrystalline, Polycrystalline and Bifacial solar panels; Photovoltaic materials, Modules and arrays; Factors affecting output of photovoltaic modules.   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | 8 Hrs             | 8 Marks                     | Suitable pedagogical strategies, both classical and contemporary innovations, for integration into the Teaching, Learning, and Evaluation (T, L, & E) Processes. These strategies should be tailored to enhance the delivery and comprehension of the course content within each Unit, ensuring that they align with the educational objectives and learning outcomes. |          |
| Unit II            | Solar photovoltaic systems and key benefits; Block diagram of solar photovoltaic system; Solar charge controller; Interfacing of solar charge controller to battery station; PWM and MPPT type Inverters; Interfacing of batteries to power inverters.                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                        |          |
| Unit III           | Calculations of Voltage, Current and Power ratings of photovoltaic systems; Installation of solar panels to a roof; On grid and off grid solar systems; Solar charge controllers; Testing and running of loads to PV systems.                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                                                                                                                        |          |
| Unit IV            | Calculations of Voltage, Current and Power ratings of batteries and its charging time; Costing and estimation of 1KVA, 5KVA and 10KVA solar systems; Safety and maintenance of rechargeable batteries; Safety precautions, testing and troubleshooting of solar photovoltaic systems |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                        |          |
| References:        |                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>Solanki C. S.; ‘Solar Photovoltaic Technology &amp; Systems: A Manual for Technicians &amp; Engineers’, PHI Publisher</li><li>Dr. Sundaravadivelu, Dr. Suresh Kumar; ‘Solar Photovoltaic Power Systems: Principles, Design &amp;</li></ul>                                                                                                                                                                                                                                                                           |                                                |                   |                             |                                                                                                                                                                                                                                                                                                                                                                        |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <p>Applications'; Notion Press Pvt. Ltd., 2018 Edition.</p> <ul style="list-style-type: none"> <li>• DIY Source; 'Solar Power for Beginners: A Technical Guide'; 2021 Edition.</li> <li>• A. K. Gupta; 'Solar PV Power and Solar Products Handbook'; NIIR Project Consultancy Services, First Edition 2022.</li> <li>• B. L. Theraja, 'Basic Electronics'; S. Chand &amp; Company Publication, 2022 Edition.</li> </ul>                                                                                                                                                                                                                                                                                                        |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>MCQs for Internal Assessment</b>                     | <ol style="list-style-type: none"> <li>1. Bifacial solar panel accepts solar energy from ----- side.<br/>a) Top    b) Bottom    c) Both    d) None</li> <li>2. Factors affecting output voltage of photovoltaic modules are -----.<br/>a) Light Intensity    b) Distance    c) Panel material    d) Above all</li> <li>3. Solar panel consists of number of ----- cells.<br/>a) Piezoelectric    b) Solovoltaic    c) Photovoltaic    d) Monovoltaic</li> <li>4. Power rating of any solar power plant is indicated in -----.<br/>a) KPA    b) KAV    c) KPV    d) KVA</li> <li>5. The term KVA stands for -----.<br/>a) Kilo Value Ampere    b) Kilo Volt Amplitude<br/>c) Kilo Volt Ampere    d) Kilo Watt Ampere</li> </ol> |
| <b>Short answer questions</b>                           | <ol style="list-style-type: none"> <li>1. What is renewable energy?</li> <li>2. What is photovoltaic cell?</li> <li>3. What is Bifacial solar panel?</li> <li>4. What is Solar charge controller?</li> <li>5. What do you mean by on-grid and off-grid solar systems?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>1. Explain the need of renewable and sustainable energy.</li> <li>2. Explain the working principle of photovoltaic cell?</li> <li>3. Compare Monocrystalline and Polycrystalline solar panels.</li> <li>4. Explain on-grid and off-grid solar systems.</li> <li>5. Explain block diagram of solar photovoltaic system.</li> </ol>                                                                                                                                                                                                                                                                                                                                                       |



## Vocational Skill Course 2: Lab/ Practical 8: Advanced applications/ practical on Major Electronics

| Level                            | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Course Code | Course Name                                                 | Credits | Teaching Hours | Exam Duration | Max Mark |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------|---------|----------------|---------------|----------|
| 5.0                              | III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 113219      | Advanced applications/<br>practical on<br>Major Electronics | 2       | 60             | 4 Hrs         | 50       |
| <b>Course Objectives:</b>        | <ul style="list-style-type: none"> <li>To reduce the unemployment by providing self- employment schemes.</li> <li>To make the students skilled technician.</li> <li>To reduce the mismatch between the demand and supply of skill man-power.</li> <li>To develop attitudes, knowledge, and skills for entrepreneurship and self-employment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                       |             |                                                             |         |                |               |          |
| <b>Course Outcomes:</b>          | <b>After successful completion of the course, the students will be able to:</b> <ul style="list-style-type: none"> <li>Apply their practical knowledge/ hands on training in the workplace.</li> <li>It fulfills the demand of industry.</li> <li>It develops skilled technician.</li> <li>Start business-oriented services.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                                                             |         |                |               |          |
|                                  | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                                             |         |                |               |          |
| <b>Lab/<br/>Practical<br/>10</b> | <b>Perform any five experiments of the followings using Bread Board:</b> <ol style="list-style-type: none"> <li>Design any type of Power Amplifier.</li> <li>Construct RC Phase Shift Oscillator.</li> <li>Construct Wein Bridge Oscillator.</li> <li>Design IC -555 as a Timer circuit.</li> <li>Construct School Bell Using IC -555.</li> <li>Construct Astable Multivibrator using IC -555.</li> <li>Construct Monostable Multivibrator using IC -555.</li> <li>Construct Bistable Multivibrator using IC -555.</li> <li>Design Basic gates using NAND gates.</li> <li>Design Basic gates using NOR gates.</li> <li>Construct Half Adder circuit.</li> <li>Construct Full Adder circuit.</li> <li>Design Arithmetic logic circuit using gates.</li> </ol> |             |                                                             |         |                |               |          |

**Note: Mode of Examination: Internal Exam (There is no need of External Examiner)**

## Electronics FP/CES- Project

| Electronics FP/CES- Project (113220)                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field Project / CE Services in Electronics: Phase-I                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Credits: 02                                                                     | Workload (Hrs./Week): 04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Course Objectives:</b>                                                       | <p>To provide hands-on experience in applying theoretical Electronics knowledge to real-world challenges through field-based projects or community engagement (CE) services.</p> <p>To train students in identifying, problems encountered in Electronics and related fieldwork or community service activities.</p> <p>To encourage students to integrate Electronics and field Electronics concepts with interdisciplinary knowledge, technology, and societal needs.</p> <p>To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences.</p> <p>To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.</p>                                                                                                                            |
| <b>Course Outcomes:</b>                                                         | <p>Students will be able to apply Electronics related analytical techniques to investigate and solve real-world problems in field settings.</p> <p>Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service.</p> <p>Students will be able to design, plan, and execute a field Electronics project or community service activity from inception to completion, including documentation and reporting.</p> <p>Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events.</p> <p>Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well-being.</p>                                                       |
| Guidelines/SOP for Selection and Implementation of Field Projects / CE Services |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>1. Project Selection and Planning</b>                                        | <p><b>Faculty Guidance:</b> Students will be assigned a faculty mentor to guide their project, providing expertise and resources.</p> <p><b>Project Topic:</b> The project topic should be relevant to Electronics and align with the student's interests and the available resources.</p> <p><b>Literature Review:</b> Students are expected to conduct a thorough literature review to understand existing knowledge and identify research gaps.</p> <p><b>Data Collection and Analysis:</b> Projects often involve experiments, field sampling, simulations, or data analysis from existing sources, depending on the topic.</p> <p><b>Project Timeline:</b> The total time allocation for the student to carry out field project is 60 hours.</p> <p>The students shall have to submit the report regarding the project in printed form containing the project title, abstract, literature review and references, etc.</p> |
| <b>2. Data Analysis and Interpretation</b>                                      | <p><b>Statistical Methods:</b> Students will learn and apply appropriate statistical methods to analyze data.</p> <p><b>Interpretation of Results:</b> Data should be interpreted within the context of the project, highlighting significant findings and limitations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>3. Report Writing and Presentation</b>                                       | <p><b>Report Format:</b> A structured report format is usually followed, including an abstract, introduction, methodology, results, discussion, and conclusion.</p> <p><b>Data Presentation:</b> Data should be presented clearly and accurately using tables, graphs, and figures.</p> <p><b>Oral Presentation:</b> Students will be required to present their findings to peers and faculty.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>4. CE Services (Community Engagement)</b>                                    | <p><b>Community Needs:</b> Projects may focus on addressing specific community needs or challenges relevant to Electronics.</p> <p><b>Collaboration:</b> Students can collaborate with local organizations to implement their projects.</p> <p><b>Impact Assessment:</b> The impact of the project on the community should be evaluated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>5. Evaluation and Assessment</b>                                             | <p><b>Project Report:</b> The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)</p> <p><b>Oral Presentation:</b> The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)</p> <p><b>Faculty Evaluation:</b> The faculty mentor will assess the student's performance throughout the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                                           |
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|                                                              | project. (20 Marks)<br><b>Total 50 Marks</b>                                                                                                                                                                                                                                                                                                                                                              |
| <b>Examples of Field Projects/CE Services in Electronics</b> | <p><b>Environmental Electronics:</b> Studying the local ecosystems and developing renewable energy solutions.</p> <p><b>Community Outreach:</b> Organizing Safety measures and awareness workshops or engaging in scientific literacy initiatives.</p> <p><b>Research Project:</b> Study related to the subjects that contribute to the advancement of knowledge and the well-being of living things.</p> |

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
**FACULTY: Science and Technology**  
**Subject: ELECTRONICS**  
**Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)**  
**Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme**

**SECOND YEAR: Level 5.0 - SEMESTER – IV (T & L Credit Scheme)**

| Mode of Teaching                                                           | Ver. No | The Vertical           | Type of Course   | Course Code | Course Name                                   | Credits   | Workload (Hrs/ Week) | Vertical Workload (Hrs/ Week) |
|----------------------------------------------------------------------------|---------|------------------------|------------------|-------------|-----------------------------------------------|-----------|----------------------|-------------------------------|
| Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/ Online/ Hybrid | a       | Major                  | Theory 5         | 113221      | Electronic Devices and Circuits-2             | 2         | 2                    | 10                            |
|                                                                            |         |                        | Theory 6         | 113222      | Digital Techniques-2                          | 2         | 2                    |                               |
|                                                                            |         |                        | Theory 7         | 113230      | Microprocessor 8085 & 8086                    | 2         | 2                    |                               |
|                                                                            |         |                        | Lab/Practical-9  | 113223      | Practical based on Theory 5, 6 & 7            | 2         | 4                    |                               |
|                                                                            | b       | Minor                  | Theory 4         | 113224      | Electronic Circuits and Digital Techniques-II | 2         | 2                    | 6                             |
|                                                                            |         |                        | Lab/Practical-10 | 113225      | Practical on Minor Theory 4                   | 2         | 4                    |                               |
|                                                                            | c       | Generic/ Open Elective | Theory 6         | 113226      | Basics of Biomedical Instrumentation          | 2         | 2                    | 2                             |
|                                                                            | d       | VSC                    | Lab/Practical-11 | 113227      | Advanced Practical on Major Theory 5, 6 & 7   | 2         | 4                    | 4                             |
|                                                                            | f       | FP/CES                 | Project          | 113229      | Field Project / CE Services on Electronics    | 2         | 4                    | 8                             |
|                                                                            |         | CC                     | Outdoor          | ----        | Separate SOP will be released                 | 2         | 4                    |                               |
|                                                                            |         | <b>TOTAL</b>           |                  |             |                                               | <b>20</b> | <b>30</b>            | <b>30</b>                     |

## Major Theory 5 - Electronic Devices and Circuits-II

| Level              | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Course Code | Course Name                        | Credits           | Teaching Hours              | Exam Duration                                                                                                                                    | Max Mark |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 113221      | Electronic Devices and Circuits-II | 2                 | 30                          | 2 Hrs                                                                                                                                            | 30       |
| Course Objectives: | <ul style="list-style-type: none"><li>Read, understand and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li><li>To give need-based education in Electronics of the highest quality at the undergraduate level.</li><li>Use Information Communication Technology to gather knowledge.</li><li>Impart skills required to gather information from resources.</li><li>Equip students in methodology related to electronic circuits, devices and systems.</li></ul>                                                                                                                 |             |                                    |                   |                             |                                                                                                                                                  |          |
| Course Outcomes:   | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>Identify electronic components and ICs.</li><li>Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li><li>Apply research-based knowledge to design and conduct experiments.</li><li>Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li><li>Utilize the basic knowledge in Electronics science.</li><li>Apply Electronics knowledge in their day-to-day life.</li></ul> |             |                                    |                   |                             |                                                                                                                                                  |          |
| Unit System        | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                                    | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                      |          |
| Unit I             | Operational Amplifier:<br>Construction and working of Difference amplifier, Block diagram of OP-AMP, Characteristics of Ideal OP-AMP, Concept of virtual ground, Parameters of OP-AMP: Input impedance, Output impedance, Open loop gain, Close loop gain, CMRR, Slew rate, Input offset voltage and current, Input bias current.                                                                                                                                                                                                                                                                                              |             |                                    | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable is expected. |          |
| Unit II            | Applications of OP-AMP:<br>OP-AMP as Inverting and Non-inverting amplifier, Adder, Subtractor, Differentiator and Integrator, Comparator and Voltage Follower.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                                    | 7 Hrs             | 7 Marks                     |                                                                                                                                                  |          |
| Unit III           | Advanced Applications of OP-AMP:<br>Solution to simultaneous equations, Differential equation for Harmonic oscillator, Damped harmonic oscillator, Regenerative comparator, Logarithmic amplifier, Construction, working and time period of Astable, Monostable and Bistable multivibrators.                                                                                                                                                                                                                                                                                                                                   |             |                                    | 8 Hrs             | 8 Marks                     |                                                                                                                                                  |          |
| Unit IV            | Analog to Digital and Digital to Analog converters:<br>Need of A/D and D/A converters. D/A converter: R-2R ladder type, Weighted resistor type, Sample and hold circuit, Definitions of Resolution, Accuracy and Linearity. A/D converter: Single and Dual slope, Counter type, Successive approximation type.                                                                                                                                                                                                                                                                                                                 |             |                                    | 7 Hrs             | 7 Marks                     |                                                                                                                                                  |          |
| References:        | Op-amp theory and application by Ramakant Gaykwad<br>Basic electronics by B. L. Thereja<br>Element of electronics by Bagde and Singh<br>Principles of electronics by V. K. Mehta<br>Integrated electronics by Millman Halkis                                                                                                                                                                                                                                                                                                                                                                                                   |             |                                    |                   |                             |                                                                                                                                                  |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | Linear integrated circuit by Ramakant Gaykwad<br>Digital principle and application by Malvino Leach                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>MCQ for Internal Assessment</b>                      | <ol style="list-style-type: none"> <li>1. An OP-AMP can be classified as _____ amplifier<br/>a) linear   b) low-<math>r_{in}</math>   c) positive feedback   d) RC-coupled</li> <li>2. Two input terminals of an Op-Amp are known as _____<br/>a) Positive and Negative                      b) Differential and non-differential<br/>c) Inverting and non-inverting              d) High and Low</li> <li>3. A DAC is a _____<br/>a) digital-to-analog computer    b) digital analysis calculator<br/>c) data accumulation converter   d) digital-to-analog converter</li> <li>4. The number of comparators in a parallel conversion type 8-bit analog to digital converter is ?<br/>a) 8   b) 16   c) 255   d) 256</li> <li>5. The Op-Amp Comparator circuit uses _____<br/>a) Positive Feedback   b) Negative Feedback   c) Regenerative feedback   d) No Feedback</li> <li>6. When in a negative scalar, both <math>R_1</math> and <math>R_f</math> are reduced to zero, the circuit functions as _____<br/>a) Integrator   b) Subtractor   c) Comparator   d) Unity Follower</li> <li>7. _____ analog-to-digital converters (ADCs) use no clock signal, because there is no timing or sequencing required.<br/>a) Actuator   b) Dual   c) Flash   d) Bipolar</li> <li>8. The problems of the binary-weighted resistor digital-to-analog converter (DAC) can be overcome by using _____.<br/>a) an 8-bit binary-weighted resistor DAC                      b) an R/2R ladder DAC<br/>c) a staircase DAC                                                              d) a flash DAC</li> </ol> |
| <b>Short answer questions</b>                           | <ol style="list-style-type: none"> <li>1. Write ideal characteristics of Op-amp</li> <li>2. What is virtual ground?</li> <li>3. What is CMRR?</li> <li>4. Define Accuracy.</li> <li>5. Define Resolution.</li> <li>6. Explain the term slew rate.</li> <li>7. Explain A/D convertor.</li> <li>8. Explain D/A convertor.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>1. Draw the block diagram of Op. Amp and explain each block.</li> <li>2. Explain the Operational Amplifier as an adder.</li> <li>3. Explain the harmonic oscillator.</li> <li>4. Explain the Op Amp as an Astable multivibrator.</li> <li>5. Explain the R-2R type D/A convertor.</li> <li>6. Explain the successive approximation type A/D convertor.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Major Theory 6- Digital Techniques-II

| Level              | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Course Code | Course Name           | Credits           | Teaching Hours              | Exam Duration                                                                                                                                    | Max Mark |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 113222      | Digital Techniques-II | 2                 | 30                          | 2 Hrs                                                                                                                                            | 30       |
| Course Objectives: | <ul style="list-style-type: none"><li>Read, understand and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li><li>To give need-based education in Electronics of the highest quality at the undergraduate level.</li><li>Use Information Digital Technology to gather knowledge.</li><li>Impart skills required to gather information from resources.</li><li>Equip students in methodology related to electronic circuits, devices and systems.</li></ul>                                                                                                                       |             |                       |                   |                             |                                                                                                                                                  |          |
| Course Outcomes:   | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>Identify electronic components and ICs.</li><li>Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li><li>Apply research-based knowledge to design and conduct experiments.</li><li>Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li><li>Utilize the basic knowledge in Electronics science.</li><li>Apply Electronics knowledge in their day-to-day life.</li></ul> |             |                       |                   |                             |                                                                                                                                                  |          |
| Unit System        | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                       | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                      |          |
| Unit I             | <b>Multivibrators and Flip Flops:</b> Construction & working of Astable, Monostable and Bistable Transistorized multivibrators, Flip Flops: Logic diagram, Truth table, construction & working of RS, CK-RS, JK, JKMS, T and D type Flip Flops Concept of Edge trigger Flip-Flop, Concepts of Preset & Clear terminals.                                                                                                                                                                                                                                                                                                        |             |                       | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable is expected. |          |
| Unit II            | <b>Shift registers and Counters:</b><br><b>Shift registers:</b> Construction & working of SISO, SIPO, PISO & PIPO, Bidirectional Shift registers, Shift register IC–7495, Applications of shift register.<br><b>Counters:</b> 4-bits Asynchronous & Synchronous Counters, Up-down counter, Modified asynchronous counters: Mod-7, Mod-10 and Mod-13, Ring counter and Johnson’s counter.                                                                                                                                                                                                                                       |             |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                  |          |
| Unit III           | <b>Combinational Logic Circuits:</b><br>Definition, construction, operation and applications:<br><b>Encoders:</b> Binary to BCD, Decimal to BCD, IC-74147.<br><b>Decoders:</b> 2:4 lines, BCD to Decimal, BCD to 7 Segment, IC- 7447,<br><b>Multiplexers:</b> 4:1 and 8:1 Mux,<br><b>De-multiplexers:</b> 1:4 and 1:8 Demux,                                                                                                                                                                                                                                                                                                   |             |                       | 8 Hrs             | 8 Marks                     |                                                                                                                                                  |          |
| Unit IV            | <b>Semiconductor Memories:</b><br>Concept of memory, Primary and Secondary memory, Classification of memories, Volatile and Non-volatile memories, Memory Hierarchy, Semiconductor memory: RAM, ROM, PROM, EPROM, EEPROM, Flash memory.                                                                                                                                                                                                                                                                                                                                                                                        |             |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                  |          |
| References:        | <ul style="list-style-type: none"><li>Digital and analog technique by Navneet, Kale and Gokhale</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                       |                   |                             |                                                                                                                                                  |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <ul style="list-style-type: none"> <li>• Modern digital electronics by R.P.Jain</li> <li>• Introduction to digital electronics by Mohinder Singh</li> <li>• Digital principle and application by Malvino Leach</li> <li>• Integrated electronics by Millman Halkis</li> <li>• Pulse digital and switching waveforms by Millman and Taub</li> <li>• Basic electronics by B. L. Thereja</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>MCQ for Internal Assessment</b>                      | <p>1. When both inputs of a J-K flip-flop cycle, the output will _____<br/> a) Be invalid b) Change c) Not change d) Toggle</p> <p>In digital logic, a counter is a device which _____<br/> a) Counts the number of outputs<br/> b) Stores the number of times a particular event or process has occurred<br/> c) Stores the number of times a clock pulse rises and falls<br/> d) Counts the number of inputs</p> <p>3. Based on how binary information is entered or shifted out, shift registers are classified into _____ categories.<br/> a) 2 b) 3 c) 4 d) 5</p> <p>4. A serial in/parallel out, 4-bit shift register initially contains all 1s. The data nibble 0111 is waiting to enter. After four clock pulses, the register contains _____<br/> a) 0000 b) 1111 c) 0111 d) 1000</p> <p>5. The instruction used in a program for executing them is stored in the _____<br/> a) CPU b) Control Unit c) Memory d) Microprocessor</p> <p>6. A flip flop stores _____<br/> a) 10 bit of information b) 1 bit of information c) 2 bit of information d) 3-bit information</p> <p>7. How many inputs will a decimal-to-BCD encoder have?<br/> a) 4 b) 8 c) 10 d) 16</p> |
| <b>Short answer questions</b>                           | <ol style="list-style-type: none"> <li>1. What is flip flop?</li> <li>2. Draw truth table of JK Flip Flop.</li> <li>3. Draw truth table of D and T Flip Flop.</li> <li>4. Write application of Counter.</li> <li>5. Write advantages of JK flip flop.</li> <li>6. What is shift register?</li> <li>7. What is multiplexer?</li> <li>8. State classification of memory.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>1. Explain construction and working of Monostable multivibrator.</li> <li>2. Explain construction, working and truth table of JKFF.</li> <li>3. Explain construction, working and truth table of up counter.</li> <li>4. Explain flash memory.</li> <li>5. Explain Ring counter in detail.</li> <li>6. Explain BCD to 7 segment decoder.</li> <li>7. Explain hierarchy of memory.</li> <li>8. Differentiate between volatile and non-volatile memory.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



## Major Theory 7- Microprocessor 8085 & 8086

| Level                                            | Semester                                                                                                                                                                                                                                                                                                                                                                                                             | Course Code | Course Name                | Credits           | Teaching Hours              | Exam Duration                                                                                                                  | Max Mark |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                                              | IV                                                                                                                                                                                                                                                                                                                                                                                                                   | 113230      | Microprocessor 8085 & 8086 | 2                 | 30                          | 2 Hrs                                                                                                                          | 30       |
| Course Objectives:                               | <ul style="list-style-type: none"><li>Describe the organization and architecture of 8085 and 8086 microprocessor.</li><li>Understanding the classification of instructions.</li><li>Addressing modes of instructions.</li><li>Realizing the interfacing of memory.</li><li>Interfacing various peripheral ICs.</li></ul>                                                                                             |             |                            |                   |                             |                                                                                                                                |          |
| Course Outcome:                                  | <ul style="list-style-type: none"><li>Understanding the organization and architecture of 8085 and 8086 microprocessor</li><li>Applying the instruction set of 8085 and 8086 Microprocessor.</li><li>Relating the addressing modes used in the instructions.</li><li>Interfacing the memory and other I/O devices.</li><li>Familiarizing the architecture and operation with 8085 and 8086 microprocessors.</li></ul> |             |                            |                   |                             |                                                                                                                                |          |
| Unit System                                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                             |             |                            | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                    |          |
| Unit I                                           | Architecture of 8085 microprocessor: Evolution of microprocessor, Block and pin diagram of 8085 microprocessor and its function, instruction format, Types of instruction set, simple program on data transfer, 8 bit addition, subtraction etc.                                                                                                                                                                     |             |                            | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration on microprocessor kit (physically and/or virtually), wherever applicable is expected. |          |
| Unit II                                          | Architecture of 8086 Microprocessor: Block diagram and pin diagram of 8086 microprocessor, BIU and EU, operating modes of 8086, G.P.R, pointer and index register, segment register, concept of segmented memory, instruction pointer, status flag, physical and effective address.                                                                                                                                  |             |                            | 7 Hrs             | 7 Marks                     |                                                                                                                                |          |
| Unit III                                         | Instruction set of 8086 microprocessors: MOV, PUSH, POP, LEA, LDS, LES, Arithmetic & Logic Instructions. Addressing mode, Bus cycle etc.                                                                                                                                                                                                                                                                             |             |                            | 8 Hrs             | 8 Marks                     |                                                                                                                                |          |
| Unit IV                                          | Programming of 8086 microprocessor: Programs of data transfer, addition, subtraction, division, multiplication using various addressing modes.                                                                                                                                                                                                                                                                       |             |                            | 7 Hrs             | 7 Marks                     |                                                                                                                                |          |
| References:                                      | <ul style="list-style-type: none"><li>Microprocessor architecture and programming and application with 8085 by Ramesh Gaokar</li><li>Microprocessor 8085 by B.Ram</li><li>Microprocessor architecture and application by Dougulus Hall</li><li>Intel microprocessor 8086 by Brey:PHI</li><li>Introduction of microprocessor by A.P.Mathur</li></ul>                                                                  |             |                            |                   |                             |                                                                                                                                |          |
| Model questions for theory external examination. |                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                            |                   |                             |                                                                                                                                |          |
| MCQ for Internal Assessment                      | <b>MCQ for internal assessment :</b><br>1) Intel 8085 is a _____ bit microprocessor.<br>a) 4-bit   b) 8-bit   c) 16-bit   d) 32-bit<br>2) What is the maximum addressable memory size of the microprocessor 8085?<br>a) 16 KB    b) 32 KB   c) 64 KB   d) 128 KB                                                                                                                                                     |             |                            |                   |                             |                                                                                                                                |          |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | <p>3) Which of the following signals is used to demultiplex the address/data bus?<br/>a) READY b) HOLD c) ALE d) INTA</p> <p>4) How many general-purpose registers are available in the 8085?<br/>a) 4 b) 5 c) 6 d) 8</p> <p>5) Which interrupt has the highest priority in the 8085?<br/>a) RST 7.5 b) RST 6.5 c) TRAP d) INTR</p> <p>6) The intel 8086 microprocessor is ..... a processor<br/>a) 8 bit b) 16 bit c) 32 bit d) 4 bit</p> <p>7) The CF is known as .....<br/>a) carry flag b) B. condition flag c) common flag d) single flag</p> <p>8) The index register are used to hold .....<br/>a) memory register b) offset address c) segment memory d) offset memory</p> <p>9) The push source copies a word from source to .....<br/>a) stack b) memory c) register d) destination</p> <p>10) The 8086 fetches instruction one after another from of memory<br/>a) code segment b) IP c) ES d) SS</p> |
| <b>Short answer questions</b> | <p>Short answer Type (2/3 Marks)</p> <ol style="list-style-type: none"> <li>1. What is microprocessor?</li> <li>2. Write function of READY and HOLD.</li> <li>3. Write function of HLDA and ALU.</li> <li>4. Write name of buses used in 8085.</li> <li>5. What is function of Program counter?</li> <li>6. What is function of Stack pointer?</li> <li>7. What is size of address bus of 8085 and 8086 microprocessor?</li> <li>8. Write instruction types of 8086.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Long answer questions</b>  | <p>Long answer Type (4/5 Marks) :</p> <ol style="list-style-type: none"> <li>1. Draw block diagram of 8085 microprocessor and write function of each.</li> <li>2. Draw block diagram of 8086 microprocessor and write function of each.</li> <li>3. Draw pin diagram of 8085 microprocessor and write function of each.</li> <li>4. Draw pin diagram of 8086 microprocessor and write function of each.</li> <li>5. Explain flag register in 8085 microprocessors.</li> <li>6. Explain flag register in 8086 microprocessors.</li> <li>7. Explain operating modes of 8086 microprocessor.</li> <li>8. Explain addressing modes of 8086 microprocessor.</li> </ol>                                                                                                                                                                                                                                                |

### Lab / Practical – 9: Practical based on Theory 5, 6 and 7

| Level | Semester | Course Code | Course Name                          | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|--------------------------------------|---------|----------------|---------------|----------|
| 5.0   | IV       | 113223      | Practical based on Theory 5, 6 and 7 | 2       | 60             | 4 Hrs         | 50       |

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab/<br/>Practical 9</b> | <p>Minimum ten experiments, at least one on each of the following aspects.</p> <ol style="list-style-type: none"><li>1. OP-AMP applications.</li><li>2. OP-AMP as Astable, Monostable and Bistable mode.</li><li>3. ADC and DAC convertor.</li><li>4. Transistorized Astable, Monostable and Bistable Multivibrator, RS, CK RS, D, T, JK and JKMS FF.</li><li>4-bit binary counter, modifying counter, Ring and Johnson's counter (using ICs), SISO, SIPO, PISO and PIPO.</li><li>6. Decoder, Multiplexer, IC74147 mounting and testing</li><li>7. Study of memory.</li><li>8. Write ALP on addition, subtraction, multiplication, Division, find maximum no. &amp; minimum no. from the series of numbers using Microprocessor 8085.</li><li>9. Write ALP on addition, subtraction, multiplication, Division on 8- bit data &amp; 16- bit data using various addressing modes.</li></ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination

### Minor Theory 4 – Electronic Circuits and Digital Techniques-II

| Level                     | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Course Code | Course Name                                   | Credits                  | Teaching Hours                     | Exam Duration                                                                                                                                    | Max Mark |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------|--------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.0                       | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 113224      | Electronic Circuits and Digital Techniques-II | 2                        | 30                                 | 2 Hrs                                                                                                                                            | 30       |
| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>Read, understand and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li> <li>To give need-based education in Electronics of the highest quality at the undergraduate level.</li> <li>Use Information Communication Technology to gather knowledge.</li> <li>Impart skills required to gather information from resources.</li> <li>Equip students in methodology related to electronic circuits, devices and systems.</li> </ul>                                                                                                                         |             |                                               |                          |                                    |                                                                                                                                                  |          |
| <b>Course Outcomes:</b>   | <p><b>After completing the course, the student will</b></p> <ul style="list-style-type: none"> <li>Identify electronic components and ICs.</li> <li>Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li> <li>Apply research-based knowledge to design and conduct experiments.</li> <li>Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li> <li>Utilize the basic knowledge in Electronics science.</li> <li>Apply Electronics knowledge in their day-to-day life.</li> </ul> |             |                                               |                          |                                    |                                                                                                                                                  |          |
| <b>Unit System</b>        | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                               | <b>Workload Allotted</b> | <b>Weightage of Marks Allotted</b> | <b>Incorporation of Pedagogies</b>                                                                                                               |          |
| <b>Unit I</b>             | <b>Operational Amplifier:</b><br>Construction and working of Difference amplifier, Block diagram of OP-AMP, Characteristics of Ideal OP-AMP, Concept of virtual ground, Parameters of OP-AMP: Input impedance, Output impedance, Open loop gain, Close loop gain, CMRR, Slew rate, Input offset voltage and current, Input bias current.                                                                                                                                                                                                                                                                                                     |             |                                               | 8 Hrs                    | 8 Marks                            | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable is expected. |          |
| <b>Unit II</b>            | <b>Applications of OP-AMP:</b><br>OP-AMP as Inverting and Non-inverting amplifier, Adder, Subtractor, Differentiator and Integrator, Comparator and Voltage Follower.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                                               | 7 Hrs                    | 7 Marks                            |                                                                                                                                                  |          |
| <b>Unit III</b>           | <b>Multivibrators and Flip Flops:</b><br>Construction & working of Astable, Monostable and Bistable Transistorized multivibrators, Flip Flops: Logic diagram, Truth table, construction & working of RS, CK-RS, JK, JKMS, T and D type Flip Flops Concept of Edge trigger Flip-Flop, Concepts of Preset & Clear terminals.                                                                                                                                                                                                                                                                                                                   |             |                                               | 8 Hrs                    | 8 Marks                            |                                                                                                                                                  |          |
| <b>Unit IV</b>            | <b>Shift registers and Counters:</b><br><b>Shift registers:</b> Construction & working of SISO, SIPO, PISO & PIPO, Bidirectional Shift registers, Shift register IC-7495, Applications of shift register.<br><b>Counters:</b> 4-bits Asynchronous & Synchronous Counters, Up-down counter, Modified asynchronous counters: Mod-7, Mod-10 and Mod-13, Ring counter and Johnson's counter.                                                                                                                                                                                                                                                     |             |                                               | 7 Hrs                    | 7 Marks                            |                                                                                                                                                  |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>References:</b>                                      | <ul style="list-style-type: none"> <li>• Op-amp theory and application by Ramakant Gaykwad</li> <li>• Basic electronics by B. L. Thereja</li> <li>• Element of electronics by Bagde and Singh</li> <li>• Principles of electronics by V. K. Mehta</li> <li>• Integrated electronics by Millman Halkis</li> <li>• Linear integrated circuit by Ramakant Gaykwad</li> <li>• Digital principle and application by Malvino Leach</li> <li>• Digital and analog technique by Navneet, Kale and Gokhale</li> <li>• Modern digital electronics by R.P.Jain</li> <li>• Introduction to digital electronics by Mohinder Singh</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>MCQ for Internal Assessment</b>                      | <p>1. An OP-AMP can be classified as _____ amplifier.<br/>a) linear b) low-<math>r_{in}</math> c) positive feedback d) RC-coupled</p> <p>2. Two input terminals of an Op-Amp are known as _____.<br/>a) Positive and Negative b) Differential and non-differential<br/>c) Inverting and non-inverting d) High and Low</p> <p>3. _____ analog-to-digital converters (ADCs) use no clock signal, because there is no timing or sequencing required.<br/>a) Actuator b) Dual c) Flash d) Bipolar</p> <p>4. The problems of the binary-weighted resistor digital-to-analog converter (DAC) can be overcome by using _____.<br/>a) an 8-bit binary-weighted resistor DAC b) an R/2R ladder DAC<br/>c) a staircase DAC d) a flash DAC</p> <p>5. Based on how binary information is entered or shifted out, shift registers are classified into _____ categories.<br/>a) 2 b) 3 c) 4 d) 5</p> <p>6. The instruction used in a program for executing them is stored in the _____.<br/>a) CPU b) Control Unit c) Memory d) Microprocessor</p> <p>6. A flip flop stores _____.<br/>a) 10 bit of information b) 1 bit of information c) 2 bit of information d) 3-bit information</p> <p>7. How many inputs will a decimal-to-BCD encoder have?<br/>a) 4 b) 8 c) 10 d) 16</p> <p>8. A multivibrator is an electronic circuit used to implement _____.<br/>a) Oscillator b) Timer c) Flip-flop d) All of the Mentioned</p> |
| <b>Short answer questions</b>                           | <ol style="list-style-type: none"> <li>1. Write ideal characteristics of Op-amp.</li> <li>2. What is virtual ground?</li> <li>3. What is CMRR?</li> <li>4. Explain the term slew rate.</li> <li>5. What is flip flop?</li> <li>6. Draw truth table of JK Flip Flop.</li> <li>7. Draw truth table of D and T Flip Flop.</li> <li>8. Write application of Counter.</li> <li>9. Write advantages of JK flip flop.</li> <li>10. What is shift register?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>1. Draw block diagram of Op-amp and explain each part.</li> <li>2. Explain how Op-amp is use as Adder.</li> <li>3. Explain how Op-amp is use as Differentiator.</li> <li>4. Explain construction and working of Monostable multivibrator.</li> <li>5. Explain construction, working and truth table of JKFF.</li> <li>6. Explain construction, working and truth table of asynchronous counter.</li> <li>7. Explain construction, working and truth table of up counter.</li> <li>8. Explain Ring counter in detail.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### Minor Lab / Practical – 10: Practical on Electronic Circuits and Digital Techniques - II

| Level | Semester | Course Code | Course Name                                                  | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|--------------------------------------------------------------|---------|----------------|---------------|----------|
| 5.0   | IV       | 113225      | Practical on Electronic Circuits and Digital Techniques - II | 2       | 60             | 4 Hrs         | 50       |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab/<br/>Practical 12</b> | <b>Minimum ten experiments, at least one on each of the following aspects.</b><br><br>1 OP-AMP study.<br>2. OP-AMP as Adder, Subtractor, Integrator, Differentiator,<br>3. Transistorized Astable, Monostable and Bistable Multivibrators<br>4. RS, CK RS, D, T, JK and JKMS Flip Flops .<br>5 .4-bit binary counter, modifying counter, Ring and Johnson's counter (using ICs), SISO, SIPO, PISO and PIPO. |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

## GOEC Theory 6: Basics of Biomedical Instrumentation

| Level              | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                      | Course Name                          | Credits | Teaching Hours    | Exam Duration               | Max Mark                                                                                                                                                                                                                                                    |
|--------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------|-------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.0                | IV       | 113226                                                                                                                                                                                                                                                                                                                                                           | Basics of Biomedical Instrumentation | 2       | 30                | 2 Hrs                       | 30                                                                                                                                                                                                                                                          |
| Course Objectives: |          | <ul style="list-style-type: none"><li>To understand and interpret Biomedical Signal.</li><li>To learn about different types of sensors and transducers.</li><li>To provide the knowledge about the biomedical instruments.</li><li>The ability to assess the performance, safety, and limitations of existing biomedical instrumentation.</li></ul>              |                                      |         |                   |                             |                                                                                                                                                                                                                                                             |
| Course Outcomes:   |          | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>They are able to understand the biomedical signal.</li><li>Identify and analyze the bio-electric signals and electrodes.</li><li>Identify and analyze different sensors and transducers.</li><li>Understand advanced instruments in health care.</li></ul>            |                                      |         |                   |                             |                                                                                                                                                                                                                                                             |
| Unit System        |          | Contents                                                                                                                                                                                                                                                                                                                                                         |                                      |         | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                 |
| Unit I             |          | Introduction to Biomedical Instruments:<br>Introduction, Importance of Biomedical instruments, Classification of Biomedical Equipments, Physiological signals, Physiology of Human Body, Safety Standards in Biomedical Instruments, Introduction of commonly used medical instruments: Electronic Thermometer, Stethoscope, BP monitor: Systolic and Diastolic. |                                      |         | 7 Hrs.            | 7 Marks                     | While teaching Basics of Biomedical Instrumentation, the suitable pedagogical strategies should be adapted. These strategies include Electrodes Sensors & transducers. Process of using Biomedical instrumentation using Both physically and virtual tools. |
| Unit II            |          | Bioelectric Signals and Electrodes:<br>Bioelectric Signals: ECG, EEG and EMG, Characteristics of Bioelectric Signals, Electrodes and its types: Needle electrode, Micro electrode, Disposable electrode, Silver/Sliver chloride electrode, Glass type electrode, Floating electrode.                                                                             |                                      |         | 8 Hrs.            | 8 Marks                     |                                                                                                                                                                                                                                                             |
| Unit III           |          | Biomedical Sensors and Transducers:<br>Basics of Sensors and Transducers in Biomedical Applications, Biomedical Sensors: Temperature Sensors, Pressure Sensors: Flow Sensors, Piezoelectric Sensors, Pulse & Movement Sensors, Signal Conditioning and Processing for Sensors.                                                                                   |                                      |         | 8 Hrs.            | 8 Marks                     |                                                                                                                                                                                                                                                             |
| Unit IV            |          | New Technologies in Healthcare: Wearable devices: Smart watches, Fitness trackers, Remote healthcare, Telemedicine: Talking to doctors using video calls, AI in healthcare, Future trends in medical technology, Calibration techniques.                                                                                                                         |                                      |         | 7 Hrs.            | 7 Marks                     |                                                                                                                                                                                                                                                             |
| References:        |          | <b>Handbook of Biomedical Instrumentation</b> by R. S. Khandpur<br><b>Publisher:</b> Tata McGraw-Hill<br><b>Biomedical Instrumentation Technology and Applications</b><br><b>Author:</b> Dr. Shakti Chatterjee and Dr. Aubert Miller<br><b>Publisher:</b> Cengage India                                                                                          |                                      |         |                   |                             |                                                                                                                                                                                                                                                             |

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|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <p><b>Medical Instrumentation: Application and Design</b> by John G. Webster, John W. Clark<br/><b>Publisher:</b> Wiley</p> <p><b>Biomedical Signal Processing and Signal Modeling</b> by Eugene N. Bruce<br/><b>Publisher:</b> Wiley-Interscience</p> <p><b>Introduction to Biomedical Engineering</b> by John Enderle, Joseph Bronzino<br/><b>Publisher:</b> Academic Press</p> <p><b>Biomedical Sensors and Instruments</b> by Tatsuo Togawa, Toshiyo Tamura, P. Ake Öberg<br/><b>Publisher:</b> CRC Press</p> <p><b>AI in Healthcare: The Grand Challenges</b> by Thomas Davenport and Ravi Kalakota<br/><b>Publisher:</b> CRC Press</p> <p><b>Wearable Sensors: Fundamentals, Implementation, and Applications</b> by Edward Sazonov, Michael R. Neuman<br/><b>Publisher:</b> Academic Press</p> <p><b>The Physiological Basis of Medical Practice</b> by John B. West, Taylor<br/><b>Publisher:</b> Lippincott Williams &amp; Wilkins</p> <p><b>Principles of Biomedical Engineering</b> by Sundararajan V. Madihally<br/><b>Publisher:</b> Artech House</p> <p><b>Telemedicine Technologies: Information Technologies in Medicine and Telehealth</b> by Bernard Fong, A. C. M. Fong, C. K. Li <b>Publisher:</b> Wiley</p> |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>MCQs for Internal Assessment</b>                     | <ol style="list-style-type: none"> <li>What is the primary purpose of biomedical instruments? <ol style="list-style-type: none"> <li>To entertain patients</li> <li>To diagnose and monitor health conditions</li> <li>To replace human doctors</li> <li>To create artificial organs</li> </ol> </li> <li>Which of the following is a bioelectric signal? <ol style="list-style-type: none"> <li>Blood pressure</li> <li>ECG</li> <li>Body temperature</li> <li>Heartbeat sound</li> </ol> </li> <li>Which sensor is commonly used in a blood pressure monitor? <ol style="list-style-type: none"> <li>Temperature sensor</li> <li>Pressure sensor</li> <li>Flow sensor</li> <li>Pulse sensor</li> </ol> </li> <li>What is telemedicine used for? <ol style="list-style-type: none"> <li>Teaching medical students</li> <li>Connecting patients with doctors remotely</li> <li>Performing surgeries</li> </ol> </li> </ol>                                                                                                                                                                                                                                                                                                       |
| <b>Short answer questions</b>                           | <ol style="list-style-type: none"> <li>What is the importance of biomedical instrumentation?<br/>बायोमेडिकल इन्स्ट्रुमेंटेशनचे महत्त्व काय आहे?<br/>जैवचिकित्सा उपकरण का क्या महत्व है?</li> <li>State the classification of biomedical electrodes?<br/>बायोमेडिकल इलेक्ट्रोडचे वर्गीकरण करा?<br/>बायोमेडिकल इलेक्ट्रोड का वर्गीकरण किजीए?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>Explain the role of physiological signals and the importance of safety standards in the design and use of biomedical instruments.</li> <li>Discuss the classification of biomedical equipment and explain the importance of biomedical instruments.</li> <li>Describe the characteristics of bioelectric signals such as ECG, and EEG.</li> <li>Discuss the surface electrodes, needle electrodes.</li> <li>Classify and explain the working principles of sensors like temperature sensors, and biosensors.</li> <li>How are technologies like telemedicine and wearable devices improving healthcare?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



### Vocational Skill Course 3: Lab/ Practical 11: Advanced Practical on Major Theory 5, 6 and 7.

| Level | Semester | Course Code | Course Name                                | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|--------------------------------------------|---------|----------------|---------------|----------|
| 5.0   | IV       | 113227      | Advanced Practical on Major Theory 5 and 6 | 2       | 60             | 4 Hrs         | 50       |

|                              |                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab/<br/>Practical 11</b> | Design minimum five applications, at least two on each of the following aspects.<br>1 Design any five advanced applications of OP-AMP.<br>2 Design any five advanced applications on Flip Flop and Counter. |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.
- Mode of Examination: Internal (There is no External Examination)**

## Electronics FP/CES- Project

| Electronics FP/CES- Project (113229)                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field Project / CE Services in Electronics: Phase-II                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                        | <b>Credits: 02</b> <b>Workload (Hrs./Week): 04</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Objectives:</b>                                                              | <p>To provide hands-on experience in applying theoretical Electronics knowledge to real-world challenges through field-based projects or community engagement (CE) services.</p> <p>To train students in identifying, problems encountered in Electronics and related fieldwork or community service activities.</p> <p>To encourage students to integrate Electronics and field Electronics concepts with interdisciplinary knowledge, technology, and societal needs.</p> <p>To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences.</p> <p>To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.</p>                                                                                                                                                                 |
| <b>Course Outcomes:</b>                                                                | <p>Students will be able to apply Electronics related analytical techniques to investigate and solve real-world problems in field settings.</p> <p>Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service.</p> <p>Students will be able to design, plan, and execute a field Electronics project or community service activity from inception to completion, including documentation and reporting.</p> <p>Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events.</p> <p>Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well beings.</p>                                                                                           |
| <b>Guidelines/SOP for Selection and Implementation of Field Projects / CE Services</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1. Project Selection and Planning</b>                                               | <p><b>Faculty Guidance:</b> Students will be assigned a faculty mentor to guide their project, providing expertise and resources.</p> <p><b>Project Topic:</b> The project topic should be relevant to Electronics and align with the student's interests and the available resources.</p> <p><b>Literature Review:</b> Students are expected to conduct a thorough literature review to understand existing knowledge and identify research gaps.</p> <p><b>Data Collection and Analysis:</b> Projects often involve experiments, field sampling, simulations, or data analysis from existing sources, depending on the topic.</p> <p><b>Project Timeline:</b> The total time allocation for the student to carry out field project is 60 hours.</p> <p>The students shall have to carry the same project done in Semester III and submit the report regarding the methodology, Recent trends, hardware required, applications for the community services etc.</p> |
| <b>2. Data Analysis and Interpretation</b>                                             | <p><b>Statistical Methods:</b> Students will learn and apply appropriate statistical methods to analyze data.</p> <p><b>Interpretation of Results:</b> Data should be interpreted within the context of the project, highlighting significant findings and limitations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>3. Report Writing and Presentation</b>                                              | <p><b>Report Format:</b> A structured report format is usually followed, including an abstract, introduction, methodology, results, discussion, and conclusion.</p> <p><b>Data Presentation:</b> Data should be presented clearly and accurately using tables, graphs, and figures.</p> <p><b>Oral Presentation:</b> Students will be required to present their findings to peers and faculty.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>4. CE Services (Community Engagement)</b>                                           | <p><b>Community Needs:</b> Projects may focus on addressing specific community needs or challenges relevant to Electronics.</p> <p><b>Collaboration:</b> Students can collaborate with local organizations to implement their projects.</p> <p><b>Impact Assessment:</b> The impact of the project on the community should be evaluated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>5. Evaluation and Assessment</b>                                                    | <p><b>Project Report:</b> The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)</p> <p><b>Oral Presentation:</b> The presentation will be evaluated on clarity, engagement, and the ability to</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                              | <p>answer questions. (10 Marks)</p> <p><b>Faculty Evaluation:</b> The faculty mentor will assess the student's performance throughout the project. (20 Marks)</p> <p><b>Total 50 Marks</b></p>                                                                                                                                                                                                           |
| <b>Examples of Field Projects/CE Services in Electronics</b> | <p><b>Environmental Electronics:</b> Studying the local ecosystems and developing renewable energy solutions.</p> <p><b>Community Outreach:</b> Organizing Safety measures and awareness workshops or engaging in scientific literacy initiatives.</p> <p><b>Research Project:</b> Study related to the subject that contribute to the advancement of knowledge and the well-being of living things.</p> |

*Note: The extended portion of the Field Project/CE Services in Electronics from Phase-I may be carried forward as Field Project/CE Services in Electronics: Phase-II in the fourth semester, subject to the approval of the assigned faculty mentor.*

# **SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

**Three Years- Six Semesters Bachelor's Degree Programme**

**3 Years B.Sc. /4 Year B.Sc. (Hons) & 4 Year B.Sc. (Hons with Research) Programme**



*Faculty of*

*Science and Technology*

*(Science Group)*

Subject: **ELECTRONICS**

(Semesters V and VI)

**Effective from Academic Year 2026-27**

**(As per Uniform NEP 2020)**

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**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
**FACULTY: Science and Technology**  
**Subject: ELECTRONICS**  
**Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)**  
**Three Years / Four Years - (Six/ Eight Semesters) Bachelor Degree Programme**

**Examination, Evaluation and Assessment Scheme**

| Vertical No. | The Vertical               | Mode of Examination & Evaluation Assessment | Theory                                                                                                                                                                                                                                                                     |           |                 |           |           |  | Theory (Total) |           | Practical |           |                 |           |           |           | Practical (Total) |  |
|--------------|----------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------|-----------|-----------|--|----------------|-----------|-----------|-----------|-----------------|-----------|-----------|-----------|-------------------|--|
|              |                            |                                             | External                                                                                                                                                                                                                                                                   |           |                 | Internal  |           |  |                |           | External  |           |                 | Internal  |           |           |                   |  |
|              |                            |                                             | Max Marks                                                                                                                                                                                                                                                                  | Min Marks | Duration (Hrs.) | Max Marks | Min Marks |  | Max Marks      | Min Marks | Max Marks | Min Marks | Duration (Hrs.) | Max Marks | Min Marks | Max Marks | Min Marks         |  |
| A            | Major                      | External & Internal                         | 30                                                                                                                                                                                                                                                                         | 9         | 2               | 20        | 6         |  | 50             | 20        | 25        | 10        | 4               | 25        | 10        | 50        | 20                |  |
|              | Elective                   |                                             | 30                                                                                                                                                                                                                                                                         | 9         | 2               | 20        | 6         |  | 50             | 20        | 25        | 10        | 4               | 25        | 10        | 50        | 20                |  |
| B            | Minor                      |                                             | 30                                                                                                                                                                                                                                                                         | 9         | 2               | 20        | 6         |  | 50             | 20        | 25        | 10        | 4               | 25        | 10        | 50        | 20                |  |
| C            | Generic/ Open Elective     |                                             | --                                                                                                                                                                                                                                                                         | --        | --              | --        | --        |  | --             | --        | --        | --        | --              | --        | --        | --        | --                |  |
| D            | VSC                        | Internal                                    | ---                                                                                                                                                                                                                                                                        | ---       |                 |           |           |  |                |           | --        | --        |                 | 50        | 20        | 50        | 20                |  |
|              | SEC                        | Internal                                    | ---                                                                                                                                                                                                                                                                        | ---       |                 |           |           |  |                |           | --        | --        |                 | 50        | 20        | 50        | 20                |  |
| F            | Internship/ Apprenticeship | Internal                                    | Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately. |           |                 |           |           |  |                |           |           |           |                 |           |           |           |                   |  |
|              | FP/CES                     |                                             |                                                                                                                                                                                                                                                                            |           |                 |           |           |  |                |           |           |           |                 |           |           |           |                   |  |
|              | CC                         |                                             |                                                                                                                                                                                                                                                                            |           |                 |           |           |  |                |           |           |           |                 |           |           |           |                   |  |

- **Internal Assessment for Theory/Practical/Laboratory:**

All the internal assessments should be conducted on the basis of Continuous Assessment Tests (CAT).

- **Continuous Assessment Tests (CAT):**

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

- Three CAT each of 10 Marks (Theory) and 10 Marks (Practical).
  - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
  - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
  - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days. .
- Each concurrent assessment (CAT-I, II & V) will be mapped to relevant Course Learning Outcome.
- Total Performance in CAT (i.e.40 %) shall be based on the best two out of three in CAT examinations
- Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

**External Assessment for Practical (Major/ Minor Lab):**

- Practical Performance : 20 Marks
- Viva-Voce : 05 Marks
- **Total** : **25 Marks**
- Duration of Examination : 04 Hrs.

**Internal Assessment for Practical (Major/ Minor Lab):**

- Internal Assessment based on CAT : 15 Marks
- Record Book : 10 Marks
- **Total** : **25 Marks**

**Internal Assessment for Practical (SEC/ VSC Lab):**

- Internal Assessment based on CAT : 20 Marks

- Record Book : 10 Marks
- Attendance : 10 Marks
- 10 MCQ/short Question : 10 Marks
- **Total** : **50 Marks**
- Duration of End Semester Examination: 04 Hrs.

**Evaluation and Assessment for FP/CES:**

- Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)
- Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)
- Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks)
- **Total 50 Marks**

*Note: The external assessments of theory courses will be conducted in accordance with the guidelines issued by the SGBA University.*

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
**FACULTY: Science and Technology**  
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**Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)**  
**Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme**

**THIRD YEAR: Level 5.5 - SEMESTER – V (T & L Credit Scheme)**

| Mode of Teaching                                                           | Ver. No | The Vertical           | Type of Course                 | Course Code | Course Name                                          | Credits   | Workload (Hrs/Week) | Vertical Workload (Hrs/Week) |
|----------------------------------------------------------------------------|---------|------------------------|--------------------------------|-------------|------------------------------------------------------|-----------|---------------------|------------------------------|
| Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/ Online/ Hybrid | f.      | Major                  | Electronics Theory 8           | 113231      | Measuring Instruments                                | 2         | 2                   | 16                           |
|                                                                            |         |                        | Electronics Theory 9           | 113232      | Communication Electronics                            | 2         | 2                   |                              |
|                                                                            |         |                        | Electronics Theory 10          | 113233      | C-Programming                                        | 2         | 2                   |                              |
|                                                                            |         |                        | Electronics Lab/Practical-12   | 113234      | Practical based on Theory 113231, 113232 & 113233    | 2         | 4                   |                              |
|                                                                            |         | Elective               | Elective Theory 1              | 113235      | Circuit Design & Simulation                          | 2         | 2                   |                              |
|                                                                            |         |                        | Electronics Lab/Practical-13 A | 113236      | Practical based on Theory 113235                     | 2         | 4                   |                              |
|                                                                            |         |                        | Elective Theory 2              | 113237      | E-Vehicle Technology                                 | / 2       | / 2                 |                              |
|                                                                            |         |                        | Electronics Lab/Practical-13 B | 113238      | Practical based on Theory 113237                     | / 2       | / 4                 |                              |
|                                                                            | g.      | Minor                  | Electronics Theory 5           | 113239      | Communication & Microprocessor 8086                  | 2         | 2                   | 6                            |
|                                                                            |         |                        | Electronics Lab/Practical-14   | 113240      | Practical based on 113239                            | 2         | 4                   |                              |
|                                                                            | h.      | Generic/ Open Elective | -                              | -           | -                                                    | -         | -                   | -                            |
|                                                                            | i.      | VSC                    | Lab/Practical-15               | 113241      | Advanced Practical on Major Theory T8, T9 and T10    | 2         | 4                   | 4                            |
|                                                                            |         | SEC                    | Lab/Practical-16               | 113242      | Skill based Practical on Major Theory T8, T9 and T10 | 2         | 4                   | 4                            |
|                                                                            |         | FP/ CES                | Project                        | 113243      | Field Project / CE Services on Electronics           | 2         | 4                   | 8                            |
|                                                                            |         | CC                     | Outdoor                        |             |                                                      | 2         | 4                   |                              |
|                                                                            |         |                        | Compulsory Paper               |             | Foundation of Artificial Intelligence                | 2         | 2                   | 2                            |
|                                                                            |         | <b>TOTAL</b>           |                                |             |                                                      | <b>24</b> | <b>38</b>           | <b>38</b>                    |



## Major Theory 8: Measuring Instruments

| Level                     | Semester                                                                                                                                                                                                                                                                                                                                                                         | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Course Name           | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                       | V                                                                                                                                                                                                                                                                                                                                                                                | 113231                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Measuring Instruments | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| <b>Course Objectives:</b> |                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"><li>• Read, understand, and interpret electrical/electronic circuits through verbal, mathematical and graphical methods.</li><li>• To give need-based education in Electronics of the highest quality at the undergraduate level.</li><li>• Use Information Communication Technology to gather knowledge.</li><li>• Impart skills required to gather information from resources.</li></ul> Equip students in methodology related to electronic circuits, devices and systems.                                                                                                                     |                       |                   |                             |                                                                                                                                      |          |
| <b>Course Outcomes:</b>   |                                                                                                                                                                                                                                                                                                                                                                                  | After completing the course, the student will <ul style="list-style-type: none"><li>• Identify electronic components and ICs.</li><li>• Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.</li><li>• Apply research-based knowledge to design and conduct experiments.</li><li>• Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications.</li><li>• Utilize the basic knowledge in Electronics science.</li><li>• Apply Electronics knowledge in their day-to-day life.</li></ul> |                       |                   |                             |                                                                                                                                      |          |
| Unit System               | Contents                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| <b>Unit I</b>             | <b>Basic Instrumentation:</b><br>Block diagram of generalized instrumentation system, Concept of transducers (Primary and secondary, active and passive, analog and digital). Resistive transducer - potentiometer, Inductive transducer - LVDT, capacitive transducer (by changing distance), measurement of displacement using capacitive transducer (By changing dielectric). |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| <b>Unit II</b>            | <b>Measurement of Temperature:</b><br>Thermocouple, Thermopile, Thermistor, RTD, Total Radiation Pyrometer, IC LM34, IC LM35, Infrared Pyrometer                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| <b>Unit III</b>           | <b>Biomedical Instrumentation:</b><br>Introduction, Type of electrode, EEG, EMG, ECG-block diagram and function of each block, X ray machine, instantaneous heart rate meter-systolic and diastolic blood pressure meter, EAR oximeter, pulse Oximeter,                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| <b>Unit IV</b>            | <b>Display, digital Instrument and recorder:</b><br>Seven segment, 14 segment, dot matrix, 16x2 LCD display, advantage and disadvantage, Digital instrument: Digital frequency meter, Digital voltmeter (Ramp type), Digital capacitance meter (Block diagram and function of each block)                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| <b>References:</b>        |                                                                                                                                                                                                                                                                                                                                                                                  | Linear integrated Circuits by Ramakant Gaikwad<br>2. Principles of Electronics by V. K. Mehta<br>3. Elements of Electronics by Bagde and Singh<br>4. Basic Electronics by B. L. Theraja (S. Chand and Company)<br>5. Electrical and electronics measurement and Instrumentation by A.K. Sawhney<br>6. Biomedical instrumentation by R.S.Khandpur                                                                                                                                                                                                                                                                                    |                       |                   |                             |                                                                                                                                      |          |

| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MCQs for Internal Assessment:</b>                    | <ol style="list-style-type: none"> <li>Example of Active transducer is -----<br/>a ) Quartz    b) cobalt    c) Sodium    d) None</li> <li>LM34 is used for measurement of temp. in -----<br/>a) Celsius        b) Farhenite    c) meters                      d) None</li> <li>LM35 is used for measurement of temp. in -----<br/>a) Celsius        b) Farhenite    c) meters                      d) None</li> <li>In LVDT Secondary windings are -----<br/>a) 1    b) 2    c) 3    d) None</li> <li>Thermistors is used for measurement of -----<br/>a) Pressure    b) Temperature    c) Volume    d) weight</li> </ol> |
| <b>One sentence/ short questions</b>                    | <ol style="list-style-type: none"> <li>Name various types of transducers.</li> <li>Classify the types of transducers.</li> <li>Write concept of Thermistor.</li> <li>Write Concept of 7- Segment display</li> <li>Write the long form of EEG.</li> <li>State applications of thermistor.</li> <li>What is thermocouple?</li> <li>What is DVM?</li> </ol>                                                                                                                                                                                                                                                                  |
| <b>Long questions</b>                                   | <ol style="list-style-type: none"> <li>Draw the Block diagram of G-I System and Explain.</li> <li>Explain Thermistor and its application.</li> <li>Explain construction and working of LVDT.</li> <li>Draw the block diagram of ECG. and explain every block.</li> <li>Explain construction and working of Thermocouple.</li> </ol>                                                                                                                                                                                                                                                                                       |

## Major Theory 9: Communication Electronics

| Level                                            | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Course Name               | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|--------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                                              | V        | 113232                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Communication Electronics | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| Course Objectives:                               |          | <ul style="list-style-type: none"><li>To understand the fundamental principles of Electronics Communication.</li><li>To study the analog communication system.</li><li>To explore the digital communication system.</li><li>To examine the optical fibre communication system.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                           |                   |                             |                                                                                                                                      |          |
| Course Outcomes:                                 |          | After completing the course, the student will <ul style="list-style-type: none"><li>Understand the fundamental principles of communication systems.</li><li>Grasp the concept of analog communication systems.</li><li>Recognize the process of converting signals to digital format and the transmission of digital signals in communication systems.</li><li>Familiarize one with various telecommunication systems.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |                   |                             |                                                                                                                                      |          |
| Unit System                                      |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                           | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| Unit I                                           |          | Analog Communication:<br>Need for modulation, Type of Modulation, Amplitude Modulation Frequency Modulation, Phase Modulation (concept, representation, Comparison, modulation index, examples). Difference between AM and FM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| Unit II                                          |          | Digital Communication:<br>Pulse Modulation, PAM, PPM, PWM, Need of Sampling, Digital Modulation, Pulse Code Modulation, PCM Sampling rate, quantization noise, Multiplexing, difference between TDM & FDM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| Unit III                                         |          | Optical Fibre Communication:<br>Merits and demerits of OFC, Block diagram of OFC, Types of optical fibre, Total internal reflection, fibre alignment, joint losses.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| Unit IV                                          |          | Telecommunication Systems:<br>Concept of LAN, WAN, MAN, Network Topology: Ring, Star, and Bus, Block diagram and function of Mobile communication, Internet- 2G, 3G, 4G, 5G.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| References:                                      |          | <ul style="list-style-type: none"><li>Frenzel, L.E. (2014). Principles of Electronic communication systems. (3rd ed.). McGrawHill.</li><li>Kennedy, G., &amp; Devis, B. (1985). Electronic Communication systems. Tata McGrawHill.</li><li>Beasley, J.S., &amp; Miller, G.M. (2007). Modern Electronics Communication. (9th ed.). Pearson.</li><li>Roddy, D., &amp; Coolen J. (2008). Electronic Communications. (4th ed.). Pearson Education, India.</li><li>Tomasi, W. (2003). Advanced Electronics Communication Systems. (6th ed.). Prentice Hall.</li><li>Lathi, B.P. (2017). Modern Digital and Analog Communication Systems. (4th ed.). Oxford University Press.</li></ul>                                                                                                                                                                                                  |                           |                   |                             |                                                                                                                                      |          |
| Model questions for theory external examination. |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |                   |                             |                                                                                                                                      |          |
| MCQs for Internal Assessment:                    |          | <ol style="list-style-type: none"><li>What is the main purpose of modulation in communication systems?<br/>a) To increase noise b) To reduce signal strength<br/>c) To transmit signals over long distances efficiently d) To store data permanently</li><li>In Amplitude Modulation (AM), which parameter of the carrier wave is varied?<br/>a) Frequency b) Phase c) Amplitude d) Wavelength</li><li>Which modulation technique provides better noise immunity?<br/>a) AM b) FM c) PAM d) PCM</li><li>Which of the following is a digital modulation technique?<br/>a) PAM b) PWM c) PCM d) FM</li><li>Which multiplexing technique divides the total time into slots for multiple signals?<br/>a) FDM b) TDM c) AM d) FM</li><li>Optical Fibre communication works on the principle of:<br/>a) Diffraction b) Refraction c) Total Internal Reflection d) Interference</li></ol> |                           |                   |                             |                                                                                                                                      |          |

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>One sentence/<br/>short<br/>questions</b> | <ol style="list-style-type: none"> <li>1. Define modulation and explain its need in communication systems.</li> <li>2. State any three differences between AM and FM.</li> <li>3. Define modulation index in AM.</li> <li>4. What is pulse modulation? Name its types?</li> <li>5. Define Pulse Code Modulation (PCM).</li> <li>6. What is quantization noise?</li> <li>7. Differentiate between TDM and FDM.</li> <li>8. State the merits and demerits of Optical Fibre Communication (OFC).</li> <li>9. Explain the principle of total internal reflection in optical Fibre.</li> <li>10. Define LAN, WAN and MAN.</li> <li>11. Draw and explain any one network topology.</li> <li>12. Write the block diagram of mobile communication system.</li> <li>13. Differentiate between 2G, 3G, 4G, and 5G technologies.</li> </ol> |
| <b>Long<br/>questions</b>                    | <ol style="list-style-type: none"> <li>1. Describe Pulse Code Modulation (PCM) in detail.</li> <li>2. Explain the concept of multiplexing. Differentiate between TDM and FDM.</li> <li>3. Draw the block diagram of Optical Fibre Communication (OFC) and explain the function of each block.</li> <li>4. Explain the principle of Total Internal Reflection in optical Fibre communication. Discuss Fibre alignment, joint losses, couplers, and jointers.</li> <li>5. Define LAN, WAN, and MAN. Explain various network topologies with advantages and disadvantages.</li> <li>6. Draw and explain the block diagram of a mobile communication system.</li> <li>7. Discuss the evolution of mobile communication technologies from 2G to 5G.</li> </ol>                                                                        |

## Major Theory 10: C- Programming

| Level                                            | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Course Code | Course Name    | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                                              | V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 113233      | C- Programming | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| Course Objectives:                               | <ul style="list-style-type: none"><li>To strengthen concepts of structured programming in C.</li><li>To develop problem-solving skills using advanced features of C language.</li><li>To understand memory management and file handling.</li><li>To build logic for real-world applications</li></ul>                                                                                                                                                                                 |             |                |                   |                             |                                                                                                                                      |          |
| Course Outcomes:                                 | After completing this course, students will be able to: <ul style="list-style-type: none"><li>Apply advanced C concepts to solve complex problems.</li><li>Use pointers effectively for memory manipulation.</li><li>Implement file handling techniques.</li><li>Develop modular and efficient programs.</li></ul>                                                                                                                                                                    |             |                |                   |                             |                                                                                                                                      |          |
| Unit System                                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| Unit I                                           | Introduction to C Programming:<br>Types of programming languages, Basic Structure of C Programs, Algorithm, flowcharting, Constants, Variables, and Data Types: Character set, keywords, constants, basic data types, variables: declaration & assigning values. Operators and Expressions: Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators.                                                                   |             |                | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| Unit II                                          | Control Statements:<br>Input/Output functions: printf(), scanf(), Decision making statements: if, if-else, nested if, switch . Looping Statements: while, do-while, for statements, go to, break, continue, nested loops.                                                                                                                                                                                                                                                             |             |                | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| Unit III                                         | Arrays and Pointers:<br>Concept of Arrays, Declaration and initialization of one and two dimensional array. Array operations. Pointers - Definition and need of pointers, Declaration, initialization.                                                                                                                                                                                                                                                                                |             |                | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| Unit IV                                          | Functions:<br>Definition and need of functions. Function prototype, categories of function call mechanism: call by value, call by reference. Function arguments and passing, returning values from functions. File operation and functions                                                                                                                                                                                                                                            |             |                | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| References:                                      | <ul style="list-style-type: none"><li>Let Us C” – Yashavant Kanetkar.</li><li>“Programming in ANSI C” – E. Balagurusamy.</li><li>“The C Programming Language” – Dennis Ritchie &amp; Brian Kernighan</li></ul>                                                                                                                                                                                                                                                                        |             |                |                   |                             |                                                                                                                                      |          |
| Model questions for theory external examination. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                |                   |                             |                                                                                                                                      |          |
| MCQs for Internal Assessment:                    | <ol style="list-style-type: none"><li>Which of the following is a high-level programming language?<br/>a) Machine Language b) Assembly Language c) C d) Binary Code<br/>Answer: c</li><li>Which of the following is not a basic data type in C?<br/>a) int b) float c) char d) string<br/>Answer: D</li><li>Which data type is used to store a single character?<br/>a) int b) char c) float d) double<br/>Answer: b</li><li>Which function is used to display output in C?</li></ol> |             |                |                   |                             |                                                                                                                                      |          |

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | <p>a) input()   b) printf()   c) scanf()   d) display()<br/> Answer: b</p> <p>5. The goto statement is used to:<br/> a) Define function   b) Jump to a labelled statement<br/> c) Loop execution   d) Exit program<br/> Answer: b</p> <p>6. An array is:<br/> a) Collection of different data types   b) Collection of same data type elements<br/> c) A function   d) A pointer<br/> Answer: b</p> <p>7. A pointer is:<br/> a) A variable storing value   b) A variable storing address<br/> c) A function   d) A keyword<br/> Answer: b</p> <p>8. What is the main purpose of functions?<br/> a) Increase code length   b) Reduce code repetition<br/> c) Slow down execution   d) Avoid variables<br/> Answer: b</p> |
| <b>One sentence/ short questions</b> | <p>1. What is a high-level language?<br/> 2. What is a variable?<br/> 3. Name any two basic data types in C.<br/> 4. What is an if statement?<br/> 5. What is printf() used for?<br/> 6. What is an array?<br/> 7. What is a pointer?<br/> 8. What is a function in C?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Long questions</b>                | <p>1. Explain various basic data types in C.<br/> 2. Explain the use of printf() and scanf() with examples.<br/> 3. Define an array and explain its types with examples.<br/> 4. Define a function and explain its need in programming.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## Major Lab/ Practical – 12: Practical on C-Programming, Communication Electronics and Measuring Instruments

| Level | Semester | Course Code | Course Name                                                                           | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|---------------------------------------------------------------------------------------|---------|----------------|---------------|----------|
| 5.5   | V        | 113234      | Practical based on C-Programming, Communication Electronics and Measuring Instruments | 2       | 60             | 4 Hrs         | 50       |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab/<br/>Practical 12</b> | <p><b>Perform minimum 10 experiments, at least one on each of the following aspects.</b></p> <ol style="list-style-type: none"> <li>1. Write a C program that takes a different data types and display on consol.</li> <li>2. Write a C program that calculates and prints the <b>sum, difference, product, and quotient</b> (division) of two integers.</li> <li>3. Write a C program to calculate both the <b>area and circumference</b> of a circle, given its radius. Use a pre-defined constant for <math>\pi</math> with value 3.14.</li> <li>4. Calculate simple interest for a loan, given the <b>Principal amount (P), Rate of interest (R), and Time in years (T)</b> as input.</li> <li>5. Write a C program to read two integer values, A and B, and then <b>swap their contents</b> so that A holds the original value of B, and B holds the original value of A. Use a third, temporary variable.</li> <li>6. Write a C program swap two integer values, A and B, <b>without using a third temporary variable.</b></li> <li>7. Write a C program that prompts the user to enter a single character and prints its corresponding <b>ASCII (American Standard Code for Information Interchange) value.</b></li> <li>8. AM generation and detection</li> <li>9. FM generation and detection</li> <li>10. Pre emphasis and De-emphasis circuits</li> <li>11. Multiplexing Techniques (FDM and TDM)</li> <li>12. Mixer Characteristics</li> <li>13. Sampling, PAM, PWM, and PPM generation and detection</li> <li>14. Displacement versus output voltage characteristics of a potentiometric transducer.</li> <li>15. Characteristics of Strain gauge and Load cell.</li> <li>16. Characteristics of LVDT, Hall Effect transducer and Photoelectric tachometer.</li> <li>17. Characteristics of LDR, thermistor and thermocouple.</li> <li>18. Step response characteristic of RTD and thermocouple.</li> <li>19. Temperature measurements using RTD with three and four leads.</li> <li>20. Measurement of Angular displacement using resistive and capacitive transducer.</li> </ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

## Major Elective Theory 1- Circuit Design and Simulation

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Course Name                   | Credits | Teaching Hours           | Exam Duration                      | Max Mark                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------|--------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.5                       | V        | 113235                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Circuit design and simulation | 2       | 30                       | 2 Hrs                              | 30                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>• Provide the basic concepts, architecture, components, and applications of simulation</li> <li>• Identify and explain the working of various sensors, actuators, and RC component used in systems.</li> <li>• Describe different technologies and protocols used for design and simulation networks.</li> <li>• Develop basic applications using simple hardware concepts.</li> <li>• Understand the importance of simulation and real-life applications in smart home, healthcare, agriculture, and industry.</li> <li>• Explain the characteristics of electrical and electronic measuring instruments.</li> <li>• Illustrate the working principles of transducers, sensors and actuators.</li> <li>• Develop and exemplify basic programming skills in Virtual Instrumentation.</li> <li>• Design and implement a system using sensor and instrumentation configuration.</li> <li>• Demonstrate the skill set using modern tool</li> </ul> |                               |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Course Outcomes:</b>   |          | <p>After completing the course, the student will</p> <ul style="list-style-type: none"> <li>• Along with prescribed hours of teaching –learning process, provide opportunity to perform the experiments/ programmes at their own time, at their own pace, at any place as per their convenience and repeat any number of times to understand the concept.</li> <li>• Provide unhindered access to perform whenever the students wish.</li> <li>• Vary different parameters to study the behaviour of the circuit without the risk of damaging equipment/ device or injuring themselves.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                     |                               |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Unit System</b>        |          | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                               |         | <b>Workload Allotted</b> | <b>Weightage of Marks Allotted</b> | <b>Incorporation of Pedagogies</b>                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Unit I</b>             |          | <b>Fundamental of Modelling:</b><br>Analog: RC network, RC, LC or RLC based electronic circuit, PN junction, transistor amplifier, MOSFET, Digital: AND gate, OR gate, NAND gate, NOR gate, XOR gate and XNOR gate, Op-amps, instrumentation amplifier, IC 555, 556,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                               |         | 7 Hrs                    | 7 Marks                            | <b>Lecture Method for basic concepts, ICT-based Teaching using videos and animations of systems, Group Discussion on applications in daily life. Demonstration Method for sensor and hardware operation, Hands-on Learning using Circuit maker/labview/python/ CAD/Scispce/kits, Laboratory Method for simulation based experiments. Interactive Lecture Method for Simulation-Based Learning using IoT simulators/software tools.</b> |
| <b>Unit II</b>            |          | <b>Software and Hardware for simulation:</b><br>Introduction to Wire, bus, junction, probe, voltage source, current source, and ground etc. used in circuit simulation software. Graphs, analysis, automation design and circuit simulation, Frequency response and AC Analysis of RC, diode, and transistor based electronic circuit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |         | 8 Hrs                    | 8 Marks                            |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Unit III</b>           |          | <b>Virtual Instrumentation:</b><br>Introduction, advantages, data types, graphical system design, modular programming, vis and sub-vis loops, arrays, clusters, plotting data, customizing graphs and charts, case structures, formula nodes, timed structures, data acquisition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                               |         | 8 Hrs                    | 8 Marks                            |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Unit IV</b>            |          | <b>Printed circuit Board Design:</b><br>Study of Packages of Electronic Components. History of Printed Circuit Boards. Various types of Printed Circuit Boards-Single Sided Boards, Double Sided Plated through Hole Boards, multilayer Boards.PCB Designing Study of-Fault Finding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |         | 7 Hrs                    | 7 Marks                            |                                                                                                                                                                                                                                                                                                                                                                                                                                        |



|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |                                                                       |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|-----------------------------------------------------------------------|
|                                                         | methods of PCBs, Repairing Techniques. De-soldering techniques, replacement of Component /Solder Pad /Track repairing methods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  | <b>Project-Based Learning</b> through simple IoT project development. |
| <b>References software</b>                              | <div>1. Multisim (Academic Version or Licensed Version)</div> <div>2. UltiBoard (Academic Version or Licensed Version )</div> <div>3. Orcade (Student Version or Licensed Version)</div> <div>4. Express PCB (Free Version or Licensed Version)</div> <div>5. Circuit Maker (Free Version or Licensed Version)</div> <div>6. Tinapro</div> <div>7. EaglePCB Design Software (Free Version or Licensed Version) (Free Version or Licensed Version)</div> <div>8. FreePCB (Free Version) Circuit Design Tools</div> <div>9. List of Software/Learning Websites</div> <div><ul style="list-style-type: none"><li>• www.ni.com (Multisim and Ultiboard - Academic version)</li><li>• <a href="http://www.cadence.com">www.cadence.com</a></li><li>• www.youtube.com (Orcade - Student version) (PCB Manufacturing Videos)</li><li>• <a href="http://www.nptel.ac.in">www.nptel.ac.in</a></li><li>• <a href="https://www.ti.com/design-resources/design-tools-simulation/analog_circuits/overview.html">https://www.ti.com/design-resources/design-tools-simulation/analog_circuits/overview.html</a></li><li>• <a href="https://www.analog.com/en/education/education-library/tutorials/analog_electronics.html">https://www.analog.com/en/education/education-library/tutorials/analog_electronics.html</a></li></ul></div> |  |  |                                                                       |
| <b>References:</b>                                      | <div>1. Basic Electronic Devices and Circuits – M. B. Patil (PHI Learning)</div> <div>2. Electronic Devices and Circuits – J. B. Gupta (K. K. Gupta, K. K. Gupta &amp; Sons)</div> <div>3. Design and Simulation of Electrical Machines with MATLAB by L. Ashok Kumar</div> <div>4. Simulation-Driven Electronics Design by Dr. Poornima Mahesh and Dr. Rajiv Iyer</div> <div>5. R. S. Khandpur "Printed Circuit Boards: Design, Fabrication, Assembly and Testing" published by McGraw-Hill in 2005</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |                                                                       |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |                                                                       |
| <b>MCQs for Internal Assessment:</b>                    | <div>1. Which software is commonly used for analog and digital circuit simulation?<br/>a) Altium Designer b) SPICE c) KiCad d) AutoCAD</div> <div>2. What does "transient analysis" simulate in circuit simulation tools?<br/>a) Frequency response b) DC operating point c) Behaviour over time<br/>d) Thermal effects</div> <div>3. Which type of simulation would help you analyze a filter's cutoff frequency?<br/>a) Transient analysis b) AC sweep analysis c) DC analysis<br/>d) Monte Carlo analysis</div> <div>4. What does PCB stand for?<br/>a) Printed Circuit Board b) Programmable Circuit Blueprint c) Physical Circuit Base d) Prototype Circuit Builder</div> <div>5. Which layer of a PCB is typically used for component placement and labelling?<br/>a) Signal layer b) Power plane c) Silkscreen layer d) Solder mask layer</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |  |                                                                       |
| <b>One sentence/ Very short answer questions</b>        | <div>1. What is need for a PCB?</div> <div>2. How do you verify Schematic Symbols or Footprints??</div> <div>3. What are the inputs you need to design a PCB?</div> <div>4. How do you place connectors?</div> <div>5. How to choose PCB material?</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |                                                                       |
| <b>Short answer questions</b>                           | <div>1. Define circuit component.</div> <div>2. List any four applications of simulation.</div> <div>3. What is the role of circuit designing and simulation?</div> <div>4. What is a virtual instrument? Give one example.</div> <div>5. Write the features of virtual instrument.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |                                                                       |
| <b>Long answer questions</b>                            | <div>1. Explain the concept of computer-based circuit design and its importance in modern technology.</div> <div>2. Describe the basic architecture of a virtual simulation platform for circuit and automation design with a neat block diagram.</div> <div>3. Explain the role of connector and component selection in systems.</div> <div>4. Write in detail about the fabrication of PCB.</div> <div>5. Explain the working of simulation software and its importance and applications.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |                                                                       |

### Major Elective Lab / Practical 13 A: Practical Based on Circuit Designing and Simulation

| Level | Semester | Course Code | Course Name                                         | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|-----------------------------------------------------|---------|----------------|---------------|----------|
| 5.5   | V        | 113236      | Practical based on Circuit Designing and simulation | 2       | 60             | 4 Hrs         | 50       |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lab/<br>Practical 13 A | <p>Minimum 10 experiments, at least one on each of the following aspects.</p> <ol style="list-style-type: none"><li>1. Simulate Series RL &amp; RC circuit and observe phase difference between waveforms of voltage and current.</li><li>2. Simulation and verification of Kirchhoff's Current Law &amp; Kirchhoff's Voltage Law.</li><li>3. Simulation of Mesh analysis for a given circuit.</li><li>4. Simulation of Nodal analysis for a given circuit.</li><li>5. Determination of Z &amp; Y parameters of a given two-port network</li><li>6. Simulate and verify Super Positions theorem.</li><li>7. Simulation and verification Reciprocity theorem.</li><li>8. Simulation and verification Thevenin's and Norton's theorem.</li><li>9. Simulation and verification Maximum Power Transfer theorem.</li><li>10. Simulation and verification Millman's theorem.</li><li>11. Simulation of Series and Parallel Resonance circuit.</li><li>12. <b>Mini Project</b></li></ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination

## Major Elective Theory 2: E-Vehicle Technology

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Course Name          | Credits                  | Teaching Hours                     | Exam Duration                                                                                                                                                                                                                                                                                                        | Max Mark |
|---------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                       | V        | 113237                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | E-Vehicle Technology | 2                        | 30                                 | 2 Hrs                                                                                                                                                                                                                                                                                                                | 30       |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>To understand the fundamentals of automotive electronics and basic architecture of Electric Vehicles (EVs).</li> <li>To study different energy storage systems, battery technologies, and power electronics used in EVs.</li> <li>To learn the working of electric drive systems, motors, sensors, and vehicle control units in EVs.</li> <li>To understand vehicle communication, safety systems, and diagnostic techniques in modern automobiles.</li> <li>To introduce smart vehicle technologies, IoT applications, and future trends in automotive electronics and electric mobility.</li> </ul>                                                                                                       |                      |                          |                                    |                                                                                                                                                                                                                                                                                                                      |          |
| <b>Course Outcomes:</b>   |          | <p><b>After completing the course, the student will</b></p> <ul style="list-style-type: none"> <li>Able to learn the basic concepts, architecture, and components of automotive electronics and Electric Vehicles (EVs).</li> <li>Describe the working and characteristics of batteries, Battery Management Systems (BMS), and power electronic devices used in EVs.</li> <li>Identify different electric motors, drive systems, sensors, and controllers used in electric vehicles.</li> <li>Understand vehicle communication systems, safety features, and diagnostic techniques in modern automobiles.</li> <li>Discuss smart vehicle technologies, IoT applications, and future trends in automotive and electric mobility systems.</li> </ul> |                      |                          |                                    |                                                                                                                                                                                                                                                                                                                      |          |
| <b>Unit System</b>        |          | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      | <b>Workload Allotted</b> | <b>Weightage of Marks Allotted</b> | <b>Incorporation of Pedagogies</b>                                                                                                                                                                                                                                                                                   |          |
| <b>Unit I</b>             |          | <b>Introduction to Automotive Electronics &amp; EV Basics:</b><br>Evolution of automotive electronics, Conventional vehicles vs Electric Vehicles (EVs), Types of EVs: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), architecture of EV, Battery pack, Electric motor, Controller, Charger, Basics of automotive electrical systems, Wiring harness and connectors, Introduction to standards and safety                                                                                                                                                                                                                                                                                  |                      | 7Hrs                     | 7 Marks                            | <b>The course will use lectures, ICT tools, demonstrations, hands-on activities, and project-based learning to explain EV and automotive electronics concepts. Group discussions, case studies, and industrial exposure will help students understand practical applications and modern automotive technologies.</b> |          |
| <b>Unit II</b>            |          | <b>Energy Storage &amp; Power Electronics in EVs:</b><br>Batteries used in EVs: Lithium-ion battery, Lead-acid, Battery parameters: State of Charge (SoC), State of Health (SoH), Battery Management System (BMS): Functions and block diagram, Cell balancing techniques, Power electronics in EV: DC-DC converters, Inverters, Charging systems: AC charging, DC fast charging                                                                                                                                                                                                                                                                                                                                                                   |                      | 8Hrs                     | 8 Marks                            |                                                                                                                                                                                                                                                                                                                      |          |
| <b>Unit III</b>           |          | <b>Electric Drive Systems &amp; Control:</b><br>Electric motors used in EVs: DC motor, BLDC motor, Induction motor, Motor drive systems and controllers, Regenerative braking system, Sensors used in EVs: Speed, temperature, position sensors, Electronic Control Units, Introduction to vehicle communication                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      | 8 Hrs                    | 8 Marks                            |                                                                                                                                                                                                                                                                                                                      |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |         |  |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|--|
| Unit IV                                                 | <b>Smart Vehicles, Safety &amp; Future Trends:</b><br>Advanced Driver Assistance Systems, Autonomous vehicle concepts, IoT in automotive electronics, Vehicle diagnostics and fault detection, Safety in EVs: Thermal management, Electrical safety, Environmental impact and sustainability, Future trends: AI in automotive systems, Smart mobility solutions.                                                                                                                                                                                                                                                                                                                                                                                                                             | 7 Hrs | 7 Marks |  |
| References:                                             | 1. Electric and Hybrid Vehicles: Design Fundamentals – Iqbal Husain, CRC Press.<br>2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles – Mehrdad Ehsani, Yimin Gao, Sebastian Gay, Ali Emadi, CRC Press.<br>3. Automotive Electrical and Electronic Systems – Tom Denton, Routledge Publication.<br>4. Electric Vehicle Technology Explained – Wiley Publication.<br>5. Understanding Automotive Electronics – Butterworth-Heinemann Publication.<br>6. Power Electronics – Khanna Publishers.<br>7. Fundamentals of Electric Vehicles – SAE India Publication.<br>8. Automobile Electrical and Electronic Systems – McGraw Hill Education.                                                                                                                                          |       |         |  |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |         |  |
| MCQs for Internal Assessment                            | 1. What does BEV stand for in Electric Vehicles?<br><b>A. Battery Electric Vehicle</b> B. Basic Electric Vehicle C. Battery Engine Vehicle<br>D. Balanced Electric Vehicle<br>2. Which battery is commonly used in modern Electric Vehicles?<br>A. Dry Cell Battery <b>B. Lithium-ion Battery</b> C. Nickel Battery D. Mercury Battery<br>3. Which device converts DC power into AC power in an EV?<br><b>A. Rectifier</b> B. Transformer <b>C. Inverter</b> D. Amplifier<br>4. What is the function of a regenerative braking system?<br>A. Increase fuel consumption B. Produce engine noise <b>C. Recover energy during braking</b> D. Reduce battery voltage<br>5. Which communication system is commonly used in vehicles for data exchange?<br><b>A. USB B. CAN Bus</b> C. HDMI D. VGA |       |         |  |
| One sentence/ Very short answer questions               | 1. What is an Electric Vehicle (EV)?<br>2. What is the function of a Battery Management System (BMS)?<br>3. What is the purpose of an inverter in an EV?<br>4. What is regenerative braking?<br>5. What is CAN bus in automotive systems?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |         |  |
| Short answer questions                                  | 1. Explain the difference between conventional vehicles and Electric Vehicles (EVs).<br>2. Describe the working and advantages of Lithium-ion batteries used in EVs.<br>3. Explain the function of a Battery Management System (BMS) in Electric Vehicles.<br>4. Write a short note on regenerative braking system in EVs.<br>5. Explain the role of sensors and Electronic Control Units (ECUs) in automotive electronics.                                                                                                                                                                                                                                                                                                                                                                  |       |         |  |
| Long answer questions                                   | 1. Explain the architecture of an Electric Vehicle (EV) with a neat block diagram and describe the function of its main components.<br>2. Discuss different types of Electric Vehicles (BEV, HEV, and PHEV) with their advantages and limitations.<br>3. Explain the working of Lithium-ion batteries and describe the role of Battery Management System (BMS) in EVs.<br>4. Describe different electric motors used in EVs and explain the working of regenerative braking system.<br>5. Explain smart vehicle technologies such as ADAS, IoT in automotive electronics, and future trends in autonomous and AI-based vehicles.                                                                                                                                                             |       |         |  |

### Major Elective Lab / Practical –13 B: Practical Based on E-Vehicle Technology

| Level | Semester | Course Code | Course Name               | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|---------------------------|---------|----------------|---------------|----------|
| 5.5   | V        | 113238      | Practical based on Theory | 2       | 60             | 4 Hrs         | 50       |

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| <b>Lab/<br/>Practical 13 B</b> | <p>Minimum ten experiments, at least one on each of the following aspects.</p> <ol style="list-style-type: none"><li>1. Study of basic components of an Electric Vehicle (EV) using block diagram/model.</li><li>2. Identification and testing of automotive electrical components such as wiring harness, connectors, fuse, and relays.</li><li>3. Study of 12V automotive electrical system and battery connections.</li><li>4. Measurement of battery parameters such as voltage, current, and State of Charge (SoC).</li><li>5. Study of Lithium-ion battery characteristics and charging/discharging process.</li><li>6. Demonstration and testing of Battery Management System (BMS) functions.</li><li>7. Study of DC-DC converter used in Electric Vehicles.</li><li>8. Study of inverter operation for DC to AC conversion in EV applications.</li><li>9. Study and speed control of DC motor used in electric drive systems.</li><li>10. Study of BLDC motor operation and its characteristics.</li><li>11. Demonstration of regenerative braking system using motor setup/simulation.</li><li>12. Interfacing and testing of sensors used in EVs (temperature, speed, and position sensors).</li><li>13. Study of Electronic Control Unit (ECU) and vehicle communication system.</li><li>14. Demonstration of CAN bus communication in automotive systems.</li><li>15. Study of EV charging methods: AC charging and DC fast charging.</li><li>16. Mini project on smart automotive/EV monitoring system using sensors and microcontroller.</li></ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

### Minor Theory 5: Communication and Microprocessor 8086

| Level              | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Course Name                           | Credits           | Teaching Hours              | Exam Duration                                                                                                                                                                                                                                                                                                        | Max Mark |
|--------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                | V        | 113239                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Communication and Microprocessor 8086 | 2                 | 30                          | 2 Hrs                                                                                                                                                                                                                                                                                                                | 30       |
| Course Objectives: |          | <ul style="list-style-type: none"><li>• To take technical and professional education in electronics and communication engineering</li><li>• To understand communication principles of Transmitter and Receiver.</li><li>• Describe the organization and architecture of 8086 microprocessor</li><li>• Understanding the classification of instructions</li><li>• Addressing modes of instructions</li><li>• Realizing the interfacing of memory</li></ul>                                                                                                                                                                     |                                       |                   |                             |                                                                                                                                                                                                                                                                                                                      |          |
| Course Outcomes:   |          | <b>After completing the course, the student will</b> <ul style="list-style-type: none"><li>• Properly understanding of principle of communication engineering</li><li>• Understanding modulation, demodulation, OFC in communication engineering</li><li>• Understanding the organization and architecture of 8085 and 8086 microprocessor</li><li>• Applying the instruction set of 8086 Microprocessor.</li><li>• Relating the addressing modes used in the instructions</li><li>• Interfacing the memory and other I/O devices.</li><li>• Familiarizing the architecture and operation with 8086 microprocessors</li></ul> |                                       |                   |                             |                                                                                                                                                                                                                                                                                                                      |          |
| Unit System        |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                       | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                                                                          |          |
| Unit I             |          | <b>Modulation and Demodulation:</b><br>Need for modulation, Types of modulation, AM theory, Frequency spectrum of AM, FM theory, Frequency spectrum of FM, Difference between AM and FM, Block diagram and working of AM and FM transmitter and receiver.                                                                                                                                                                                                                                                                                                                                                                     |                                       | 8Hrs              | 8 Marks                     | <b>The course will use lectures, ICT tools, demonstrations, hands-on activities, and project-based learning to explain EV and automotive electronics concepts. Group discussions, case studies, and industrial exposure will help students understand practical applications and modern automotive technologies.</b> |          |
| Unit II            |          | <b>Fibre Optic and Digital Communication:</b><br>Advantages and disadvantages of OFC, Block diagram of OFC, Types of optical Fibres.<br>Pulse modulation: PAM, PWM, PPM, Sampling theorem,<br>PCM: Bandwidth and quantizing noise, Multiplexing principles: TDM and FDM                                                                                                                                                                                                                                                                                                                                                       |                                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                      |          |
| Unit III           |          | <b>Architecture of 8086 Microprocessor:</b><br>Block diagram, pin diagram and function of 8086 microprocessor, BIU and EU, operating modes of 8086, G.P.R, pointer and index register, segment register etc.                                                                                                                                                                                                                                                                                                                                                                                                                  |                                       | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                                                                      |          |
| Unit IV            |          | <b>Instructions and Programming of microprocessor 8086:</b><br>Data transfer, Arithmetic & Logic Instructions. Addressing mode, Bus cycle, Programs of data transfer, addition, subtraction, division, and multiplication                                                                                                                                                                                                                                                                                                                                                                                                     |                                       | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                      |          |
| References:        |          | 1. A textbook of communication engineering by A.Kumar<br>2. Electronics and communication by Roddy and Coolean<br>3. Telecommunication principles circuit and system by S. Rambhadran                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                       |                   |                             |                                                                                                                                                                                                                                                                                                                      |          |

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|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                              | 4. Modern digital and analog communication system by B.P.Rathi<br>5. Communication electronics by N.D..Deshpande<br>6. Microprocessor architecture and programming and application with 8085by Ramesh Gaokar<br>7. Microprocessor 8085 by B.Ram<br>8. Microprocessor architecture and application by Dougulus Hall<br>9. Intel microprocessor 8086 by Brey:PHI<br>10. Introduction of microprocessor by A.P.Mathur                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Model questions for theory external examination.</b>      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>MCQs for Internal Assessment:</b>                         | <b>MCQ for internal assessment:</b><br>1) AM stands for -----<br>a) Ave rage modulation b) Adapter modulation c) Amplitude modulation d) None<br>2) There are ----- sidebands in FM<br>a) 1 b) 2 c) 4 d) Infinite<br>3) OFC stands for-----<br>a) Optical fibre cable b) Optical Fibre cable c) Optical frequency cable d) None<br>4) PWM stands for -----<br>a) Position width modulation b) Pulse width modulation<br>c) Pulse wide modulation d) None<br>5) PPM stands for-----<br>a) Pulse power modulation b) Position position modulation<br>c) Pulse pulse modulation d) Pulse position modulation<br>6) The intel microprocessor 8086 is a ..... processor<br>a) 8 bit b) 16 bit c) 32 bit d) 4 bit<br>7) The CF is known as .....<br>a) carry flag b) B. condition flag c) common flag d) single flag<br>8) The index register are used to hold .....<br>a) memory register b) offset address c) segment memory d) offset memory<br>9) The push source copies a word from source to .....<br>a) stack b) memory c) register d) destination<br>10) The 8086 fetches instruction one after another from ..... of memory<br>a) code segment b) IP c) ES d) SS |
| <b>One sentence/<br/>Very short<br/>answer<br/>questions</b> | <b>Short answer Type (2/3 Marks)</b><br>1. What is modulation?<br>2. What is need of modulation?<br>3. What is types modulation?<br>4. Write advantages of OFC?<br>5. What is PAM?<br>6. What is TDM?<br>7. What is microprocessor?<br>8. Write name of buses used in 8086.<br>9. What is function of Stack pointer?<br>10. What is size of address bus of 8086 microprocessor?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Long answer<br/>questions</b>                             | <b>Long answer Type (4/5 Marks) :</b><br>1. Explain theory of AM.<br>2. Draw and explain block diagram of AM transmitter.<br>3. Draw and explain block diagram of OFC.<br>4. Differentiate between TDM and FDM.<br>5. Explain PAM and PWM in detail.<br>6. Draw block diagram of microprocessor 8086 and write function of each.<br>7. Draw pin diagram of microprocessor 8086 and write function of each.<br>8. Explain flag register in 8086 microprocessors.<br>9. Explain operating modes of 8086 microprocessor<br>10. Explain addressing modes of 8086 microprocessor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

### Minor Lab / Practical –14: Practical Based on Communication and Microprocessor 8086

| Level | Semester | Course Code | Course Name                                              | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|----------------------------------------------------------|---------|----------------|---------------|----------|
| 5.5   | V        | 113240      | Practical based on Communication and Microprocessor 8086 | 2       | 60             | 4 Hrs         | 50       |

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| <b>Lab/<br/>Practical<br/>14</b> | <p>Perform minimum 10 experiments from the following,</p> <ol style="list-style-type: none"><li>1. AM generation and detection</li><li>2. FM generation and detection</li><li>3. Study of AM/ FM radio Receiver.</li><li>4. Study of AM/ FM radio Transmitter.</li><li>5. Multiplexing Techniques (FDM and TDM)</li><li>6. Study of Mixer and its Characteristics</li><li>7. Sampling, PAM, PWM, and PPM generation and detection.</li><li>8. Write and execute a program using microprocessor 8086 for Addition of two 8-bit numbers.</li><li>9. Write and execute a program using microprocessor 8086 for Addition of two 16-bit numbers.</li><li>10. Write and execute a program using microprocessor 8086 for Subtraction of two 8-bit numbers.</li><li>11. Write and execute a program using microprocessor 8086 for Subtraction of two 16-bit numbers.</li><li>12. Write and execute a program using microprocessor 8086 for Multiplication of two 8-bit numbers.</li><li>13. Write and execute a program using microprocessor 8086 for Division of numbers.</li><li>14. Write and execute a program using microprocessor 8086 to perform logical AND operation between two numbers.</li><li>15. Write and execute a program using microprocessor 8086 to perform logical OR operation between two numbers.</li></ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination



**Vocational Skill Enhancement Course 4: Lab/ Practical 15: Advanced Practical on Major Theory  
113231, 113232 and 113233**

| Level | Semester | Course Code | Course Name                                                  | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|--------------------------------------------------------------|---------|----------------|---------------|----------|
| 5.5   | V        | 113241      | VSEC - Advanced applications/ practical on Major Electronics | 02      | 60             | 4 Hrs.        | 50       |

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| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>To reduce the unemployment by providing self-employment schemes.</li> <li>To make the students skilled person.</li> <li>To reduce the mismatch between the demand and supply of skill man-power.</li> <li>To develop attitudes, knowledge, and skills for entrepreneurship and self-employment.</li> </ul> |
| <b>Course Outcomes:</b>   | After successful completion of the course, the students will be able to: <ul style="list-style-type: none"> <li>Apply their practical knowledge/ hands on training in the workplace.</li> <li>It fulfills the demand of industry.</li> <li>Start business-oriented services.</li> </ul>                                                           |

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| <b>Lab/ Practical 19</b> | Design minimum Six applications in total, at least 2 from each of the following aspects. <ol style="list-style-type: none"> <li>Design advanced applications based on Measuring instruments.</li> <li>Design advanced applications based on Communications Electronics.</li> <li>Design advanced applications based on C Programming.</li> </ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.
- Mode of Examination: Internal (There is no External Examination)

**Skill Enhancement Course (SEC) 3: Lab/ Practical 16: Skill based Practical on Major Theory  
113231, 113232 and 113233**

| Level | Semester | Course Code | Course Name                                                     | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|-----------------------------------------------------------------|---------|----------------|---------------|----------|
| 5.5   | V        | 113242      | Skill based Practical on Major Theory 113231, 113232 and 113233 | 02      | 60             | 4 Hrs.        | 50       |

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| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>To develop practical and technical skills through hands-on electronics projects.</li> <li>To provide knowledge of electronic components, circuit design, and project implementation.</li> <li>To train students in soldering, PCB fabrication, testing, and troubleshooting techniques.</li> <li>To introduce students to modern tools and technologies such as sensors, Arduino, and automation systems.</li> <li>To encourage creativity, innovation, teamwork, and problem-solving abilities through project-based learning.</li> </ul>                                                                                                 |
| <b>Course Outcomes:</b>   | <ul style="list-style-type: none"> <li>Students will be able to identify, test, and use electronic components and instruments effectively.</li> <li>Students will be able to design, assemble, and troubleshoot basic electronic circuits and projects.</li> <li>Students will gain practical knowledge of sensor interfacing, Arduino/microcontroller programming, and automation systems.</li> <li>Students will be able to develop simple project prototypes for real-life applications using modern electronic techniques.</li> <li>Students will improve technical, teamwork, documentation, and problem-solving skills required for industry and higher studies.</li> </ul> |

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| <b>Lab/<br/>Practical 16</b> | <p>Design and develop any one Project/ application from the following aspects.</p> <ol style="list-style-type: none"> <li><b>Smart Temperature Display System</b><br/>Components: LM35 / DHT22, LCD (16x2), Arduino<br/>Concepts: ADC, sensor interfacing<br/>Extension: Add buzzer for high temperature alert</li> <li><b>Ultrasonic Distance Measurement System</b><br/>Components: Ultrasonic sensor, LCD/OLED<br/>Concepts: Pulse timing, distance calculation<br/>Application: Parking assistant</li> <li><b>Smart Irrigation System</b><br/>Components: Soil moisture sensor, relay, pump<br/>Concepts: Automation, environmental sensing<br/>Working: Water plants only when soil is dry</li> <li><b>Smart Home Automation System</b><br/>Components: Relays, sensors, Arduino<br/>Control: Mobile/Bluetooth/WiFi<br/>Features: Control lights, fan, appliances</li> <li><b>Industrial Safety Monitoring System</b><br/>Components: Gas + temperature sensors<br/>Concepts: Multi-sensor integration<br/>Output: Alarm + automatic shutdown</li> <li><b>Automated Water Level Controller</b><br/>Components: Water level sensor, relay<br/>Concepts: Control systems<br/>Working: Automatically turns motor ON/OFF</li> <li><b>Smart Parking System</b><br/>Components: IR sensors, display</li> </ol> |
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|  | Concepts: Sensor network<br>Display: Available parking slots<br><b>8. Any other skill-based applications/ Projects related to Electronics</b> |
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**Note :**

- Students during lab hours shall have to present academic project in the subject Electronics.
- Mode of Examination: Internal (There is no External Examination)

## Electronics FP/CES- Project

| Electronics FP/CES- Project (113243)                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field Project / CE Services in Electronics: Phase-III                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Credits: 02                                                                            | Workload (Hrs./Week): 04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Course Objectives:</b>                                                              | <ol style="list-style-type: none"> <li>1. To provide hands-on experience in applying theoretical Electronics knowledge to real-world challenges through field-based projects or community engagement (CE) services.</li> <li>2. To train students in identifying, problems encountered in Electronics and related fieldwork or community service activities.</li> <li>3. To encourage students to integrate Electronics and field Electronics concepts with interdisciplinary knowledge, technology, and societal needs.</li> <li>4. To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences.</li> <li>5. To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.</li> </ol>                                                                                                                                                    |
| <b>Course Outcomes:</b>                                                                | <ol style="list-style-type: none"> <li>1. Students will be able to apply Electronics related analytical techniques to investigate and solve real-world problems in field settings.</li> <li>2. Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service.</li> <li>3. Students will be able to design, plan, and execute a field Electronics project or community service activity from inception to completion, including documentation and reporting.</li> <li>4. Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events.</li> <li>5. Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well beings.</li> </ol>                                                                              |
| <b>Guidelines/SOP for Selection and Implementation of Field Projects / CE Services</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>1. Project Selection and Planning</b>                                               | <ul style="list-style-type: none"> <li>• <b>Faculty Guidance:</b> Students will be assigned a faculty mentor to guide their project, providing expertise and resources.</li> <li>• <b>Project Topic:</b> The project topic should be relevant to Electronics and align with the student's interests and the available resources.</li> <li>• <b>Literature Review:</b> Students are expected to conduct a thorough literature review to understand existing knowledge and identify research gaps.</li> <li>• <b>Data Collection and Analysis:</b> Projects often involve experiments, field sampling, simulations, or data analysis from existing sources, depending on the topic.</li> <li>• Project Timeline: The total time allocation for the student to carry out field project is 60 hours.</li> <li>• The students shall have to carry the same project done in Semester III &amp; IV and submit the complete project report in form of thesis containing conclusion, future scope (with hardware) etc.</li> </ul> |
| <b>2. Data Analysis and Interpretation</b>                                             | <ul style="list-style-type: none"> <li>• <b>Statistical Methods:</b> Students will learn and apply appropriate statistical methods to analyze data.</li> <li>• <b>Interpretation of Results:</b> Data should be interpreted within the context of the project, highlighting significant findings and limitations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>3. Report Writing and Presentation</b>                                              | <ul style="list-style-type: none"> <li>• <b>Report Format:</b> A structured report format is usually followed, including an abstract, introduction, methodology, results, discussion, and conclusion.</li> <li>• <b>Data Presentation:</b> Data should be presented clearly and accurately using tables, graphs, and figures.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                              | <ul style="list-style-type: none"> <li>• <b>Oral Presentation:</b> Students will be required to present their findings to peers and faculty.</li> </ul>                                                                                                                                                                                                                                                                                                                                                         |
| <b>4. CE Services (Community Engagement)</b>                 | <ul style="list-style-type: none"> <li>• <b>Community Needs:</b> Projects may focus on addressing specific community needs or challenges relevant to Electronics.</li> <li>• <b>Collaboration:</b> Students can collaborate with local organizations to implement their projects.</li> <li>• <b>Impact Assessment:</b> The impact of the project on the community should be evaluated.</li> </ul>                                                                                                               |
| <b>5. Evaluation and Assessment</b>                          | <ul style="list-style-type: none"> <li>• <b>Project Report:</b> The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)</li> <li>• <b>Oral Presentation:</b> The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)</li> <li>• <b>Faculty Evaluation:</b> The faculty mentor will assess the student's performance throughout the project. (20 Marks)</li> <li>• <b>Total 50 Marks</b></li> </ul> |
| <b>Examples of Field Projects/CE Services in Electronics</b> | <ul style="list-style-type: none"> <li>• <b>Environmental Electronics:</b> Studying the local ecosystems and developing renewable energy solutions.</li> <li>• <b>Community Outreach:</b> Organizing Safety measures and awareness workshops or engaging in scientific literacy initiatives.</li> <li>• <b>Research Project:</b> Study related to the subject that contribute to the advancement of knowledge and the well-being of living things.</li> </ul>                                                   |

*Note: The extended portion of the Field Project/CE Services in Electronics from Phase-I may be carried forward as Field Project/CE Services in Electronics: Phase-II in the fourth semester, subject to the approval of the assigned faculty mentor.*

\*This paper is compulsory to all students of each stream in Semester V.

| Level                                                                                                                                                                                                   | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                        | Course Code                                                                                        | Course Name                           | Credits | Teaching Hours           | Exam Duration                      | Max Mark                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------|---------|--------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.5                                                                                                                                                                                                     | V                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                    | Foundation of Artificial Intelligence | 2       | 30                       | 2 Hrs                              | 30                                                                                                                                                                                                                                                                                                                                                               |
| <b>Evaluation Scheme: Total: 50</b><br>Internal: 20<br>External: 30<br><b>Methods of Internal Assessment:</b><br>15 Marks to Class Tests, /Assignments/ Viva voce/ Presentation & 5 Marks to Attendance |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                    |                                       |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Objectives</b>                                                                                                                                                                                | <ul style="list-style-type: none"> <li>To introduce AI concepts in a simple, real-life way with focus on understanding applications, ethics, and future opportunities.</li> </ul>                                                                                                                                                                                                                                                               |                                                                                                    |                                       |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Outcomes</b>                                                                                                                                                                                  | After completion of the course, the students will be able to:                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                    |                                       |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                         | <b>CO</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Course Outcomes</b>                                                                             | <b>BT Level</b>                       |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                         | CO-1                                                                                                                                                                                                                                                                                                                                                                                                                                            | Explain the basic concepts, history, and types of AI with real-life examples.                      | L1 – Knowledge, L2 – Understanding    |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                         | CO-2                                                                                                                                                                                                                                                                                                                                                                                                                                            | Describe AI structures and architectures using simple real-world analogies.                        | L2 – Understanding, L3 – Application  |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                         | CO-3                                                                                                                                                                                                                                                                                                                                                                                                                                            | Identify and analyze applications of AI in the area of arts, commerce, humanities, and daily life. | L3 – Application, L4 – Analysis       |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                         | CO-4                                                                                                                                                                                                                                                                                                                                                                                                                                            | Evaluate ethical, social issues and predict future opportunities of AI in their own fields.        | L4 – Analysis, L5 – Evaluation        |         |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Unit System</b>                                                                                                                                                                                      | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                    |                                       |         | <b>Workload Allotted</b> | <b>Weightage of Marks Allotted</b> | <b>Incorporation of Pedagogies</b>                                                                                                                                                                                                                                                                                                                               |
| <b>Unit I</b>                                                                                                                                                                                           | <b>Introduction to Artificial Intelligence:</b><br>Definition of AI: What is Intelligence? Natural vs. Artificial, Simple definition of AI; History & Evolution of AI: From early computers to modern AI; Types of AI: Narrow AI vs. General AI vs. Super AI; AI in Everyday Life: Google Maps, E-commerce suggestions, Chatbots, Social Media feeds; Key Components: Data, Algorithms, Computing Power                                         |                                                                                                    |                                       |         | 8 Hrs                    | 8 Marks                            | While teaching Electronics as a complete subject, classical and contemporary innovations pedagogies are to use, for integration into the Teaching, Learning, and Evaluation processes. Technology based pedagogy should involve use of advance electronic tools, instruments, media and other available e-resources to enhance the students learning experience. |
| <b>Unit II</b>                                                                                                                                                                                          | <b>AI Structures, Architectures &amp; Techniques:</b><br>Basic Structure of an AI System; AI Architectures (Simplified): Rule Based System, Machine Learning, Neural Networks; Key Concepts: Knowledge Representation (using symbols, facts), Search & Problem Solving (maze example, finding shortest route), Natural Language Understanding (Google Translate, chatbots)                                                                      |                                                                                                    |                                       |         | 7 Hrs                    | 7 Marks                            |                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Unit III</b>                                                                                                                                                                                         | <b>Applications of AI in Society:</b><br>AI in Different Fields: Education (Personalized learning apps, plagiarism checkers), Healthcare (Disease prediction, medical chatbots), Commerce (Fraud detection in banking, stock market predictions, customer support), Daily Life (Smart home devices, language translation, travel assistants); AI & Decision Making: Hiring, Loan Approval, Court Decisions; Advantages of AI, Limitations of AI |                                                                                                    |                                       |         | 7 Hrs                    | 7 Marks                            |                                                                                                                                                                                                                                                                                                                                                                  |

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |         |  |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|--|
| <b>Unit IV</b>    | <b>Ethical, Social &amp; Future Aspects of AI:</b><br>Ethical Concerns in AI: Privacy issues (CCTV, online data), Bias & Fairness (AI preferring certain groups), Job Displacement (automation replacing humans); Responsible AI: Transparency, Accountability, Human oversight; Future Trends in AI: Self-driving cars, AI in governance, creative industries; AI and You (Career Perspective): Opportunities in Digital Marketing, Content Creation, Business Analytics, HR Tech, Creative Industries (non-programming roles)                                                                                                                                     | 8 Hrs | 8 Marks |  |
| <b>References</b> | <b>Textbook:</b><br>Melanie Mitchell – Artificial Intelligence: A Guide for Thinking Humans<br><b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Boden, Margaret A., Artificial Intelligence: A Very Short Introduction</li> <li>2. Elaine Rich – Artificial Intelligence (3rd Edition)</li> <li>3. Godbole, Achyut, Artificial Intelligence (आर्टिफिशियल इंटेलिजन्स), Bookganga Publication.</li> <li>4. Kulkarni, Dr Anand, आर्टिफिशियल इंटेलिजन्सचा वाटेवर, Sakal Media Pvt. Ltd.</li> <li>5. Stuart Russell – Human Compatible (2019)</li> <li>6. Thorpe, Josh, AI for Students: Creative Hacks for Academic Success, Promplty Books</li> </ol> |       |         |  |

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

**FACULTY: Science and Technology**

**Subject: ELECTRONICS**

**Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)**

**Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme**

**THIRD YEAR: Level 5.5 - SEMESTER – VI (T & L Credit Scheme)**

| Mode of Teaching                                                           | Ver. No | The Vertical                  | Type of Course                 | Course Code | Course Name                                         | Credits   | Workload (Hrs/Week) | Vertical Workload (Hrs/Week) |
|----------------------------------------------------------------------------|---------|-------------------------------|--------------------------------|-------------|-----------------------------------------------------|-----------|---------------------|------------------------------|
| Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/ Online/ Hybrid |         | <b>Major</b>                  | Electronics Theory 11          | 113244      | Microcontroller 8051                                | 2         | 2                   | 16                           |
|                                                                            |         |                               | Electronics Theory 12          | 113245      | Sensors and Actuators                               | 2         | 2                   |                              |
|                                                                            |         |                               | Electronics Theory 13          | 113246      | Arduino Programming                                 | 2         | 2                   |                              |
|                                                                            |         |                               | Electronics Lab/Practical-17   | 113247      | Practical based on Theory 113244, 113245 & 113246   | 2         | 4                   |                              |
|                                                                            |         | <b>Elective</b>               | Elective Theory 3              | 113248      | Introduction to Internet of Things                  | 2         | 2                   |                              |
|                                                                            |         |                               | Electronics Lab/Practical-18 A | 113249      | Practical based on Theory 113248                    | 2         | 4                   |                              |
|                                                                            |         |                               | Elective Theory 4              | 113250      | Python Programming                                  | / 2       | / 2                 |                              |
|                                                                            |         |                               | Electronics Lab/Practical-18 B | 113251      | Practical based on Theory 113250                    | / 2       | / 4                 |                              |
|                                                                            | b.      | <b>Minor</b>                  | Electronics Theory 6           | 113252      | Microcontroller & Sensors                           | 2         | 2                   | 6                            |
|                                                                            |         |                               | Electronics Lab/Practical-19   | 113253      | Practical based on Minor Theory 113252              | 2         | 4                   |                              |
|                                                                            | c.      | <b>Generic/ Open Elective</b> | -                              | -           | -                                                   | -         | -                   | -                            |
|                                                                            | d.      | <b>VSC</b>                    | Lab/Practical-20               | 113254      | Advanced Practical on Major 113244, 113245 & 113246 | 2         | 4                   | 4                            |
|                                                                            |         | <b>Internship</b>             | On Job Training                | 113255      | Internship/ OJT                                     | 120 Hours | 4                   | 8                            |
|                                                                            |         | <b>CC</b>                     | Outdoor                        |             |                                                     | 2         | 4                   |                              |
|                                                                            |         | <b>TOTAL</b>                  |                                |             |                                                     | <b>20</b> | <b>38</b>           | <b>38</b>                    |



## Major Theory 11: Microcontroller 8051

| Level              | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Course Name          | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|--------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                | VI       | 113244                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Microcontroller 8051 | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| Course Objectives: |          | <ul style="list-style-type: none"><li>To introduce the fundamentals of microcontrollers and distinguish them from microprocessors.</li><li>To understand the architecture and internal organization of the microcontroller 8051.</li><li>To study key components such as registers memory, timers, and interrupts.</li><li>To learn the 8051 instruction sets and develops assembly language programs.</li><li>To understand serial communication and interfacing techniques with external devices.</li></ul>                                                                                                                 |                      |                   |                             |                                                                                                                                      |          |
| Course Outcomes:   |          | <b>After completing the course, the student will able to</b> <ul style="list-style-type: none"><li>Explain the basic concepts and architecture of the microcontroller 8051.</li><li>Identify and use various registers, memory types, and architectural components.</li><li>Apply different addressing modes and execute instruction sets effectively.</li><li>Develop assembly language programs for data transfer, arithmetic, and logical operations.</li><li>Implement serial communication and interface the 8051 with peripherals like ADC, 8255, and LEDs.</li></ul>                                                   |                      |                   |                             |                                                                                                                                      |          |
| Unit System        |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| Unit I             |          | Microcontroller 8051 Architecture:<br>Microcontroller Introduction, Difference between Microprocessor and Microcontroller, features, block diagram of microcontroller, Pin Configuration, CPU, registers: A, B, PC, and DPTR.                                                                                                                                                                                                                                                                                                                                                                                                 |                      | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| Unit II            |          | Registers, Timers and Interrupts:<br>SFR, PSW, Internal RAM, Stack & SP, counter & timers: TCON & TMOD, Interrupts: IP & IE.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| Unit III           |          | Instruction set and Programming:<br>Addressing modes, Instruction set: Data transfer, arithmetic, logical operation, JUMP, Loop and CALL instructions. Assembly language programming: simple data transfer, arithmetic, logical and single bit.                                                                                                                                                                                                                                                                                                                                                                               |                      | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| Unit IV            |          | Communication & Interfacing:<br>Basics of serial and parallel communication, Transmission Modes, SBUF register, SCON and PCON registers, interfacing to ADC 0804, interfacing to the 8255, interfacing to LED and power reduction mode.                                                                                                                                                                                                                                                                                                                                                                                       |                      | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| References:        |          | <ol style="list-style-type: none"><li>The 8051 Microcontroller architecture, Programming &amp; Applications- Kenneth J.Ayala (Penram international)</li><li>The 8051 Microcontroller and Embedded Systems.- M. A. Mazadi, J. C. Mazadi (Pearson Education, Asia)</li><li>Microprocessor, microcontroller &amp; applications- U. S. Shah (TechMax Publication Pune).</li><li>Programming and Customizing the 8051 Microcontroller- Mike Predko (TMH, New Delhi)</li><li>Advanced Digital Electronics, Microprocessor and 8051 Microcontroller by Y. B. Gandole, D. S. Dhote and S. P. Yawale. G.C. publisher, Nagpur</li></ol> |                      |                   |                             |                                                                                                                                      |          |

| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MCQs for Internal Assessment:</b>                    | <ol style="list-style-type: none"> <li>The 8051 is a:               <ol style="list-style-type: none"> <li>Microprocessor</li> <li><b>Microcontroller</b></li> <li>Memory device</li> <li>I/O device</li> </ol> </li> <li>The Program Counter (PC) is used to:               <ol style="list-style-type: none"> <li>Store data</li> <li><b>Store address of next instruction</b></li> <li>Perform arithmetic</li> <li>Control I/O</li> </ol> </li> <li>Which register is used for serial data transfer in 8051?               <ol style="list-style-type: none"> <li>A</li> <li>B</li> <li><b>SBUF</b></li> <li>DPTR</li> </ol> </li> <li>Which of the following is bit-addressable register?               <ol style="list-style-type: none"> <li>A register</li> <li>DPTR</li> <li><b>PSW</b></li> <li>PC</li> </ol> </li> <li>The 8051 has how many I/O ports?               <ol style="list-style-type: none"> <li>2</li> <li>3</li> <li><b>4</b></li> <li>5</li> </ol> </li> <li>Which instruction is used for addition?               <ol style="list-style-type: none"> <li>MOV</li> <li><b>ADD</b></li> <li>ANL</li> <li>ORL</li> </ol> </li> <li>SCON register is used in:               <ol style="list-style-type: none"> <li>Timer control</li> <li><b>Serial communication</b></li> <li>Interrupt control</li> <li>Memory access</li> </ol> </li> <li>TMOD register is related to:               <ol style="list-style-type: none"> <li>Interrupts</li> <li>Serial communication</li> <li><b>Timers</b></li> <li>I/O ports</li> </ol> </li> <li>Which mode reduces power consumption in 8051?               <ol style="list-style-type: none"> <li>Active mode</li> <li><b>Idle mode</b></li> <li>Run mode</li> <li>Execute mode</li> </ol> </li> <li>ADC0804 is used for:               <ol style="list-style-type: none"> <li>Digital to Analog conversion</li> <li><b>Analog to Digital conversion</b></li> <li>Memory storage</li> <li>Communication</li> </ol> </li> </ol> |
| <b>One sentence/ short answer questions</b>             | <ol style="list-style-type: none"> <li>Differentiate between a microprocessor and a microcontroller.</li> <li>Draw the block diagram of the microcontroller 8051.</li> <li>Explain the function of the Program Counter and Data Pointer register.</li> <li>What is the PSW register? Explain its any two flags?</li> <li>Explain the features of microcontroller 8051.</li> <li>Explain TMOD/ TCON registers used in timers.</li> <li>What are interrupts? Explain IE/ IP registers.</li> <li>Write short notes on data transfer and arithmetic instructions.</li> <li>Describe the function of SBUF and SCON registers.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>Explain the architecture of the microcontroller 8051 with a neat block diagram.</li> <li>Describe the internal organization of RAM in Microcontroller 8051.</li> <li>Explain the function of PSW, SP, and DPTR registers in detail.</li> <li>Describe different addressing modes of 8051 with examples.</li> <li>Explain the 8051 instruction set in details with suitable examples.</li> <li>Write an assembly language program for data transfer, arithmetic, and logical operations.</li> <li>Explain transmission modes in details.</li> <li>Describe interfacing of 8051 with ADC0804 with diagram and working.</li> <li>Explain interfacing of 8051 with 8255 programmable peripheral interface.</li> <li>Describe LED interfacing with 8051 and write a sample program.</li> <li>Explain power reduction modes in 8051 in details.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Major Theory 12: Sensors & Actuators

| Level              | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Course Code | Course Name         | Cre dits          | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 113245      | Sensors & Actuators | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| Course Objectives: | <ul style="list-style-type: none"><li>To provide a fundamental understanding of the physics and operating principles of various sensors and actuators.</li><li>To familiarize students with the actuators and power electronic circuits required to translate electronic signals into mechanical motion.</li><li>To develop skills in designing signal conditioning circuits (amplifiers, filters, and bridges) for real-world sensor data.</li><li>To introduce students to digital interfacing and data acquisition systems used in modern industrial and IoT applications.</li></ul>                        |             |                     |                   |                             |                                                                                                                                      |          |
| Course Outcomes:   | <ul style="list-style-type: none"><li>After completing the course, the student will</li><li>Identify and classify sensors based on their output characteristics and measurement range.</li><li>Analyze the performance of sensors by calculating parameters like sensitivity, linearity, and resolution.</li><li>Design and implement Wheatstone bridge and Instrumentation Amplifier circuits for low-level signal extraction.</li><li>Select appropriate actuators (Stepper, Servo, or DC motors) for specific automation tasks.</li><li>Interface analog sensors with digital systems using ADCs.</li></ul> |             |                     |                   |                             |                                                                                                                                      |          |
| Unit System        | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |                     | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| Unit I             | Fundamentals of Sensor:<br>Definition and importance of sensors, Role of sensors in electronics and automation, Difference between sensor and transducer, Classification of sensors: Active and Passive sensors, Analog and Digital sensors, Characteristics: Accuracy, Precision, Resolution, Sensitivity, Hysteresis and Linearity.                                                                                                                                                                                                                                                                          |             |                     | 7 Hrs             | 7 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| Unit II            | Types of Sensors:<br>Temperature sensor: LM35, Thermistor, Light sensor: LDR, Photodiode, Motion sensor, Pressure and humidity sensors, Ultrasonic sensor and its applications                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |                     | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| Unit III           | Introduction to Actuators:<br>Definition and importance of actuators, Difference between sensors and actuators, Classification of actuators: Electrical, Mechanical, Hydraulic, and Pneumatic actuators, Solenoid actuator, motor-based actuator.                                                                                                                                                                                                                                                                                                                                                              |             |                     | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| Unit IV            | Signal Conditioning & Data Acquisitions:<br>Signal conditioning: Definition, need and importance, Basic signal conditioning operations: Amplification, filtering, isolation, and attenuation. Introduction to Data Acquisition Systems, Block diagram and working of DAQ system, Computer based data acquisition systems                                                                                                                                                                                                                                                                                       |             |                     | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| References:        | <ol style="list-style-type: none"><li>Sensors and Transducers by D. Patranabis.</li><li>A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney</li><li>Instrumentation: Devices and Systems by C.S. Rangan, G.R. Sarma, and V.S.V. Mani</li><li>Transducers and Instrumentation by D.V. S. Murty</li><li>Basic Electrical Engineering by D.P. Kothari</li><li>Electronic Instrumentation by H.S. Kalsi</li><li>Transducer Engineering by S. Renganathan</li><li>Linear Integrated Circuits by D. Roy Choudhury</li></ol>                                                       |             |                     |                   |                             |                                                                                                                                      |          |

| Model questions for theory external examination. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| MCQs for Internal Assessment:                    | <ol style="list-style-type: none"> <li>Which of the following is an example of a Passive Transducer?<br/>A) Thermocouple B) Photovoltaic cell <b>C) LDR</b> D) Piezoelectric crystal</li> <li>The ability of a sensor to provide the same output for the same input under constant conditions is called:<br/>A) Accuracy <b>B) Repeatability</b> C) Sensitivity D) Resolution</li> <li>In an LVDT, the output voltage is zero at the null position because:<br/>A) The primary current is zero<br/><b>B) The induced voltages in the two secondary coils are equal and opposite</b><br/>C) The core is removed D) The secondary coils are in phase</li> <li>Which temperature sensor is known for having a "Negative Temperature Coefficient" (NTC)?<br/>A) RTD (PT100) <b>B) Thermistor</b> C) Thermocouple D) LM35</li> <li>Which motor is specifically designed for precise "Step-by-Step" angular displacement?<br/>A) AC Induction Motor B) Shunt DC Motor <b>C) Stepper Motor</b> D) Universal Motor</li> <li>What is the purpose of a "Flyback Diode" in a relay driving circuit?<br/>A) To increase the switching speed<br/><b>B) To protect the transistor from high-voltage spikes during turn-off</b><br/>C) To limit the current to the coil D) To rectify AC to DC</li> <li>A Servo Motor uses which of the following to maintain its position?<br/>A) High voltage <b>B) Feedback mechanism</b> (Potentiometer/Encoder)<br/>C) Permanent magnets only D) Hydraulic fluid</li> <li>An Instrumentation Amplifier is characterized by:<br/>A) Low Input Impedance and High Gain <b>B) High CMRR and High Input Impedance</b><br/>C) Low CMRR and Low Gain D) High Output Impedance</li> <li>For an 8-bit DAC, if the full-scale output is 5V, the resolution is approximately:<br/>11. A) 0.625 V B) 0.050 V <b>C) 0.019 V</b> D) 1.25 V</li> </ol> |
| One sentence/ short answer questions             | <ol style="list-style-type: none"> <li>Define Sensitivity in sensors.</li> <li>Define Hysteresis in sensors.</li> <li>Differentiates between Active and Passive transducers.</li> <li>State the role of a Flyback Diode in relay circuits.</li> <li>What is the main advantage of an Instrumentation Amplifier over a standard Differential Amplifier?</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Long answer questions                            | <ol style="list-style-type: none"> <li>Explain the construction and working principle of an LVDT.</li> <li>Describe the working of a Stepper Motor and its "steps per revolution" concept.</li> <li>Explain the working principle of a Piezoelectric Sensor.</li> <li>Draw the circuit of a 3-Op-amp Instrumentation Amplifier. Derive the expression for its output voltage.</li> <li>Explain Pulse Width Modulation. Show how it is used to control the speed of a DC motor.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### Major Theory 13: Arduino Programming

| Level              | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Course Name         | Credits           | Teaching Hours              | Exam Duration                                                                                                                                                                                                                                                           | Max Mark |
|--------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                | VI       | 113246                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Arduino Programming | 2                 | 30                          | 2 Hrs                                                                                                                                                                                                                                                                   | 30       |
| Course Objectives: |          | <ul style="list-style-type: none"><li>To understand the architecture, specifications, and pin configuration of the Arduino UNO.</li><li>To learn installation and setup of Arduino IDE and basic Arduino programming concepts.</li><li>To perform digital and analog I/O operations using functions like pinMode(), digitalWrite(), and analogRead().</li><li>To interface basic devices such as LEDs, LCD, switches, relay, buzzer, and motors with Arduino.</li><li>To study and implement interfacing of various sensors like temperature, humidity, IR, ultrasonic, and rain sensor.</li></ul> |                     |                   |                             |                                                                                                                                                                                                                                                                         |          |
| Course Outcomes:   |          | <b>After completing the course, the student will able to</b> <ul style="list-style-type: none"><li>Understand and configure the Arduino UNO R3 and its development environment.</li><li>Apply Arduino programming concepts for digital and analog input/output operations.</li><li>Interface and control basic electronic components such as LEDs, LCDs, switches, and motors.</li><li>Demonstrate working of different sensors and acquire real-world data.</li><li>Develop simple embedded system applications using Arduino and sensors.</li></ul>                                              |                     |                   |                             |                                                                                                                                                                                                                                                                         |          |
| Unit System        |          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                             |          |
| Unit I             |          | Introduction to Arduino:<br>Introduction to Arduino UNO, Technical Specifications, Pin configuration, Concept of digital and analog ports, Power to an Arduino, Arduino IDE Installation & setup: Port, board selection, Library installations.                                                                                                                                                                                                                                                                                                                                                    |                     | 8 Hrs             | 8 Marks                     | In addition to classroom teaching, demonstration of the Arduino UNO R3 may be effectively integrated with appropriate pedagogical approaches such as Experiential Learning, Collaborative Learning and the use of Simulation Tools like Tinkercad, wherever applicable. |          |
| Unit II            |          | Arduino I/O and Basic Operations:<br>Arduino Data Types, Functions of pinMode(), digitalWrite(), analogRead(), delay(), HIGH/LOW status of digital pins. Operation of inbuilt and external LED, Blinking and changing intensity of LED.                                                                                                                                                                                                                                                                                                                                                            |                     | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                         |          |
| Unit III           |          | Basic Interfacing and Programming:<br>Interfacing of Arduino with DC motor, Stepper motor, LED, 16x2 LCD, Switch, Relay, Buzzer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                         |          |
| Unit IV            |          | Sensors Interfacing and Programing:<br>Basic function & interfacing of Humidity sensor, Temperature sensor, Moisture sensor, Proximity sensor, IR sensor, Ultrasonic sensor, Rain Sensor, Gas sensor.                                                                                                                                                                                                                                                                                                                                                                                              |                     | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                         |          |
| References:        |          | <ul style="list-style-type: none"><li>Programming Arduino, 2<sup>nd</sup> edition, by Simon Monk, MC GRAW HILL.</li><li>Arduino Made simple with interactive projects, by Ashwin Pajankar, BPB publications</li></ul>                                                                                                                                                                                                                                                                                                                                                                              |                     |                   |                             |                                                                                                                                                                                                                                                                         |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <ul style="list-style-type: none"> <li>• Arduino-Based Embedded Systems Interfacing, Simulation, and LabVIEW GUI, 1<sup>st</sup> edition, by Rajesh Singh, CRC Press.</li> <li>• <a href="https://docs.arduino.cc/learn/starting-guide/getting-started-arduino/">https://docs.arduino.cc/learn/starting-guide/getting-started-arduino/</a></li> <li>• <a href="https://www.hackerearth.com/blog/arduino-programming-for-beginners">https://www.hackerearth.com/blog/arduino-programming-for-beginners</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>MCQs for Internal Assessment:</b>                    | <ol style="list-style-type: none"> <li>Which microcontroller is used in the Arduino Uno board?<br/><b>A. ATmega328P</b> B. ATmega2560 C. PIC16F877A D. ESP8266</li> <li>In the Arduino IDE, which function runs only once when the program starts?<br/>A. loop() <b>B. setup()</b> C. main() D. start()</li> <li>Which Arduino pins are used for analog input?<br/>A. Digital pins (0-13) B. PWM pins<br/><b>C. Analog pins (A0-A5)</b> D. Power pins</li> <li>What is the range of values returned by analogRead() in Arduino Uno?<br/>A. 0 to 255 B. 0 to 512 <b>C. 0 to 1023</b> D. 0 to 4095</li> <li><b>Which sensor is used to measure distance using sound waves?</b><br/>A. IR Sensor <b>B. Ultrasonic Sensor</b> C. Temperature Sensor D. Humidity Sensor</li> <li>Which function is used to create a delay in milliseconds?<br/>A. delayMicroseconds() B. millis() <b>C. delay()</b> D. micros()</li> </ol> |
| <b>One sentence/ short answer questions</b>             | <ol style="list-style-type: none"> <li>1. Explain the architecture of the Arduino Uno.</li> <li>2. What is the role of the Arduino IDE?</li> <li>3. Explain the working of pinMode() and digitalWrite() functions.</li> <li>4. What is the difference between delay() and millis()?</li> <li>5. Explain looping and decision-making techniques in Arduino.</li> <li>6. Explain the use of the DHT22 sensor.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"> <li>1. Explain the features, pin configuration, and architecture of the Arduino Uno.</li> <li>2. Describe the functions and structure of programs written in the Arduino IDE.</li> <li>3. Explain digital and analog I/O operations in Arduino with examples.</li> <li>4. Discuss looping and decision-making techniques used in Arduino programming.</li> <li>5. Explain time-related functions: delay(), delayMicroseconds(), millis(), and micros().</li> <li>6. Describe interfacing of LED and push button with Arduino with working.</li> <li>7. Explain interfacing of a 16x2 LCD with Arduino.</li> <li>8. Describe working and interfacing of a DC motor and relay with Arduino.</li> <li>9. Describe the interfacing and applications of the DHT22 and rain sensor.</li> <li>10. Explain the working and interfacing of ultrasonic and IR sensors.</li> </ol>            |

## Major Lab / Practical 17: Practical on Major Theory 113244, 113245 & 113246

| Level | Semester | Course Code | Course Name        | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|--------------------|---------|----------------|---------------|----------|
| 5.5   | VI       | 113247      | Electronics Lab 17 | 2       | 60             | 4 Hrs.        | 50       |

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>To understand programming and operations of the Microcontroller 8051.</li> <li>To study working and applications of sensors like LVDT, thermistor, LDR, photodiode, and ultrasonic sensor.</li> <li>To measure physical parameters such as temperature, displacement, light, and distance.</li> <li>To implement basic signal conditioning circuits like low-pass and high-pass filters.</li> <li>To develop Arduino-based applications using Arduino UNO and Arduino IDE.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Outcomes:</b>   | <ul style="list-style-type: none"> <li>Apply programming concepts of the 8051 Microcontroller for basic operations.</li> <li>Demonstrate the use of different sensors for real-world measurements.</li> <li>Analyze and measure physical parameters using appropriate sensors.</li> <li>Design basic signal conditioning circuits.</li> <li>Interface sensors and actuators using Arduino UNO.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Lab Practical 17</b>   | <p><b>Perform minimum 10 experiments at least three on each of the following aspects.</b></p> <p><b>8051 Microcontroller</b></p> <ol style="list-style-type: none"> <li>Data transfer using 8051 <math>\mu\text{c}</math></li> <li>Arithmetic using 8051 <math>\mu\text{c}</math> i.e. Addition, subtraction, multiplication, division etc.</li> <li>Logical using 8051 <math>\mu\text{c}</math></li> </ol> <p><b>Sensor &amp; Actuators</b></p> <ol style="list-style-type: none"> <li>Displacement measurement using LVDT.</li> <li>Temperature measurement using NTC thermistor.</li> <li>Light intensity measurement using LDR sensor.</li> <li>Study of PN junction photodiode sensor.</li> <li>Distance measurement using ultrasonic sensor.</li> <li>Implementation of low-pass filters using RC circuit.</li> <li>Implementation of high-pass filters using RC circuit.</li> </ol> <p><b>Arduino Programming</b></p> <ol style="list-style-type: none"> <li>Installing and setting up Arduino IDE (board &amp; port selection).</li> <li>Writing and uploading first program (Hello World using Serial Monitor).</li> <li>LED ON/OFF using HIGH/LOW logic.</li> <li>LED blinking using digital output (inbuilt LED).</li> <li>Controlling external LED brightness using potentiometer.</li> <li>Interfacing 16x2 LCD display (display text).</li> <li>Interfacing relay module (ON/OFF control of DC motor).</li> <li>Interfacing temperature &amp; humidity sensor (DHT22).</li> <li>Interfacing buzzer (generate tone/beep).</li> <li>Interfacing ultrasonic sensor (distance measurement).</li> <li>Interfacing rain sensor (rain detection system).</li> </ol> |

**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

### Major Elective Theory 3: Introduction to Internet of Things

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Course Name                        | Credits                  | Teaching Hours                     | Exam Duration                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Max Mark |
|---------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                       | VI       | 113248                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Introduction to Internet of Things | 2                        | 30                                 | 2 Hrs                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 30       |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>• Provide the basic concepts, architecture, components, and applications of Internet of Things (IoT).</li> <li>• Identify and explain the working of various sensors, actuators, and microcontrollers used in IoT systems.</li> <li>• Describe different communication technologies and protocols used for data transmission in IoT networks.</li> <li>• Develop basic IoT-based applications using simple hardware and cloud connectivity concepts.</li> <li>• Understand the importance of IoT security, privacy, and real-life applications in smart home, healthcare, agriculture, and industry.</li> </ul>                                                |                                    |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
| <b>Course Outcomes:</b>   |          | <p><b>After completing the course, the student will</b></p> <ul style="list-style-type: none"> <li>• Understand the fundamentals, architecture, characteristics, and applications of Internet of Things (IoT).</li> <li>• Identify and interface various sensors, actuators, and microcontrollers used in IoT systems.</li> <li>• Understands of IoT communication technologies and protocols such as Wi-Fi, Bluetooth, ZigBee, MQTT, and HTTP.</li> <li>• Able to design and implement simple IoT-based projects for real-time monitoring and data acquisition.</li> <li>• Analyze the role of IoT in smart applications and understand basic issues related to IoT security and privacy.</li> </ul> |                                    |                          |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
| <b>Unit System</b>        |          | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    | <b>Workload Allotted</b> | <b>Weightage of Marks Allotted</b> | <b>Incorporation of Pedagogies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
| <b>Unit I</b>             |          | <b>Fundamentals of Internet of Things</b><br>Introduction to Internet of Things (IoT), Evolution of IoT and its importance, Basic components of IoT system, IoT architecture and layers, Characteristics and advantages of IoT, Applications of IoT in daily life, Challenges and limitations of IoT                                                                                                                                                                                                                                                                                                                                                                                                  |                                    | 7 Hrs                    | 7 Marks                            | <b>Lecture Method for basic concepts, ICT-based Teaching using videos and animations of IoT systems, Group Discussion on IoT applications in daily life.</b><br><br><b>Demonstration Method</b> for sensor and hardware operation, <b>Hands-on Learning</b> using Arduino/NodeMCU kits, <b>Laboratory Method</b> for sensor interfacing experiments.<br><br><b>Interactive Lecture Method</b> for protocols and networking basics, <b>Simulation-Based Learning</b> using IoT |          |
| <b>Unit II</b>            |          | <b>Sensors, Actuators and Hardware for IoT</b><br>Introduction to sensors and actuators, Types of sensors used in IoT: temperature, humidity, light, motion, gas.<br>Working principle of common sensors, Microcontrollers used in IoT, Introduction to Arduino, NodeMCU. Interfacing of sensors with microcontrollers, Basic data acquisition in IoT systems                                                                                                                                                                                                                                                                                                                                         |                                    | 8 Hrs                    | 8 Marks                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
| <b>Unit III</b>           |          | <b>Communication Technologies in IoT</b><br>Basics of wireless communication for IoT, IoT communication protocols, Wi-Fi, Bluetooth, ZigBee, and LoRa basics, Introduction to Internet protocols, Data transmission in IoT systems, Cloud connectivity and data storage basics, Overview of IoT platforms                                                                                                                                                                                                                                                                                                                                                                                             |                                    | 8 Hrs                    | 8 Marks                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
| <b>Unit IV</b>            |          | <b>IoT Applications and Basic Project Development</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                    | 7 Hrs                    | 7 Marks                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |



|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |                                                                                                        |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--------------------------------------------------------------------------------------------------------|
|                                                         | IoT system design steps, Smart home automation concept, IoT in healthcare monitoring, IoT in agriculture and environmental monitoring, Data visualization and monitoring using IoT platforms, Introduction to IoT security and privacy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  | simulators/software tools.<br><br><b>Project-Based Learning</b> through simple IoT project development |
| <b>References:</b>                                      | <ol style="list-style-type: none"><li>1. Internet of Things: A Hands-On Approach, Universities Press, 2015.</li><li>2. The Internet of Things: A Key Applications and Protocols, Wiley Publication, 2012.</li><li>3. Building the Internet of Things, Wiley Publication, 2016.</li><li>4. Getting Started with the Internet of Things, O'Reilly Media, 2011.</li><li>5. Internet of Things: Principles and Paradigms, Morgan Kaufmann, 2016.</li><li>6. The Internet of Things: Connecting Objects to the Web, Wiley Publications.</li><li>7. Foundational Elements of an IoT Solution, O'Reilly Media.</li><li>8. Building the Internet of Things with IPv6 and MIPv6, Wiley Publications.</li><li>9. Introduction to IoT, Cambridge University Press.</li><li>10. Internet of Things, Oxford University Press India.</li></ol> |  |  |                                                                                                        |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |                                                                                                        |
| <b>MCQs for Internal Assessment</b>                     | <ol style="list-style-type: none"><li>1. What does IoT stand for?<br/>A. Internet of Technology <b>B. Internet of Things</b> C. Integration of Things D. Internet of Telecommunications</li><li>2. Which of the following is an application of IoT?<br/><b>A. Smart Home</b> B. Typewriter C. Calculator D. Printer Cable</li><li>3. Which device is commonly used as a microcontroller in IoT?<br/><b>A. Arduino</b> B. Monitor C. Keyboard D. Scanner</li><li>4. Which sensor is used to measure temperature?<br/>A. Gas Sensor B. Light Sensor <b>C. Temperature Sensor</b> D. Motion Sensor</li><li>5. Which communication technology is commonly used for short-range wireless communication?<br/><b>A. Bluetooth</b> B. HDMI C. VGA D. Humidity Sensor</li></ol>                                                           |  |  |                                                                                                        |
| <b>One sentence/ Very short answer questions</b>        | <ol style="list-style-type: none"><li>1. What is Internet of Things (IoT)?</li><li>2. What is the function of a sensor in an IoT system?</li><li>3. Name any one microcontroller used in IoT.</li><li>4. What is Bluetooth used for in IoT?</li><li>5. What is the main purpose of IoT in smart agriculture?</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |                                                                                                        |
| <b>Short answer questions</b>                           | <ol style="list-style-type: none"><li>1. Define Internet of Things (IoT).</li><li>2. List any four applications of IoT.</li><li>3. What is the role of sensors in an IoT system?</li><li>4. What is an actuator? Give one example.</li><li>5. Write the features of Arduino board.</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |                                                                                                        |
| <b>Long answer questions</b>                            | <ol style="list-style-type: none"><li>1. Explain the concept of Internet of Things (IoT) and its importance in modern technology.</li><li>2. Describe the basic architecture of an IoT system with a neat block diagram.</li><li>3. Explain the role of sensors and actuators in IoT systems.</li><li>4. Write in detail about the features and applications of Arduino board in IoT.</li><li>5. Explain the working of NodeMCU and its importance in IoT applications.</li></ol>                                                                                                                                                                                                                                                                                                                                                |  |  |                                                                                                        |

## Major Elective Lab/ Practical 18A: Practical on Introduction to Internet of Things

| Level | Semester | Course Code | Course Name         | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|---------------------|---------|----------------|---------------|----------|
| 5.5   | VI       | 113249      | Electronics lab 18A | 2       | 60             | 4 Hrs         | 50       |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Lab<br/>Practical<br/>18A</b> | <p><b>Minimum any 10 experiments of the following aspects.</b></p> <ol style="list-style-type: none"> <li><b>Study of IoT System and Development Boards</b><br/>Introduction to IoT concept, block diagram of IoT system, and study of development boards such as Arduino / NodeMCU / Raspberry Pi.</li> <li><b>Installation of Arduino IDE and Basic Programming</b><br/>Installation of Arduino IDE software and writing a simple program for LED blinking.</li> <li><b>Digital Input and Output Experiment</b><br/>Interfacing push button switch and LED with Arduino to understand digital input and output operations.</li> <li><b>Analog Input Experiment</b><br/>Interfacing a potentiometer or analog sensor with Arduino and displaying analog values on serial monitor.</li> <li><b>Temperature Sensor Interfacing</b><br/>Interfacing temperature sensor (LM35 / DHT11) with Arduino and displaying temperature values.</li> <li><b>Light Sensor Interfacing</b><br/>Interfacing LDR sensor with Arduino to measure light intensity.</li> <li><b>Humidity Sensor Interfacing</b><br/>Interfacing DHT11/DHT22 sensor to measure humidity and temperature.</li> <li><b>Motion Detection System</b><br/>Interfacing PIR motion sensor with Arduino for motion detection.</li> <li><b>IoT Communication using NodeMCU (Wi-Fi Module)</b><br/>Connecting NodeMCU with Wi-Fi network and sending sensor data to serial monitor.</li> <li><b>Sending Sensor Data to Cloud Platform</b><br/>Uploading sensor data to IoT cloud platform such as ThingSpeak.</li> <li><b>IoT Based Smart Device Control</b><br/>Controlling LED or relay module through internet using NodeMCU.</li> <li><b>Mini Project</b><br/>Development of a simple IoT application such as Smart home lighting system, Temperature monitoring system, Smart irrigation system</li> </ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

## Major Elective Theory 4: Python Programming

| Level                     | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Course Code | Course Name        | Credits           | Teaching Hours              | Exam Duration                                                                                                                                                                                                                                                                                                                                                                                                              | Max Mark |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|-------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                       | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 113250      | Python Programming | 2                 | 30                          | 2 Hrs                                                                                                                                                                                                                                                                                                                                                                                                                      | 30       |
| <b>Course Objectives:</b> | <ul style="list-style-type: none"> <li>• Provide the basic concepts, architecture, components, and applications</li> <li>• Identify and explain the working of various component used in systems.</li> <li>• Describe different technologies and protocols</li> <li>• Develop basic applications using simple hardware concepts.</li> <li>• Understand the importance and real-life applications in smart home, healthcare, agriculture, and industry.</li> <li>• Develop and exemplify basic programming skills in Virtual Instrumentation.</li> </ul> |             |                    |                   |                             |                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
| <b>Course Outcomes:</b>   | <p><b>After completing the course, the student will</b></p> <ul style="list-style-type: none"> <li>• Design and implement a system using sensor and instrumentation configuration. Identify, define, state, list, name the various terminologies of Python Programming.</li> <li>• Understand various concepts and blocks of Python Programming.</li> <li>• Apply the concepts of Python Programming to design real time embedded applications.</li> <li>• Demonstrate the skill set using modern tool</li> </ul>                                       |             |                    |                   |                             |                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
| Unit System               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                    | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                                                                                                                                                                                                                                                                                                                |          |
| <b>Unit I</b>             | <b>Installation, Data Types and Input/output:</b><br>Importance of Python, Installing Python in Windows/Linux, Executing Python programs, Comments in Python, Internal working of Python, Identifiers, keywords, and indentation, Python character set, Tokens, the print () function, Assignment of values to variables, Getting User Input: input () function, The eval () function, Python Core Data Types                                                                                                                                           |             |                    | 7 Hrs             | 7 Marks                     | <b>Lecture Method for basic concepts, ICT-based Teaching using videos and animations of systems, Group Discussion on applications in daily life.</b><br><br><b>Demonstration Method</b> for sensor and hardware operation,<br><b>Hands-on Learning</b> using python,<br><b>Laboratory Method</b> for simulation based experiments.<br><br><b>Interactive Lecture Method</b> for <b>Simulation-Based Learning</b> using IoT |          |
| <b>Unit II</b>            | <b>Operators and Control Statements:</b><br>Assignment, Logical, Arithmetic; Operator precedence and Associativity, Bitwise operator, the compound assignment operator; Decision statements- Boolean operators, Boolean Expressions and Relational operators, Decision making statements; Loop Control Statements- while loop, range () function, for loop; break statement, continue statement.                                                                                                                                                        |             |                    | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
| <b>Unit III</b>           | <b>List, tuple, dictionary in Python:</b><br>Lists- creating lists, list operations, list manipulation, list functions, Tuple- creating tuple, tuple operations, tuple functions and methods, Dictionary- creating dictionary, dictionary operations, dictionary functions and methods                                                                                                                                                                                                                                                                  |             |                    | 8 Hrs             | 8 Marks                     |                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
| <b>Unit IV</b>            | <b>Functions in Python and Programs for Embedded Applications:</b><br>Understanding and defining functions in python, flow of execution in a function call, passing parameters, returning values from functions, scope of variables. Python                                                                                                                                                                                                                                                                                                             |             |                    | 7 Hrs             | 7 Marks                     |                                                                                                                                                                                                                                                                                                                                                                                                                            |          |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |                                                                                                         |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|---------------------------------------------------------------------------------------------------------|
|                                                         | Libraries, Design of real time IoT applications using different microcontroller and Python Programming. Basic exercises using Python Programming for real time embedded system applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  | simulators/software tools.<br><br><b>Project-Based Learning</b> through simple IoT project development. |
| <b>References:</b>                                      | <div>1. Coding Projects in Python, A step by step guide to creating your own Python Projects, DK, Penguin Random House, 1st American Edition, 2017.</div> <div>2. Learn Python the HardWay, 3rd Edition, Zed A Shaw, Addison-Wesley, 2014</div> <div>3. Learning Python,5th Edition, O'Reilley,2013</div> <div>4. Python Programming for Beginners, 2015 Corey Kidd.</div> <div>5. <a href="http://www.tutorialspoint.com">www.tutorialspoint.com</a></div> <div>6. <a href="http://www.python.org">www.python.org</a></div> <div>7. <a href="https://www.codecademy.com/learn/learn-python">https://www.codecademy.com/learn/learn-python</a></div> <div>8. <a href="https://www.w3schools.com/python">https://www.w3schools.com/python</a></div> <div>9. <a href="https://www.learnpython.org">https://www.learnpython.org</a></div> <div>10. <a href="https://www.geeksforgeeks.org/python-programming-language">https://www.geeksforgeeks.org/python-programming-language</a></div>                                                                                                                                                                                                                                                                                                                                                  |  |  |                                                                                                         |
| <b>Model questions for theory external examination.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |                                                                                                         |
| <b>MCQs for Internal Assessment</b>                     | <div>1. Who developed Python Programming Language?<br/>a) Wick van Rossum   b) Rasmus Lerdorf   c) Guido van Rossum   d) Niene Stom</div> <div>2. Is Python case sensitive when dealing with identifiers?<br/>a) no                      b) yes                      c) machine dependent   d) none of the mentioned</div> <div>3. Which of the following is the correct extension of the Python file?<br/>a) .python                b) .pl                      c) .py                      d) .p</div> <div>4. Is Python code compiled or interpreted?<br/>a) Python code is both compiled and interpreted<br/>b) Python code is neither compiled nor interpreted<br/>c) Python code is only compiled                      d) Python code is only interpreted</div> <div>5. Which keyword is used for function in Python language?<br/>a) Function                b) def                      c) Fun                      d) Define</div> <div>6. What is the order of precedence in python?<br/>a) Exponential, Parentheses, Multiplication, Division, Addition, Subtraction<br/>b) Exponential, Parentheses, Division, Multiplication, Addition, Subtraction<br/>c) Parentheses, Exponential, Multiplication, Addition, Division, Subtraction<br/>d) Parentheses, Exponential, Multiplication, Division, Addition, Subtraction</div> |  |  |                                                                                                         |
| <b>One sentence/ Very short answer questions</b>        | <div>1. Define Arithmetic operators.</div> <div>2. How many arithmetic operations in python ?</div> <div>3. What is concatenation operator?</div> <div>4. What is a string?</div> <div>5. What is slicing in strings?</div> <div>6. What is interactive mode in python?</div> <div>7. How script mode is used?</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |                                                                                                         |
| <b>Short answer questions</b>                           | <div>1. What is the difference between a tuple and a list in Python?</div> <div>2. How do you handle exceptions in Python?</div> <div>3. What is a decorator in Python and how do you use it?</div> <div>4. Explain the difference between local and global variables in Python.</div> <div>5. How do you define a function in Python?</div> <div>6. Explain the difference between len() and count() in Python.</div> <div>7. What is the difference between append() and extend() in a Python list?</div> <div>8. What is the difference between list() and set() in Python?</div> <div>9. How do you perform file I/O operations in Python?</div> <div>10. How do you define a lambda function in Python?</div> <div>11. How do you implement a linked list in Python?</div> <div>12. How do you implement a dictionary in Python?</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |                                                                                                         |

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | 13. How do you implement a tree in Python?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Long<br/>answer<br/>questions</b> | <ol style="list-style-type: none"> <li>1. Write a Short note on Data types in python.</li> <li>2. Explain precedence and associativity of operators with examples.</li> <li>3. Explain different operators in python with examples.</li> <li>4. Define a variable. How to assign values to them?</li> <li>5. What is the purpose of Indentation in Python?</li> <li>6. Explain the features of python.</li> <li>7. What is identifier? And explain Rules to define identifiers in Python?</li> <li>8. Briefly explain how to read data from the keyboard.</li> <li>9. Briefly explain the conditional statements available in python.</li> <li>10. Describe the various control flow statements in python.</li> <li>11. Explain the Syntax of for loop and the use of range function with an Example.</li> </ol> |

### Major Elective Lab/ Practical 18B: Practical on Python Programming

| Level | Semester | Course Code | Course Name         | Credits | Teaching Hours | Exam Duration | Max Mark |
|-------|----------|-------------|---------------------|---------|----------------|---------------|----------|
| 5.5   | VI       | 113251      | Electronics lab 18B | 2       | 60             | 4 Hrs         | 50       |

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <b>Lab Practical 18B</b> | <p><b>Minimum any ten experiments from the following aspects.</b></p> <ol style="list-style-type: none"> <li>1. Write a program to demonstrate different number data types in python.</li> <li>2. Write a program to perform different arithmetic operations on numbers in python</li> <li>3. Write a program to create, concatenate and print a string and accessing substring from a given string</li> <li>4. Write a python script to print the current date in following format “Sun May 29 02:26:23 IST 2017”</li> <li>5. Write a python program to find largest of three numbers</li> <li>6. Write a python program to convert temperature to and from Celsius to Fahrenheit.</li> <li>7. Write a program to get a list of the even numbers from a given list of numbers.(use only comprehensions)</li> <li>8. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.</li> <li>9. Conversion from one coordinate system to another coordinate system using Python commands.</li> <li>10. Calculation of Force, Electric field and Potential at a given point using Python commands.</li> <li>11. Calculation of ripple factor for a given rectifier: Half-wave/Full-wave/Bridge circuit using Python program.</li> <li>12. Obtain the characteristics for the given circuit using Maximum power transfer theorem.</li> <li>13. Calculation of the equivalent circuit parameters and efficiency of a Transformer at different loads using Python commands.</li> <li>14. Modelling of an electrical circuit using Python program. Apply Nodal analysis and Mesh analysis for a given electrical circuit.</li> </ol> |
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**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

### Minor Theory 6: Microcontroller and Sensors

| Level              | Semester                                                                                                                                                                                                                                                                                 | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Course Name                 | Credits           | Teaching Hours              | Exam Duration                                                                                                                        | Max Mark |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 5.5                | VI                                                                                                                                                                                                                                                                                       | 113252                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Microcontroller and Sensors | 2                 | 30                          | 2 Hrs                                                                                                                                | 30       |
| Course Objectives: |                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"><li>• To introduce the fundamentals of microcontrollers and distinguish them from microprocessors.</li><li>• To understand the architecture and internal organization of the microcontroller 8051.</li><li>• To learn the 8051 instruction sets and develops assembly language programs.</li><li>• To provide a fundamental understanding and operating principles of various sensors.</li><li>• To familiarize students with the actuators and power electronic circuits required to translate electronic signals into mechanical motion.</li></ul>                    |                             |                   |                             |                                                                                                                                      |          |
| Course Outcomes:   |                                                                                                                                                                                                                                                                                          | <b>After completing the course, the student will able to</b> <ul style="list-style-type: none"><li>• Explain the basic concepts and architecture of the microcontroller 8051.</li><li>• Apply different addressing modes and execute instruction sets effectively.</li><li>• Develop assembly language programs for data transfer, arithmetic, and logical operations.</li><li>• Identify and classify sensors based on their output characteristics and measurement range.</li><li>• Analyze the performance of sensors by calculating parameters like sensitivity, linearity, and resolution.</li></ul> |                             |                   |                             |                                                                                                                                      |          |
| Unit System        | Contents                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             | Workload Allotted | Weightage of Marks Allotted | Incorporation of Pedagogies                                                                                                          |          |
| Unit I             | <b>Microcontroller 8051 Architecture:</b><br>Microcontroller Introduction, Difference between Microprocessor and Microcontroller, features, block diagram of microcontroller, Pin Configuration, CPU, registers                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             | 8 Hrs             | 8 Marks                     | Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable. |          |
| Unit II            | <b>Instruction set of 8051 and Programming:</b><br>Addressing modes, Instruction set: Data transfer, arithmetic, logical operation, JUMP, Loop and CALL instructions. Assembly language programming: simple data transfer, arithmetic, logical and single bit.                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| Unit III           | <b>Fundamentals of Sensing &amp; Sensor Classification:</b> Active vs. Passive, Analog vs. Digital, and Null vs. Deflection.<br><b>Static &amp; Dynamic Char.:</b> Accuracy, Precision, Resolution, Sensitivity, Hysteresis and Linearity. Strain Gauges, LVDT, Thermistors (NTC), LM35. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             | 8 Hrs             | 8 Marks                     |                                                                                                                                      |          |
| Unit IV            | <b>Introduction to Sensors:</b><br>Photodiodes, Phototransistors, LDRs, and IR sensors. Piezoelectric effect, Ultrasonic Sensor, pH sensors, Gas sensors (MQ series).                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             | 7 Hrs             | 7 Marks                     |                                                                                                                                      |          |
| References:        |                                                                                                                                                                                                                                                                                          | <ol style="list-style-type: none"><li>1. The 8051 Microcontroller architecture, Programming &amp; Applications- Kenneth J.Ayala (Penram international)</li><li>2. The Microcontroller and Embedded Systems.- M. A. Mazadi, J. C. Mazadi (Pearson Education, Asia)</li><li>3. Sensors and Transducers by D. Patranabis.</li><li>4. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney</li><li>5. Electronic Instrumentation by H.S. Kalsi</li></ol>                                                                                                                    |                             |                   |                             |                                                                                                                                      |          |

| Model questions for theory external examination. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MCQs for Internal Assessment :                   | <ol style="list-style-type: none"> <li>The 8051 is a:<br/>a) Microprocessor    <b>b) Microcontroller</b>    c) Memory device    d) I/O device</li> <li>The Program Counter (PC) is used to:<br/>a) Store data    <b>b) Store address of next instruction</b><br/>c) Perform arithmetic    d) Control I/O</li> <li>Which register is used for serial data transfer in 8051?<br/>a) A    b) B    <b>c) SBUF</b>    d) DPTR</li> <li>Which of the following is bit-addressable register?<br/>a) A register    b) DPTR    <b>c) PSW</b>    d) PC</li> <li>The 8051 has how many I/O ports?<br/>a) 2    b) 3    <b>c) 4</b>    d) 5</li> <li>Which instruction is used for addition?<br/>a) MOV    <b>b) ADD</b>    c) ANL    d) ORL</li> <li>Which of the following is an example of a Passive Transducer?<br/>a) Thermocouple    b) Photovoltaic cell    <b>c) LDR</b>    d) Piezoelectric crystal</li> <li>The ability of a sensor to provide the same output for the same input under constant conditions is called:<br/>a) Accuracy    <b>b) Repeatability</b>    c) Sensitivity    d) Resolution</li> <li>In an LVDT, the output voltage is zero at the null position because:<br/>a) The primary current is zero<br/><b>b) The induced voltages in the two secondary coils are equal and opposite</b><br/>c) The core is removed    d) The secondary coils are in phase</li> <li>Which temperature sensor is known for having a "Negative Temperature Coefficient" (NTC)?<br/>a) RTD (PT100)    <b>b) Thermistor</b>    c) Thermocouple    d) LM35</li> </ol> |
| Short answer questions                           | <ol style="list-style-type: none"> <li>Differentiate between a microprocessor and a microcontroller.</li> <li>Explain the function of the Program Counter and Data Pointer register.</li> <li>What is the PSW register? Explain its any two flags.</li> <li>What are interrupts? Explain IE/IP registers.</li> <li>Write short notes on data transfer and arithmetic instructions.</li> <li>Define Sensitivity in sensors.</li> <li>Define Hysteresis in sensors.</li> <li>Differentiates between Active and Passive transducers.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Long answer questions                            | <ol style="list-style-type: none"> <li>Explain the architecture of the microcontroller 8051 with a neat block diagram.</li> <li>Describe the internal organization of RAM in Microcontroller 8051.</li> <li>Discuss the timer/counter operation in 8051 with TMOD and TCON registers.</li> <li>Describe different addressing modes of 8051 with examples.</li> <li>Explain the instruction set in details with suitable examples.</li> <li>Write an assembly language program for data transfer, arithmetic, and logical operations</li> <li>Explain the construction and working principle of an LVDT.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



### Minor Lab / Practical 19: Practical on Minor Theory Microcontroller and Sensors

| Level                        | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Course Code | Course Name              | Credits | Teaching Hours | Exam Duration | Max Mark |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------|---------|----------------|---------------|----------|
| 5.5                          | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 113253      | Minor Electronics Lab 19 | 2       | 60             | 4 Hrs.        | 50       |
| <b>Course Objectives:</b>    | <ul style="list-style-type: none"> <li>To understand programming and operations of the 8051 Microcontroller.</li> <li>To study working and applications of sensors like LVDT, thermistor, LDR, photodiode,</li> <li>To measure physical parameters such as temperature, displacement, light, and distance.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                          |         |                |               |          |
| <b>Course Outcomes:</b>      | <ul style="list-style-type: none"> <li>Apply programming concepts of the 8051 Microcontroller for basic operations.</li> <li>Demonstrate the use of different sensors for real-world measurements.</li> <li>Analyze and measure physical parameters using appropriate sensors.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                          |         |                |               |          |
| <b>Lab/<br/>Practical 19</b> | <p><b>Minimum 10 experiments at least three on each of the following aspects.</b></p> <p><b>8051 Microcontroller</b></p> <ol style="list-style-type: none"> <li>Data transfer using 8051 <math>\mu</math>c</li> <li>Arithmetic using 8051 <math>\mu</math>c i.e. Addition, subtraction, multiplication, division etc.</li> <li>Logical using 8051 <math>\mu</math>c</li> </ol> <p><b>Sensors</b></p> <ol style="list-style-type: none"> <li>Displacement measurement using LVDT.</li> <li>Temperature measurement using NTC thermistor.</li> <li>Light intensity measurement using LDR sensor.</li> <li>Study of PN junction photodiode sensor.</li> <li>Study of IR sensor.</li> <li>Study of pH Sensor.</li> <li>Study of Gas Sensor.</li> </ol> |             |                          |         |                |               |          |

**Note :**

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

**Vocational Skill Enhancement Course 5: Lab/ Practical 20: Advanced applications/ projects on  
Major Theory 113244, 113245 and 113246**

| Level                        | Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Course Code | Course Name        | Credits | Teaching Hours | Exam Duration | Max Mark |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|---------|----------------|---------------|----------|
| 5.5                          | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 113254      | Electronics Lab 20 | 2       | 60             | 4 Hrs.        | 50       |
| <b>Course Objectives:</b>    | <ul style="list-style-type: none"> <li>To understand programming and operations of the Microcontroller 8051.</li> <li>To study working and applications of sensors like LVDT, thermistor, LDR, photodiode, and ultrasonic sensor.</li> <li>To measure physical parameters such as temperature, displacement, light, and distance.</li> <li>To implement basic signal conditioning circuits like low-pass and high-pass filters.</li> <li>To develop Arduino-based applications using Arduino UNO and Arduino IDE.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                    |         |                |               |          |
| <b>Course Outcomes:</b>      | <ul style="list-style-type: none"> <li>Apply programming concepts of the Microcontroller 8051 for basic operations.</li> <li>Demonstrate the use of different sensors for real-world measurements.</li> <li>Analyze and measure physical parameters using appropriate sensors.</li> <li>Design basic signal conditioning circuits.</li> <li>Interface sensors and actuators using Arduino UNO.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |                    |         |                |               |          |
| <b>Lab/<br/>Practical 20</b> | <p><b>Minimum 5 Projects should be constructing from the following aspects.</b></p> <ol style="list-style-type: none"> <li><b>Smart Temperature Display System</b><br/> <b>Components:</b> LM35 / DHT22, LCD (16x2), Arduino<br/> <b>Concepts:</b> ADC, sensor interfacing<br/> <b>Extension:</b> Add buzzer for high temperature alert</li> <li><b>Ultrasonic Distance Measurement System</b><br/> <b>Components:</b> Ultrasonic sensor, LCD/OLED<br/> <b>Concepts:</b> Pulse timing, distance calculation<br/> <b>Application:</b> Parking assistant</li> <li><b>Smart Irrigation System</b><br/> <b>Components:</b> Soil moisture sensor, relay, pump<br/> <b>Concepts:</b> Automation, environmental sensing<br/> <b>Working:</b> Water plants only when soil is dry</li> <li><b>Smart Home Automation System</b><br/> <b>Components:</b> Relays, sensors, Arduino<br/> <b>Control:</b> Mobile/Bluetooth/WiFi<br/> <b>Features:</b> Control lights, fan, appliances</li> <li><b>Industrial Safety Monitoring System</b><br/> <b>Components:</b> Gas + temperature sensors<br/> <b>Concepts:</b> Multi-sensor integration<br/> <b>Output:</b> Alarm + automatic shutdown</li> <li><b>Automated Water Level Controller</b><br/> <b>Components:</b> Water level sensor, relay<br/> <b>Concepts:</b> Control systems<br/> <b>Working:</b> Automatically turns motor ON/OFF</li> <li><b>Smart Parking System</b><br/> <b>Components:</b> IR sensors, display<br/> <b>Concepts:</b> Sensor network<br/> <b>Display:</b> Available parking slots</li> </ol> |             |                    |         |                |               |          |

### Internship/ Apprenticeship corresponding to Major: On Job Training

| Level                     | Semester | Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Course Name                 | Credits | Teaching Hours | Credits allotment                                                                                                                                                                |
|---------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.5                       | VI       | 113255                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Electronics on job training | 4       | 120 Hrs.       | When the student provided the Certificate of attendance “On job training” for 120 Hrs. will be given 4 credits and as for the less attendance, proportionally given the credits. |
| <b>Course Objectives:</b> |          | <ul style="list-style-type: none"> <li>• <b>Industrial Exposure:</b> To bridge the gap between academic theory and real-world industrial practice.</li> <li>• <b>Skill Diversification:</b> To provide hands-on experience with industry-grade tools, software, and machinery that are unavailable in a classroom.</li> <li>• <b>Professionalism &amp; Ethics:</b> To inculcate a sense of workplace discipline &amp; ethics and corporate culture.</li> <li>• <b>Problem-Solving:</b> To encourage students to apply critical thinking to live technical challenges and troubleshooting.</li> <li>• <b>Networking:</b> To help students build a professional network and understand the various career paths within their domain.</li> </ul> |                             |         |                |                                                                                                                                                                                  |
| <b>Course Outcomes:</b>   |          | <p>The student will be able to ...</p> <ul style="list-style-type: none"> <li>• Execute standard operating procedures (SOPs) and safety protocols relevant to the industry/ company.</li> <li>• Analyse real-time data or hardware behaviour to identify faults or optimize processes.</li> <li>• Manage time and resources effectively to meet project goals and deliver quality work.</li> <li>• Present technical reports, project documentation, and findings to a professional audience.</li> <li>• Collaborate effectively within a multi-disciplinary team to achieve a common goal.</li> <li>• Adapt to new culture, technological ideas and utilized software specifically provided by the industry/ company.</li> </ul>             |                             |         |                |                                                                                                                                                                                  |