Sant Gadge Baba Amravati University, Amravati

Examinations leading to the Degree of Bachelor of Science

Three Years (Six Semesters) Degree Programme under Choice Based Credit System (CBCS)

Scheme of Teaching, Learning, Examination and Evaluation (B.Sc. Physics) (Semester-V)

Subject: Physics

Sr. No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits			Hrs.	Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total		Theory + M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade
													Internal	External			
1	(DSC-25) Quantum Mechanics, Crystallography, Electrical Properties of Materials and Transducers		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
2	Practical for (DSC-25)		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
3	(DSC-26)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	Practical for (DSC-26)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	DSC –(27)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	Practical for DSE –27		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	Mini-Project/Hands-on Training/Workshop/DIY related to Subject excluding Mathematics Phase I			-	6	6	--	2.25	2.25	2	Internal Assessment by college/institute/department				50	25	P
8	*Open Elective Course (OEC)						75 hrs (during session) optional to extracurricular and co-curricular activities										
9	Internship/Apprenticeship /Field Work/Work Experience						150 Hours cumulatively from Sem II to Sem V resulting into earning of 5 Credits (Minimum 120 Hours mandatory resulting into earning of 4 Credits)										
	Total																

L: Lecture, T: Tutorial, P: Practical, DIY: Do It yourself activity

Notes:

1. Internship/Apprenticeship/Field Work/Work Experience is Mandatory. It can be carried out cumulatively from Semester I to Semester V for a duration of 150 Hours resulting into earning of 5 Credits (Minimum 120 Hours resulting into earning of 4 Credits is mandatory for every student). Internship /Apprenticeship/Field Work / Work Experience will be conducted after I semester till Vth semester in vacations for minimum 120 hrs, cumulatively entailing 4 Credits. It's credits and grades will be reflected in final semester VI credit grade report.

2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977, 11-7-1977 Appendix- P

3. If DSC (excluding Mathematics) is Physics, then 2 Tutorial be added.

4. There shall be Skill Enhancement Module (SEM) in each course of DSC and DSE

5. OEC (Optional) can be studied during semester I to V, Its credits and grades will be reflected in final semester VI credit grade report. OEC may be opted from Sem I to Sem V. It is comprised of GIC, Skill Course and MOOC (through SWAYAM)

6. Minimum 10% of the total credits of the UG (Bachelor's Degree) programme, that is, at least 12 credits are mandatory to be earned by all the students from Ancillary Credit Courses as mentioned in Table A (SGBAU, Direction No. 76/2022 ,Date 06/10/2022)

7. Extra-curricular and co-curricular activities: Maximum 5 Credits may be earned through Extra-curricular and co-curricular activities, which will be an option to OEC (maximum 75 hours and 5 credits), so that students performing in such activities shall be given exemption from undertaking OEC.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

B.Sc. Part-III (PHYSICS) Semester V

Discipline Specific Core (DSC-25)

Title: Quantum Mechanics, Crystallography, Electrical Properties of Materials and Transducers

Theory Credits: 4.5

Course Outcomes:

On successful completion of this course, the student will be able to:

1. Gain knowledge of foundations of Quantum Mechanics, understand the concept of wave-particle duality, Matter waves, develope critical understanding of concept Heisenberg's Uncertainty Principle and anticipation of quantum mechanical aspects in real world.
2. Understand the basic aspects of wave-function, Group velocity, Phase velocity, Schrodinger's Time-dependent and Time independent equations, Quantum Mechanical Operators, Energy Eigen Functions and Eigen Values.
3. Examine the Crystal Structures, Calculate Miller Indices, identify Bravais Lattice and understand various types of defects in solids.
4. Understand the electric properties of materials. Explain mean free path, drift velocity, conductivity and Fermi Energy. Identify conductors, semiconductors and insulators. Calculate energy band gaps.
5. Understand the construction and working of various transducers such as Resistive transducer, Strain gauges, LVDT, Pressure Inductive transducer, Capacitive Pressure Transducer, Load cell, Piezoelectrical and Photo Electric transducer, Temperature transducers: RTD (Resistance Temperature Detectors), Thermistors and Thermocouple. Construct some of these transducers.
6. Understand principles and working of Temperature Sensors. Construction of Real Time Thermometers using Temperature Sensors.

Syllabus: Quantum Mechanics, Crystallography, Electrical Properties of Materials and Transducers

Unit I: Origin of Quantum Mechanics (15 L)

Historical Background: Failure of classical wave theory in explaining Black body radiation, Assumptions of Planck's Quantum Theory, Photoelectric Effect, Compton Effect. Wave Particle Duality, Matter Waves: De Broglie Hypothesis, Davisson Germer experiment, Concept of Wave Packet, Phase velocity, Group velocity and relation between them, Heisenberg's uncertainty principle: Different forms of uncertainty principle; Thought experiments: Gamma ray microscope, Numerical.

Unit II: The Schrodinger equation and its applications (15 L)

Wave function: Physical significance and limitations, Normalized wave function, Wave function for free particle, Operators in quantum Mechanics, Eigen functions and Eigen values, Schrodinger time dependent equation, Schrodinger time independent equation, Particle in one dimensional and three dimensional box (Energy Eigen values and Normalized Eigen functions), Potential barrier, Tunnelling effect, Numerical.

UNIT-III: Crystallography (15 L)

Amorphous and Crystalline Materials, Unit Cell, Seven crystal system, Bravais Lattices, Properties of Unit Cell: Co-ordination number, Volume of a unit cell, Atoms per unit cell, Atomic radius and Packing fraction. Millar Indices, Diffraction of X-rays by Crystals, Bragg's Law, Madelung constant of NaCl crystal lattice. Introduction to defects in solids: Point, line and plane defects, Numerical.

UNIT -IV: Electrical Properties of Materials (15 L)

Free electrons, conduction electrons, electron collision, mean free path, drift velocity, conductivity and Ohm's law, density of states, Concept of Fermi energy, Band structure: Electron in periodic potential, Bloch theorem, Kroning-Penney model, nearly free electron model (qualitative), energy band, energy gap, metals, insulators and semiconductors and their properties, Numerical.

UNIT- V: Transducers (15 L)

Introduction, Classification of transducers, Active and passive transducers, Resistive transducer, Strain gauges, LVDT, Pressure inductive transducer, Capacitive pressure transducer, Load cell, Piezoelectrical and Photo Electric transducer, Temperature transducers: RTD (Resistance Temperature Detectors), Thermistors and Thermocouple.

UNIT-VI: Skill Enhancement Module (SEM) (15 L)

Temperature Sensors Introduction, Temperature Sensor Types (RTD, Thermocouple, Thermostat, Thermistors, IR Radiation Thermometers, Optical Pyrometers), Temperature Sensors Characteristics

(Temperature Range, Linearity, Sensitivity, Response Time, Stability, Accuracy, Durability), Temperature Sensors (Advantages and Disadvantages).

List of Activities: (Any two)

1. Construction of Thermometer using RTD.
2. Construction of Thermometer using Thermocouple.
3. Construction of Thermometer using Thermistor.
4. Construction of Thermometer using IR Sensor.

References:

1. Introduction to Quantum Mechanics by David Griffiths.
2. Quantum Physics (3rd Edition) by Eisberg and Resnick.
3. Schaum's Outline of Quantum Mechanics by Eugene Merzbacher
4. Quantum Mechanics by Ghatak and Chakrabarti
5. Quantum Mechanics: An Indian Adaptation by V.K. Thanedar
6. A Textbook of Quantum Mechanics by P.K. Ghosh
7. A Textbook of Crystallography by P.K. Ghosh
8. Crystallography and Solid State Physics by Raghunathan and Venkataraman
9. Electrical Properties of Materials by Prabhat Choudhary
10. A Textbook of Engineering Physics by M.N. Avadhanulu and P.G. Kshirsagar
11. Introduction to Solid State Physics by Charles Kittel (Indian Edition)
12. Introduction To Transducers by Arun K. Ghosh
13. Sensors and Transducersby D. Patranabis (PHI Learning)
14. Electronic Instruments and Instrumentation Technology by Khandelwal (S. Chand Publishing)
15. Basic Electronics by B. L. Theraja, S. Chand Publication
16. Principles of Electronics by V. K. Mehta, S. Chand Publications
17. Sensors, Thermal Sensors by Jörg Scholz, Teresio Ricolfi, Wiley Publishers

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

B.Sc. Part-III (PHYSICS) Semester V

Practicals for Discipline Specific Core (DSC-25)

Title: Practicals for Discipline Specific Core (DSC-25)

Practical Credits: 2.25

Course outcomes:

On successful completion of this course, the student will be able to:

- Analyze and interpret experimental data to draw meaningful conclusions.
- Apply theoretical knowledge from lectures to practicals / experiments.
- Develop proficiency in conducting experiments related to Crystallography, Electrical Properties of Materials and Transducers
- Adhere to laboratory safety protocols and proper handling of materials and instruments.
- Collect accurate data and interpret experimental results to assess the viability and efficiency of different energy resources.
- Collaborate effectively with team members to conduct experiments and solve complex problems.

List of Experiments: (Students have to perform minimum ten experiments from given list)

1. Determination of Plank's Constant by using LED.
2. To study Characteristics of Photocell
3. To determine Planck’s constant using photocell
4. To study crystal models and identification of crystal planes.
5. To determine lattice parameter using X-ray diffraction pattern.
6. To determine energy gap of semiconductor using four probe method.
7. To determine activation energy of Thermistor.
8. To determine energy gap of semiconductor using reverse bias method.
9. To study thermo emf using thermocouple.
10. To determine the temperature coefficient of resistance of platinum using platinum resistance thermometer.
11. To measure the displacement using LVDT.
12. To determine the Fermi energy of a given conductor by studying resistance variations at different temperatures

13. To study characteristics of linear potentiometer.
14. To study V-I Characteristics of a Light Dependent Resistor (LDR).
15. To calibrate an ammeter using a potentiometer and a standard resistor.
16. To calibrate a voltmeter using a potentiometer.
17. To investigate the use of resistive transducers for measuring angular displacement.
18. To investigate the use of capacitive transducers for measuring angular displacement.

19. To determine the Fermi energy of a given conductor by studying resistance variations at different temperatures.

References:

1. Training in EXPERIMENTAL PHYSICS, through demonstration and problems by- Rajesh Khaparde
2. B.Sc. Practical Physics, Harnam Singh , Dr. P.S.Hemne, S. Chand and Company
3. Textbook of Practical Physics, H.P.Shrivastav, ABD Publisher
4. B.Sc. Practical Physics, C.L.Arora , S.Chand and Company
5. https://vlab.amrita.edu/
6. https://www.vlab.co.in/
7. http://vlabs.iitb.ac.in/vlab/labsps.html
8. Practical Physics by S.L.Gupta, V.Kumar, Pragati Prakashan, Meerut
9. University Practical Physics by D.C.Tayal , Himalaya Publishing House

Sant Gadge Baba Amravati University, Amravati

Examinations leading to the Degree of Bachelor of Science

Three Years (Six Semesters) Degree Programme under Choice Based Credit System (CBCS)

Scheme of Teaching, Learning, Examination and Evaluation (B.Sc.- Physics) (Semester-VI)

Sr. No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total		Theory + M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade
													Internal	External			
1	DSE – I Elective Basket for Subject-**Physics** **(DSE I) (a)** Atomic and Molecular Spectroscopy, Nuclear Physics & Energy Resources. **(DSE I) (b)** Digital Electronics **(DSE I) (c)** Introduction to Python programming		6	-	-	6	4.5	-	4.5	3	80	20	-	-	100	40	P
2	Practical for (DSE-I) DSE-I (a) DSE-I (b) DSE-I (c)		-	-	6	6	-	2.25	2.25	3	-	-	25	25	50	25	P
3	DSE-II-Elective Basket for subject-……																
4	Practical for (DSE-II)																
5	DSE-III-Elective Basket for subject-……																
6	Practical for DSE-III																
7	Mini-Project/Hands-on Training/Workshop/DIY related to Subject excluding Mathematics Phase II				6	6	--	2.25	2.25	2	Internal Assessment by college/institute/department				50	25	P
	Total																

Notes:

1. Internship/Apprenticeship/Field Work/Work Experience is Mandatory. It can be carried out cumulatively from Semester I to Semester V for a duration of 150 Hours resulting into earning of 5 Credits (Minimum 120 Hours resulting into earning of 4 Credits is mandatory for every student). Internship /Apprenticeship/Field Work / Work Experience will be conducted after I semester till Vth semester in vacations for minimum 120 hrs, cumulatively entailing 4 Credits. It's credits and grades will be reflected in final semester VI credit grade report.

2. Teaching period in the various subjects in the faculty of science shall be as prescribed by the executive council dated 1/2-4-1977, 11-7-1977 Appendix- P

3. **If DSC (excluding Mathematics) is Physics, then 2 Tutorial be added**.

4. There shall be Skill Enhancement Module (SEM) in each course of DSC and DSE

5. OEC (Optional) can be studied during semester I to V, Its credits and grades will be reflected in final semester VI credit grade report. OEC may be opted from Sem I to Sem V. It is comprised of GIC, Skill Course and MOOC (through SWAYAM)

6. DSE (DISCIPLINE/DEPARTMENT SPECIFIC ELECTIVE): A BASKET CONTAINING AT LEAST TWO COURSES/SUBJECTS SHALL BE PROVIDED, SO THAT STUDENT HAS A CHOICE FOR THE SELECTION.

7. Minimum 10% of the total credits of the UG (Bachelor's Degree) programme, that is, at least 12 credits are mandatory to be earned by all the students from Ancillary Credit Courses as mentioned in Table A (SGBAU, Direction No. 76/2022 ,Date 06/10/2022)

8. Extra-curricular and co-curricular activities: Maximum 5 Credits may be earned through Extra-curricular and co-curricular activities, which will be an option to OEC (maximum 75 hours and 5 credits), so that students performing in such activities shall be given exemption from undertaking OEC.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)

Discipline Specific Elective [DSE-I (a)]

Title: Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Theory Credits: 4.5

Course outcomes:

On successful completion of this course, the students will be able to:

1. Evaluate the validity and limitations of theoretical models and experimental data in atomic physics.
2. Describe the structure of atoms, including electron configurations and the periodic table.
3. Demonstrate proficiency in experimental techniques related to atomic and molecular physics.
4. Develop and apply problem-solving skills to theoretical and practical problems in atomic and molecular physics.
5. Describe the principles of nuclear fission, fusion and their applications.
6. Understand the different types of radioactivity and their properties
7. Critically evaluate nuclear physics theories, models, and experimental data.
8. Evaluate the environmental impacts of different energy resources and technologies, focusing on sustainability and mitigation strategies.
9. Understand the principles behind electrical energy generation, transmission, and distribution.

Theory: Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Unit-I (15 Lectures)

Revision of various atomic models, Vector atom model (concepts of space quantization and electron spin), Pauli exclusion principle and electron configuration, Quantum states, Spectral notations of quantum states. Spin-orbit interaction (single valence electron atom), Energy levels of Sodium atom, Selection rules, Spectra of sodium atom, sodium doublet. Spectral terms of two electron atoms, terms for equivalent electrons, LS and JJ-coupling schemes. Numerical

Unit-II (15 Lectures)

X-rays: Production, need of high atomic number material as target, origin and mechanism of X-rays, Duane-Hunt law, continuous and characteristics X-rays spectrum, Moseley's law.

Raman Effect: Introduction, Experimental arrangement, characteristics of Raman lines, quantum theory of Raman Effect, Raman Shift. Numerical

Unit-III (15 Lectures)

Size and structure of atomic nucleus and its relation with atomic weight, Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

Fission and fusion - Mass deficit, relativity and generation of energy; Fission - Nature of fragments and emission of neutrons. Nuclear reactor: Slow neutrons interacting with Uranium 235, Fusion and thermo-nuclear reactions. Numerical

Unit-IV (15 Lectures)

Radioactivity: Stability of nucleus, Law of radioactive decay, Mean life & half-life, α-decay: Velocity of Alpha particles, Range of α-particles, Range-Energy Relation (Geiger's Law), Geiger-Nuttal Law, Gamow's explanation of α-decay (qualitative). β-decay: types, energy released in β decay processes, β ray spectrum and Pauli's neutrino hypothesis, γ-ray emission. Numerical

Unit V: (15 Lectures)

Solar thermal systems and applications: Sun as a source of energy, Solar Constant, Construction and working of Liquid flat plate collector, Concentrating collectors, Solar drying, Solar water heating systems.

Solar Photovoltaic systems and applications: Photovoltaic principle, Power output and conversion efficiency, Limitation to photovoltaic efficiency, Basic photovoltaic system for power generation, Application of solar photovoltaic systems, Advantages and disadvantages of Solar PV System. Numerical

Unit VI: Skill Enhancement Module (SEM) (15 Lectures)

An Introduction to Energy Sources: Classification and comparison of energy sources (hydro, thermal, nuclear, solar, wind, biomass, and fossil fuels) considering environmental safety, economy, production and distribution aspects. Energy audit.

Activities:

1. Energy audit of college campus/public campus/house/building/program hall
2. Comparison of energy sources.
3. Study of solar water heater
4. Study of large scale solar heaters for industrial/cooking/water heating applications.

5. Study of flat plate, parabolic solar concentrators
6. Efficiency measurement of PV systems using I-V characteristics of Amorphous Si, Mono-crystalline Si, Polycrystalline Si in individual, series and parallel combinations.
7. Effect of intensity of incident light, incident angle and shading on Solar PV Module on Output power.
8. Study and design of solar lanterns, street lights using solar systems
9. Study of Installation and commissioning of roof top solar PV panel systems
10. Study of net metering systems

Note: It is expected that students should undertake at least 2 activities. Students should be encouraged to study this course by using Case–Study approach.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009, PHI Learning
3. Modern Physics, R.A. Serway, C.J. Moses, and C. A. Moyer, 2005, Cengage Learning
4. Physics for degree students (B.Sc. 3rd year) by C. L. Arora & P.S. Hemne, S. Chand Publication.
5. Concepts of Modern Physics, S. L. Gupta, S. Gupta, Dhanpat Rai Publications

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)

Practical for Discipline Specific Elective [DSE-I (a)]

Title: Practical for Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Practical Credits: 2.25

Practicals: Atomic and Molecular Physics, Nuclear Physics & Energy Resources

Course outcomes:

On successful completion of this course, the student will be able to:

1. Analyze and interpret experimental data to draw meaningful conclusions.
2. Apply theoretical knowledge from lectures to practicals / experiments.
3. Develop proficiency in conducting experiments related to energy resources and atomic and molecular spectroscopy.
4. Adhere to laboratory safety protocols and proper handling of materials and instruments.
5. Collect accurate data and interpret experimental results to assess the viability and efficiency of different energy resources.
6. Collaborate effectively with team members to conduct experiments and solve complex problems.

List of Experiments: (Students have to perform minimum ten experiments from given list)

1. To study absorption spectrum of Iodine vapors.
2. To study Raman spectrum.
3. To identify elements in optical line spectrum.
4. To determine ‘e/m’ by Millikan’s oil drop experiment.
5. To determine ‘e/m’ by Thomson’s method.
6. Determination of Rydberg’s constant.
7. To study radioactive decay process using dice roll experiment.
8. To determine absorption coefficient of material for beta rays.
9. To calculate the thermal efficiency of liquid flat plate collector.
10. To study the box type solar cooker.
11. To determine an instantaneous thermal efficiency of parabolic collector.
12. To calculate an efficiency and fill factor of PN junction solar cell.
13. To study I-V characteristic of solar cells.
14. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
15. Mini project -equivalent to 2 experiments.
16. Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)

Reference Books & Web links for Virtual Experiments:

1. Advanced Practical Physics for students, B. L. Flint & H. T. Worsnop, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, Kitab Mahal, New Delhi
4. https://www.vlab.co.in
5. https://vlab.amrita.edu
6. https://iitb.vlabs.co.in

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology
B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)
Discipline Specific Elective [DSE-I (b)]

Title: Digital Electronics
Theory Credits: 4.5

Course Outcomes:

On successful completion of this course the students should be able to:

1. Know number systems, binary codes, their interconversions and arithmetic.
2. Understand the basic gates and use of NAND and NOR as an universal gate.
3. Design and construct logic circuits using logic gates.
4. Understand Boolean algebra to minimize logic equation.
5. Understand use of logic gates as adder and subtractor.
6. Understand difference between analog and digital circuits.
7. Know about logic families like DTL, TTL, CMOS, etc.
8. Know the construction and working of different types of Encoders and Decoders.
9. Design and construct different types of Encoders and Decoders.
10. Know the construction and working of different types of Multiplexers and Demultiplexers.
11. Design and construct different types of Multiplexers and Demultiplexers using gates.

Syllabus: Digital Electronics

UNIT-I **(15 L)**

Number system and Codes: Decimal, Binary, Octal and Hexadecimal number system and their inter conversion. 1's & 2's Complement. Binary addition, Binary subtraction, Multiplication and Division, Subtraction by 1's & 2's Complement. **Binary codes:** 8421 BCD, Excess-3 and Gray code.

UNIT-II **(15 L)**

Digital circuits/Logic gates: Difference between Analog and Digital circuits, Concept of Logic gate, Positive & Negative Logic. AND, OR & NOT gates, NAND & NOR gates as universal gates. EXOR & EXNOR gates.

UNIT-III **(15 L)**

Boolean algebra: Boolean laws, De Morgan's theorems, Simplification of logic circuit using Boolean algebra, Minterms and Maxterms. Conversion of a truth table into an equivalent logic circuit

by Sum of Products method and Karnaugh map (up to 4 variables), Half Adder, Full Adder, Half subtractor and Full subtractor.

UNIT-IV **(15 L)**

Digital logic families: Transistor as a switch**,** Classification of logic families, Characteristics (fan-in, fan-out, noise immunity, propagation delay, power dissipation, speed of operation) of RTL, DTL, TTL and CMOS logic. Timer IC 555 Pin diagram and its application as Multivibrator.

UNIT-V **(15 L)**

Combinational logic circuits: Encoders: Binary to BCD, Decimal to BCD IC 74147. Decoders: 4 bit Binary Decoder, BCD to 7 segment, IC 7447, Multiplexer (4X1), Demultiplexer (1X4) (Definition, Construction and operation with truth table)

UNIT-VI **(15 L)**

Skill Enhancement Module: Illustrate to practice the digital Trainer kit, Identification of various digital ICs, Develop skill to convert the given number into the specified number system, skill of subtraction using 1's & 2's complement, construct & verify the truth table of all gates using NAND & NOR gates. Construct encoder and decoder by using IC 74147, IC 7447 and verify the truth table. Construct multiplexer and demultiplexer circuits and verify truth table.

Activities (Any two)

1. To subtract binary numbers using 9's & 10's complement.
2. To convert given decimal number into Binary, Octal & Hexadecimal number.
3. To encode and decode the given numbers.
4. To study numbering system of digital IC's.
5. To study & find out characteristics of TTL IC.
6. To design and construct simple logic trainer kit
7. To minimize a given logic circuit.

Reference Books:

1. Modern Digital Electronics by R. P. Jain, 2/e, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Digital Principles and Applications by A. P. Malvino and D. P. Leach, 4/e, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Digital Fundamentals by T. L. Floyd, Pearson Education, 8/e.
4. Digital Integrated Electronics by H. Taub & D. Schilling, McGraw Hill Book Company.

Delhi.
5. Digital Electronics by W. H. Gothmann, Prentice Hall of India Private Ltd., 2/e.
6. Digital & analog technique by Navneet, Kale & Gokhale, Kitab Mahal Prakashan.
7. Experiments in digital principles by Donald Leach, McGraw Hill International Edition.
8. Digital Electronics by G. K. Kharate, Oxford University Press.
9. Digital Techniques and Applications by V. G. Yangalwar, Nirali Prakashan.
10. Digital Electronics and Logic design By N. G. Palan, Technova Publication.
11. Digital Electronics: Principles, devices and Applications by Anil K. Maini, Wiley.
12. Advance Digital Electronics, Microprocessor and 8051 Microcontroller by Dr. Y. B. Gandole, Dr. D. S. Dhote & Dr. S. P. Yawale, G.C. Publishers, Nagpur.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology
B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)
Practical for Discipline Specific Elective [DSE-I (b)]

Title: Practical for Digital Electronics
Practical Credits: 2.25

List of Experiments: (Students have to perform minimum ten experiments from given list)

1. To study operation and verify truth table of, AND, OR and NOT gate.
2. To study operation and verify truth table of NAND and NOR gate.
3. To study operation and verify truth table of NOT gate or Inverter using NOR and NAND gate.
4. To study the operation of NOR gate as Inverter, OR & AND gate.
5. To study the operation of NAND gate as Inverter, OR & AND gate.
6. To study operation and verify truth table of EXOR and EXNOR gate.
7. To verify De Morgan's theorems.
8. To assemble and study the operation of half adder.
9. To carry out addition of 4-digit number using IC7483 (Four bit full adder)
10. To study operation of BCD to Decimal decoder.
11. To study operation of Decimal priority encoder.
12. To study operation of Multiplexer.
13. To study operation of Demultiplexer.
14. To study astable multivibrator using IC 555.
15. To study Monostable multivibrator using IC 555.
16. To study Bistable multivibrator using IC 555.

Reference:

1. Electronics simplified-A practical Approach by Abhishek Roy, Hardik Nagrecha, Allied Publishers Pvt. Ltd.
2. Make:Electronics-3rd Edition by Charles Platt
3. The art of Electronics by Thomas Hayes, Paul Horowitz (Amazon.in)
4. Electronics projects for beginners by A.K. Maini (Pustak Mahal)
5. Digital Electronics by Willium Gothmann (PHI Edition)
6. Electronics Practicals by A.K.Mittal (Comptech Publications Pvt. Ltd.)

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
Faculty of Science and Technology
B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)
Discipline Specific Elective [DSE-I (c)]

Title: Introduction to Python Programming
Theory Credits: 4.5

Course Outcomes:
On successful completion of this course the students should be able to:

1. Demonstrate proficiency in Python programming language, including understanding the syntax, data types, control structures, and built-in functions/operators.
2. Develop problem-solving skills, ability to analyze problems, design algorithms, and implement solutions.
3. Implement debugging techniques and exception handling, identifying and fixing syntax errors, runtime errors, and semantic errors in Python code.
4. Develop fundamental data structures and algorithms in Python, lists, tuples, dictionaries, and string manipulation and understand their applications.
5. Demonstrate proficiency in file handling operations, reading from and writing to text files, using modules in Python for mathematical operations, random number generation and time-related functionalities.

Syllabus: Introduction to Python Programming		
Unit I	**Introduction to Computers and Programming** Introduction to Computer, Block diagram of Computer, hardware, software. Introduction to System Software- Operating System, Editor, Complier, Assembler, Linker, Loader. Problem solving using computers. Introduction to computer programming, Introduction to program planning tools- algorithm, flowcharts, pseudo codes, Software Development Life Cycle, Introduction to open source operating systems and programming languages.	**15 L**
Unit II	**Introduction to Python Programming Language** History, features, Installing Python, Introduction to Python Interpreter and program execution, Python Installation Process in Windows and Linux, Python IDE. **Variables and Expressions** Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. **Conditional Statements:** if, if-else, nested if –else	**15 L**

	Looping: for, while, nested loops **Control statements:** Terminating loops, skipping specific conditions.	
Unit III	**Debugging:** Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The Difference Between Brackets, Braces, and Parentheses **Functions:** Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, Checking Types **Strings:** A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations.	**15 L**
Unit IV	**Lists:** Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods. **Tuples and Dictionaries:** Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods	**15 L**
Unit V	**Files:** Text Files, The File Object Attributes, Directories **Exceptions:** Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions **Regular Expressions:** Concept of regular expression, various types of regular expressions, using match function. **Classes and Objects:** Overview of OOP (Object Oriented Programming), Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Inheritance, Method Overriding, Data Encapsulation and Data Hiding.	**15 L**

	Modules: Importing module, Creating and exploring, modules, Math module, Random module, Time module.	
Unit VI (SEM)	Introduction to Arduino, Setting up the Arduino board and connecting it to a computer, Understanding the structure of an Arduino sketch (setup and loop functions), Basic Electronics and Circuit Building, Input and Output. **Activity:** To build simple Arduino project based on basic electronic components.	**15 L**

References:

1. Let us Python- 6th Edition by Aditya Kanetkar, Yashavant Kanetkar (BPB)
2. Introduction to Problem Solving with Python by E. Balagurusamy (TMH)
3. Python Programming, 2nd Edition by Reema Thareja (OXFORD)
4. Learning Python, Fourth Edition by Mark Lutz (online PDF is available)
5. Exploring Python by Budd (TMH)
6. The Absolute Beginner's Guide to Python Programming: A Step-by-Step Guide with Examples and Lab Exercises by Kevin Wilson (APRESS)
7. https://www.programiz.com/python-programming/examples
8. https://realpython.com/arduino-python/

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
Faculty of Science and Technology
B.Sc. Part-III (PHYSICS) Semester VI (CBCS Pattern)
Practical for Discipline Specific Elective [DSE-I (c)]

Title: Practical for Introduction to Python Programming
Practical Credits: 2.25

Introduction to Python Programming
List of Experiments: (Students have to perform minimum ten experiments from given list)

1. Installing Python on Windows or Linux operating systems and Exploring the Python interpreter and executing Python programs.
2. Python Program to Print Hello world!
3. Write python program to store data in list and then try to print them.
4. Python program to do basic trim and slice on string.
5. Python program to print list of numbers using range and for loop
6. Python program to store strings in list and then print them.
7. Python program to let user enter some data in string and then verify data and print welcome to user.
8. Python program in which an function (with single string parameter) is defined and calling that function prints the string parameters given to function.
9. Python program in which an class is define, then create object of that class and call simple print function define in class.
10. Python Program to Add Two Numbers
11. Python Program to Find the Square Root
12. Python Program to Calculate the Area of a Triangle
13. Python Program to Print Output Without a Newline
14. Python Program to Differentiate Between type() and isinstance()
15. Python Program to Check if a Number is Positive, Negative or 0
16. Python Program to Check if a Number is Odd or Even
17. Python Program to Check Leap Year
18. Python Program to Find the Largest Among Three Numbers
19. Python Program to Print all Prime Numbers in an Interval
20. Python Program to Find the Factorial of a Number
21. Python Program to Display Powers of 2 Using Anonymous Function

22. Python Program to Find HCF or GCD
23. Python Program to Find LCM
24. Python Program to Find the Factors of a Number
25. Python Program to Make a Simple Calculator
26. Python Program to Shuffle Deck of Cards
27. Python Program to Display Calendar
28. Python Program to Merge Mails
29. Python Program to Find the Size (Resolution) of an Image
30. Python Program to Safely Create a Nested Directory
31. Python Program to Catch Multiple Exceptions in One Line
32. Python Program to Copy a File

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1. Let us Python- 6th Edition by Aditya Kanetkar, Yashavant Kanetkar (BPB)
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7. https://www.programiz.com/python-programming/examples
8. https://realpython.com/arduino-python/