NOTIFICATION

No. 172/2026 Dated : 01/10/2026

Subject: Implementation of new syllabus of the subjects of Semester III & IV of the newUnder-graduate Program B.E. (Electronics & Computer Engineering) as per NEP - 2020 guidelines.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus of the subjects of Semester III & IV of the newUnder-graduate Program B.E. (Electronics & Computer Engineering) as per NEP- 2020 guidelines to be implemented from the academic session 2026-2027 onwards as under:

Sd/-
(Dr.Avinash Asanare)
Registrar
Sant Gadge Baba Amravati University

B.E. [ELECTRONICS & COMPUTER ENGINEERING] SEM. III & IV [NEP-2020 SYLLABUS]

SEMESTER- III

PROGRAM CORE COURSE –I (PCC-I)
3EK200PC Electronic Devices and Circuits

Course Requisite:

1. Engineering Physics.

Course Objectives:

1. To understand the basics of diodes.
2. To illustrate the applications of diodes.
3. To understand Bipolar Junction Transistor in details.
4. To describe basics of JFET, MOSFET.
5. To explain the feedback concept, topologies and their applications.
6. To Describe the Multistage Amplifiers.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Describe the working of diodes.
2. Illustrate the application of diodes.
3. Describe Bipolar Junction Transistor in details.
4. Understand basics of JFET, MOSFET, UJT and their operational parameters.
5. Explain the feedback concept, topologies and their applications.
6. Describe the Multistage Amplifiers.

Unit No.	Contents	No. of lectures
1	**Introduction to Diodes:** **PN junction diode:** Construction, Working, diode equation, V-I characteristics. **Zener diode:** Construction, Working, V-I characteristics **LED:** Construction, Working and V-I Characteristics. **Photodiode:** Construction, Working and V-I Characteristics.	06
2	**Applications of Diodes:** **PN junction diode:** As a Switch, rectifier, analysis of Half Wave Rectifier, Full Wave Rectifier, filters C, L, LC and CLC filters, Clipping and Clamping circuits. **Zener diode:** As a voltage regulator.	06
3	**Bipolar Junction Transistors:** BJT configurations: CB, CE and CC with characteristics and parameters, transistor as a switch, Transistor switching times, dc load line, transistor biasing methods, bias stability, h-parameters and hybrid Model.	06
4	**JFET:** Theory, construction and characteristics, parameters (μ, gm & rd) **MOSFET:**Theory, construction and characteristics of enhancement & depletion type MOSFET. **UJT:** Theory, construction and characteristics; UJT as relaxation oscillator.	06
5	**Feedback amplifiers:** Feedback concept, effects of negative feedback, basic feedback topologies. **Sinusoidal Oscillators:** Barkhausen's criteria, Hartley, Colpitts, RC Phase shift, Wein bridge and crystal oscillators.	06

6	**Multistage Amplifiers:** Need of multistage, RC coupled amplifier, transformer coupled amplifier, direct coupled amplifier, emitter follower, Darlington emitter follower, Bootstrapping principle.	**06**

Text Books:

1 "Electronic Devices and Circuits", David Bell Oxford University Press, 2010.
2 'Integrated Electronic's Milliman and Halkias Tata McGraw Hill, New Delhi.

References:

1 Electronic Devices and Circuit theory, Robert L.Boylestad Publ. Pearson Education.
2 Electron Devices Floyd Pearson Asia 5th Edition, 2001.
3 Electronic Circuit Analysis and Design Donald A Neamen Tata McGraw Hill, 3rd Edition, 2003.

PROGRAM CORE COURSE –II (PCC-II)
3EK201PC SIGNALS & SYSTEMS

Course Requisite:
1. Engineering Mathematics
2. Transform Techniques

Course Objectives:
1. Understand the fundamental characteristics of signals and systems.
2. Understand signals and systems in terms of the time and transform domains.
3. Develop the mathematical skills to solve problems involving Convolution, Sampling and Reconstructions, building the basic LTIC system, etc.

Course Outcomes: After successfully completing the course, students will be able to:
1. Understand the continuous time signals and systems mathematically and their classification along with the mathematical operations.
2. Understand the spectral characteristics of continuous-time periodic signals using Fourier series.
3. Analyse the spectral characteristics of continuous-time aperiodic signals and systems using Fourier Transform.
4. Apply the Laplace transform for analysis of continuous-time systems.
5. Understand the Discrete Time signals and systems mathematically and analysis their classification with the mathematical operations.
6. Analysis the spectral characteristics of Discrete Time signals and systems using Discrete Time Fourier Transform.

Unit No.	Contents	No. of lectures
1	**Continuous time signals and systems**: Signal types, Signal Classification, Signal properties, Standard Signals, Energy and Power Signal, Signal Operations, Signal models, Even and Odd functions, Convolution, System Classification.	07
2	**Continuous-Time Signal Analysis -The Fourier Series:** Periodic Signal Representation by Trigonometric Fourier Series, Existence and Convergence of Fourier Series, Exponential Fourier Series.	05
3	**Continuous-Time Signal Analysis-The Fourier Transform:** Aperiodic Signal Representation by Fourier Integral, Properties of Fourier Transform, Signal Transmission through LTI Continues Systems, Signal energy, Inverse Fourier Transform, Fourier Spectrum, Sampling of Signals.	06

4	**Continuous-Time System Analysis Using Laplace Transform**: Laplace Transform, Region of convergence, Inverse Laplace transforms. Application of Laplace transform for determination of solution of differential equation and System realization up to second order, Frequency response of LTI continues system.	06
5	**Time-Domain Analysis of Discrete-Time Signals & Systems:** Signal Operations, Classification of Discrete-Time Systems, Discrete-Time System Equations, System response to Internal condition, Unit Impulse Response, System response to External Input, Sampling theorem.	06
6	**Fourier Analysis of Discrete-Time Signals:** Discrete-Time Fourier Series (DTFS), Aperiodic Signal Representation by Fourier Integral, Properties of DTFT, Relationship between DTFT & CTFT.	06

Text Books:

1. Lathi B. P., "Principles of Linear Systems and Signals" Second Edition (International Version) Oxford University Press.
2. Alan V. Oppenheim & Alan S. Willsky with S. Hamid Nawab, "Signals & Systems" PHI Publication, Edition.

Reference Books:

1. Ambardar A., "Analog and Digital Signal Processing", Thomson Learning-2005.
2. Simon Haykin, Barry Van Veen, "Signals & Systems", II Edition, Wiley Pub.
3. Michael J. Roberts, "Signals and Systems Analysis Using Transform Methods and MATLAB", Mc Hill Publication.

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PROGRAM CORE COURSE –II (PCC-III)

3EK202PC Discrete Structure and Graph Theory

Course Pre-requisite: Basic knowledge of Mathematics

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure by being able to do each of the following:

- Use mathematically correct terminology and notation.
- Constructs correct direct and indirect proofs.
- Apply logical reasoning to solve a variety of problems

Course Outcomes (Expected Outcome):

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

1. Analyze and express logic sentences in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3. Classify algebraic structure for a given mathematical problem.
4. Perform combinatorial analysis to solve counting problems.
5. Perform operation on trees data structures.
6. Develop the given problem as graph networks and solve with techniques of graph theory

Unit No.	Contents	No. of lectures
Unit I	**The Foundations: Logic and Proofs :** Propositions, Truth Tables, Compound Propositions, Logical Operators, Logic and Bit Operations; Logical Equivalences, Normal Forms, De Morgan's Laws, Satisfiability: Applications and Solving Problems; Predicates, Quantifiers: Restricted Domains, Precedence, Logical Equivalences; Rules of Inference for Propositional Logic.	**07**

Unit II **Unit III**	**Sets, Functions and Relation:** Introduction, Venn Diagrams, Subsets, Size of a Set, Power Sets, Cartesian Products, Set Notation with Quantifiers, Truth Sets and Quantifiers, Set Operations, Functions, Inverse Functions, Compositions and Graphs of Functions, Partial Functions; Sequences, Summations; Countable Sets, An Uncountable Set; Functions as Relations, Relations on a Set, Properties of Relations, Combining Relations; Representing Relations Using Matrices; Representing Relations, Closures of Relations, Equivalence Relations. **Algebraic Structures:** Algebraic Systems: Examples and General Properties; Semi-groups and Monoids: Homomorphism of Semigroups and Monoids, Sub-semigroups and Submonoids; Groups: Definitions, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Sub-groups, algebraic Systems with Two Binary Operations; Group Codes: The Communication Model and Basic Notions of Error Correction, Hamming Distance.	**07** **07**
Unit IV	**Exception handling and Input/Output:** Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.	**07**
Unit V	**Applets:** Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.	**07**
Unit VI	**Event Handling:** Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.	**07**

Text Books:

1. Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill).

Reference Books:

1. H.M.Dietel and P.J.Dietel, "Java How to Program" Pearson Education / PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (Mc-Graw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer‟s Guide to Java Certification, 3rd Edition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners, (SPD), 2010.

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3EK400EL COMMUNITY ENGAGEMENT PROJECT/ FIELD PROJECT

Course Requisite:

1. All courses / laboratories from I, II Semesters.

Course Objectives:

Students shall UNDERTAKE and EXECUTE a Mini Project through a group of students to:-

1. Understand the "Project Development Cycle", through Mini Project.
2. Inculcate hardware and software knowledge implementation skills.
3. Develop students‟ abilities to transmit technical information clearly through Technical Report writing on the Mini Project work carried out.

Course Outcomes: After successfully completing the course, students will be able to:

1. Acquired knowledge within the chosen area of technology for project development.
2. Identify, reproduce, improve and refine the technical aspects of the chosen project with a comprehensive and systematic approach.
3. Work as an individual or in a team in development of technical projects and communicate and report effectively project related activities and findings.
4. Do the social survey, analyses it, identify problem and find probable solution for the **benefit** of society.

Minor Project Work:
Group Size:
Minimum 5 and maximum 10 students can form a group for the mini project.

Project Type:
The selected mini project should be based on any of the following,

- Design and development of a prototype electronics system/product.
- Design and development of laboratory equipment's.
- Industry needs based basic survey or Testing or Analysis etc.
- Investigate performance of govt. schemes for society benefits.
- Parametric analysis of components / systems / device.s
- Investigation of optimum process / material for product development.
- Solution for society / industry problems.

General guidelines:
Project domain may be from the following, but not limited to:

- Solar Systems. / IOT / RFID
- Robotics Mechanisms / Digital systems
- Mini modal/ Hardware/Software
- Analysis of varies apps
- Automation and Control Systems
- Microcontroller based Systems/Ardino
- Agriculture system.
- Smart systems using AI

Project Report:
A project report with following contents shall be prepared:

1. Title, Certificate and Index
2. Objectives.
3. Introduction
4. Literature survey
5. Methodology-Experimental Method/Data collection and Analysis methods (using Google Form)/case study/survey Method /Research Method
6. Analysis-Graphical representation /Simulation/experimentation/survey/testing etc.
7. Problem Identification
8. Probable solution
9. Conclusion.
10. References.

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PROGRAM CORE COURSE -I (PCC-I)
3EK203PC ELECTRONICS DEVICES & CIRCUITS - Lab

Course Requisite:
1. Electronics Devices and Circuits.
2. Engineering Physics

Course Objectives:
1. To demonstrate the characteristics of various diodes and transistors.
2. To demonstrate the applications of diodes and transistors.
3. To compare the characteristics of diodes, transistors and oscillators.

Course Outcomes:
After successfully completing the course, the students will be able to:
1. Demonstrate the characteristics of various diodes and transistors.
2. Demonstrate the applications of diodes and transistors.
3. Compare the characteristics of diodes, transistors and oscillators.

Expt. No	Experiment
1.	To verify V-I characteristics of p-n junction diode and obtain static and dynamic resistance values
2.	To verify V-I characteristics of Zener junction diode and obtain static and dynamic resistance values

3.	To calculate efficiency and ripple factor of Half wave, Full wave and Bridge wave Rectifier.
4.	To study different types of filter circuits and calculate its ripple factor for C-filter
5.	To study Zener diode as a voltage regulator
6.	To obtain output characteristics of the clipping circuits for different reference voltages and to verify the responses.
7.	To study and observe the performance of various clamper circuit.
8.	To verify characteristics of CE mode of BJT and compute its parameters such as gain (β), input and output Impedance.
9.	To compare calculate and observe frequency response of oscillations of 3 stage RC phase shift oscillator
10.	To compare calculate and observe frequency response of oscillations of RC Wien Bridge oscillator.
11.	To plot frequency response of RC coupled amplifier and determine its bandwidth.
12.	To plot frequency response of Transformer coupled amplifier and determine its Bandwidth.
13.	To sketch the drain and transfer characteristics of n-channel JFET and determine ac drain resistance, trans-conductance and amplification factor
14.	To sketch V-I characteristics of UJT and determine Intrinsic stand-off ratio

* Minimum 08 experiments should be conducted out of above enlisted.

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PROGRAM CORE COURSE -II (PCC-II)
3EK204PC SIGNAL & SYSTEMS - LAB

Course Requisite:
1. Signals & Systems

Course Objectives:
1. To use software to visualize analysis of Signals and System
2. To manipulate the time signals and identify the type of given system.

Course Outcomes:
After successfully completing the course, the students will be able to:
1. Generate different plots and explore results to draw valid conclusions and inferences in Signal Processing
2. Enable on how to approach for requirement of signal processing and system design using simulation tools
3. Familiarize with the concepts of sampling.

Expt. No	Experiment
01	Study of Signal Processing Functions used in MATLAB / SCILAB
02	Program to generate standard continuous Time Signals
03	Program to generate standard discrete Time Signals.
04	Program to perform basic operations on signals.
05	Program to find Even and Odd parts of a signal.
06	Program to check Periodicity of signals.
07	Program to find the Energy and Power of a Signal.
08	Program to identify a given system as linear/ non-linear, time variance/ invariance property of a given system.
09	Program to demonstrate the time domain sampling of band limited signals (Nyquist theorem).
10	Program to find Fourier transform of given signal.
11	Implement system equation using Simulnk/Xcos to find output of system for different input signals.

* Minimum 08 experiments should be conducted out of above enlisted.

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MULTIDISCIPLINARY MINOR –I (MDM-I)

3EK205MD FOUNDATIONS OF COMPUTING & PROGRAMMING

Course Prerequisite:
Basic familiarity with mathematics and logical reasoning.

Course Objectives:
1. To introduce fundamental concepts of computing and its relevance across engineering domains.
2. To develop problem-solving skills using algorithmic approaches.
3. To provide exposure to basic programming constructs using a high-level language (Python).
4. To build foundational understanding required for advanced computational courses.

Course Outcomes (COs):
1 CO1: Understand computing systems and problem-solving logic. (Unit 1)
2 CO2: Apply algorithmic thinking to solve simple problems. (Unit 2)
3 CO3: Implement basic programs using control structures and I/O operations. (Unit 3)

Unit No.	Contents	No. of lectures
01	**Basics of Computing & Programming** Introduction to Computers and Programming Languages, Components of a Computer System and Software Types, Number Systems (Binary, Decimal, Hexadecimal) and Conversions, Basics of Algorithms and Flowcharts, Introduction to Python: Syntax, Variables, Data Types.	**07**

02	**Control Structures and Functions** Conditional Statements: if, if-else, nested if, Looping Constructs: for, while, Introduction to Functions and Modular Programming, Basic Math Operations and Built-in Functions in Python.	**08**
03	**Input-Output and Basic Problem Solving** Input from User and Output Formatting, Lists and String Handling, Simple Problem-Solving , Examples using Loops and Conditions, Writing and Executing Python Scripts.	**07**

Text book(s): Reema Thareja, "Python Programming: Using Problem Solving Approach," Oxford University Press, 2017.

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist," O'Reilly Media, 2nd Edition, 2015.
2. Zelle, John M., "Python Programming: An Introduction to Computer Science," Franklin, Beedle & Associates, 2017.
3. Anita Goel, "Computer Fundamentals," Pearson Education, 2010.
4. Charles Severance, "Python for Everybody: Exploring Data Using Python 3," CreateSpace, 2016.
5. Yashavant Kanetkar, "Let Us Python," BPB Publications, 2020.

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OPEN ELECTIVE –I (OE-I)

3EK206OE- I (i) BASICS OF COMPUTING FOR ENGINEERS

Pre-requisites:

1. Basic understanding of mathematical logic and problem-solving.
2. Familiarity with basic operations on a computer (keyboard, file handling, browsing).
3. General curiosity towards technology and engineering applications.

Course Objectives:

1. To introduce the fundamentals of computing and its applications across engineering domains.
2. To familiarize students with core computing concepts such as data, logic, programming, and storage.
3. To provide hands-on understanding of basic programming logic and computational thinking.
4. To help students develop problem-solving skills using algorithms and flowcharts.
5. To relate computing applications with real-life engineering challenges and tools.

Course Outcomes (COs):

After completing this course, students will be able to:

1. Understand the role of computing in modern engineering practices.
2. Apply basic logical reasoning and computational thinking to solve simple engineering problems.
3. Interpret data and operations using flowcharts, pseudo-code, and basic algorithms.
4. Recognize various computing tools used in engineering industries.
5. Appreciate ethical and societal implications of computing.

Unit No.	Contents	No. of lectures
1	**Introduction to Computers & Computing:** Evolution and Applications of Computers in Engineering, Components of a Computer System: Hardware & Software, Operating Systems Basics (Windows/Linux), Introduction to Data, Binary Systems, and Memory Hierarchy, Role of Computers in Engineering Domains (CAD, CAM, Simulation, etc.).	**08**
2	**Fundamentals of Programming & Logic Building:** Understanding Algorithms and Flowcharts, Variables, Constants, Data Types, Input/Output, Arithmetic and Logical Operators, Control Structures: if-else, loops (for, while), Problem Solving with Simple Pseudocode Examples.	**08**
3	**Introduction to Computational Thinking:** What is Computational Thinking?, Abstraction, Decomposition, Pattern Recognition, Algorithm Design, Case Studies of Computational Thinking in Civil, Mechanical, and Electrical Engineering Real-World Examples using Block-Based Programming (e.g., Scratch or Blockly), .	**08**
4	**Data & File Management in Engineering: (7 Hours)** Understanding Structured vs Unstructured Data, File Handling Basics (Creating, Reading, Writing Files), Data Representation (Tables, Graphs, Charts), Applications: Excel, Google Sheets, Data Logging in Labs.	**06**

5	**Overview of Programming Tools & Environments: (7 Hours)** Common Engineering Programming Tools (Python, MATLAB, Excel Macros), Introduction to Online IDEs, Simulators, and AutoCAD Programming, Cloud-Based Tools for Engineers (e.g., Google Colab, Replit), Software Tools in Design and Simulation.	**06**
6	**Ethical and Professional Aspects of Computing (7 Hours)** Digital Citizenship and Responsible Use of Technology, Data Privacy, Cyber Ethics and Safety , Open Source Software and Licensing, Introduction to Engineering Software Lifecycle & Automation, Relevance of Computing in Sustainable Engineering Practices.	**06**

Text Books:

1. H. Taub, D. L. Schilling, and G. Saha, Principles of Communication Systems, 4th ed. New York, NY, USA: McGraw-Hill Education, 2008.
2. S. Haykin, Communication Systems, 5th ed. Hoboken, NJ, USA: Wiley, 2009.
3. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 5th ed. Oxford, UK: Oxford University Press, 2020.
4. G. Kennedy and B. Davis, Electronic Communication Systems, 4th ed. New York, NY, USA: McGraw-Hill Education, 1993.

Reference Books:

1. H. P. Hsu, Analog and Digital Communication, 2nd ed. New York, NY, USA: McGraw-Hill Education, 2003.
2. J. G. Proakis and M. Salehi, Communication Systems Engineering, 2nd ed. Upper Saddle River, NJ, USA: Pearson, 2002.
3. S. Sharma, A. K. Gautam, and T. L. Singal, Analog Communication. New Delhi, India: Pearson, 2018.
4. S. Haykin and M. Moher, An Introduction to Analog and Digital Communications, 2nd ed. Hoboken, NJ, USA: Wiley, 2007.

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OPEN ELECTIVE –I (OE-I)
3EK206OE- I (ii) Basics of Artificial Intelligence

Course Requisite:
Engineering Mathematics

Course Objectives:
1. To introduce fundamental concepts of Artificial Intelligence (AI)
2. To understand problem-solving and knowledge representation techniques
3. To explore basic machine learning concepts and applications
4. To study real-world applications of AI .

Course Outcomes:
After successfully completing the course, the students will be able to:
CO1: Understand fundamental concepts, history, and applications of Artificial Intelligence.
CO2: Apply search techniques like BFS, DFS, and A* to solve AI problems.
CO3: Understand and apply knowledge representation and logical reasoning methods.
CO4: Explain basic machine learning concepts and learning techniques.
CO5: Understand structure and working of artificial neural networks.
CO6: Identify real-world AI applications and ethical issues.

Unit No.	Contents	No. of lectures
1	**Introduction to Artificial Intelligence** Definition and history of AI, Goals and applications of AI, AI vs Human Intelligence, Branches of AI, Intelligent agents and their types	06
2	**Problem Solving and Search Techniques** AI problem formulation, State space representation, Uninformed search techniques: Breadth First Search (BFS), Depth First Search (DFS), Informed search techniques: Best First Search, A* Algorithm, Heuristic functions.	06
3	**Knowledge Representation and Reasoning** Knowledge representation methods, Propositional logic, Predicate logic, Inference mechanisms, Rule-based systems.	06
4	**Machine Learning Basics** Introduction to Machine Learning, Types: Supervised learning, unsupervised learning, Basic algorithms: Linear Regression & Classification concepts, Overfitting and underfitting	06
5	**Artificial Neural Networks** Biological neuron vs artificial neuron, Structure of ANN, Perceptron model , Activation functions, Applications of neural networks	06
6	**Applications of AI** AI in healthcare, AI in robotics, Natural Language Processing (NLP) ,Computer Vision, AI in smart systems and IoT, Ethical issues in AI.	06

Text Books :
1. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig (3rd Edition)
2. Artificial Intelligence – Elaine Rich & Kevin Knight (3rd Edition)

References:
1. Machine Learning – Tom M. Mitchell (1st Edition)
2. Deep Learning – Ian Goodfellow (1st Edition)

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Entrepreneurship / Economics Management Course

3EK207EM ENTREPRENEURSHIP DEVELOPMENT

Course Objectives:

1. To understand the fundamentals of entrepreneurship and its role in economic development.
2. To understand the innovation and design thinking to develop business ideas.
3. To study the feasibility study and basic business plan for entrepreneurial ventures.

Course Outcomes:

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

1. Explain the fundamentals of entrepreneurship and its role in economic development.
2. Apply innovation and design thinking to develop business ideas.
3. Prepare a feasibility study and basic business plan for entrepreneurial ventures.

Unit No.	Contents	No. of lectures
1	**Unit I: Fundamentals of Entrepreneurship** Definition and Characteristics of Entrepreneurship, Types of Entrepreneurs: Startup Entrepreneurs, Social Entrepreneurs, Technopreneurs, Role of Entrepreneurship in Economic Development, Entrepreneurial Competencies and Traits, Difference Between Entrepreneur and Manager, Problems faced by Entrepreneurs, Myths and Misconceptions About Entrepreneurship.	08
2	**Unit II: Entrepreneurial Process and Innovation** Steps in the Entrepreneurial Process: Opportunity Identification, Idea Generation, and Validation, Feasibility Study: Market, Technical, and Financial Feasibility, Business Model Development: Business Model Canvas (BMC), Role of Innovation in Entrepreneurship, Introduction to Design Thinking for Problem Solving, Overview of Intellectual Property Rights (IPR).	08
3	**Unit III: Business Planning and Startup Ecosystem** Importance and Components of a Business Plan: Executive Summary, Marketing Plan, and Financial Plan, Legal Structures for Startups: Sole Proprietorship, Partnership, and Company, Government Support for Entrepreneurs: Startup India, Make in India, MSME, and DIC, Role of Incubators, Accelerators, and Venture Capitalists, Elevator Pitch and Presentation Skills for Business Ideas, Introduction to Emerging Trends: Social Entrepreneurship and Green Entrepreneurship.	08

Text Book:

1. "Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath, Pearson Education.

Reference Books:

1. "Entrepreneurship" by Hisrich, Peters, and Shepherd, McGraw-Hill Publication
2. "Innovation and Entrepreneurship" by Peter F. Drucker.
3. "Entrepreneurial Development" by Dr. S. S. Khanka, S. Chand Publication
4. Government Resources on Entrepreneurship (e.g., startupindia.gov.in)

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VALUE EDUCATION COURSE

3KE208VE ENVIRONMENTAL SCIENCE

Course Objectives:

1. To develop an understanding of the interdisciplinary nature of environmental studies and its relevance to engineering applications, promote sustainable engineering solutions.
2. To identify and differentiate between renewable and non-renewable resources, and understand their engineering implications.
3. To foster problem-solving and decision-making skills related to environmental issues in engineering design and planning, to raise awareness of environmental policies, laws.

Course Outcomes (Cos):

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

1. Demonstrate an interdisciplinary understanding of environmental issues and explain their relevance to various engineering domains.
2. Identify and compare renewable and non-renewable resources, and analyze their usage and limitations from an engineering perspective, Evaluate the impact of engineering activities and industrialization on ecosystems, biodiversity.
3. Apply critical thinking and problem-solving skills to propose eco-friendly and sustainable solutions in engineering design and planning.

Unit No.	Contents	No. of lectures
1	**Unit I: Environmental Concepts and Resource Management (9M)** Environmental Science Definition scope and importance, Natural Resources: Classification: Renewable and Non-renewable, Growing energy needs and technological solutions, Role of engineers in resource conservation, Sustainable resource use Equitable use of resources for sustainable lifestyles, Energy-efficient and eco-friendly practices in engineering.	09
2	**Unit II: Ecosystems, Biodiversity, and Pollution (12M)** Ecosystems: Concept, structure, and function, Producers, Consumers, Decomposers, and Energy flow, Ecological succession, food webs, pyramids, Major ecosystems: Forest, Grassland, Desert, Aquatic, Biodiversity:, Levels, hotspots in India, importance in technology and agriculture Threats and conservation methods, Pollution: Types: Air, Water, Soil, Noise – sources and effects, Solutions for pollution control Solid Waste Management: 3Rs (Reduce, Reuse, Recycle)	12
3	**Unit III: Sustainable Development, Ethics, and Environmental Legislation** Sustainable development: Definition, need and importance, Urban issues: water harvesting, energy, resettlement of displaced people, Smart cities and green building concepts Environmental ethics:	09
	Environmental awareness and responsibilities of engineers, Environmental legislation: Key Acts: Air Act, Water Act, Forest Conservation Act, Wildlife Protection Act, Role of institutions, NGOs, engineers in implementation.	

Text Books:

1. Textbook of Environmental Studies – Erach Bharucha (UGC)
2. Environmental Studies – Shanta Satyanarayan, Dr. Suresh Zade, Dr. Shashikant Sitre& Dr. Pravin Meshram (Allied Publishers).

Reference Books:

1. Essentials of Ecology and Environmental Science by Dr. S. V. S. Rana, PHI Learning Pvt Ltd, Delhi.
2. Environmental Chemistry by Anil Kumar De, Wiley Eastern Limited
3. Environmental Science by T.G. Miller, Wadsworth Publishing Co., 13th Edition.
4. Ecology and Environment by P.D. Sharma, Rastogi Publications.
5. Fundamental concepts in Environmental Studies by Dr. D. D. Mishra, S. Chand Publications.
6. Perspective in Environmental Studies by A. Kaushik and C. P. Kaushik, New Age International (P) Limited.

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SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

B.E. in Electronics & Computer Engineering Syllabus [NEP- 2020]

(SEMESTER- IV)

PROGRAM CORE COURSE-II (PCC-I)

4EK209PC ANALOG CIRCUITS

Course Requisite:

Electronics Devices and Circuits.

Course Objectives:

1. To understand the basics and internal structure of Op-Amp.
2. To analyse and design linear and non-linear applications of Op-Amp.
3. To understand and design concepts of voltage regulators.
4. To study and synthesize the waveform generators using IC 555 and IC 565.
5. To demonstrate applications of Op-Amp in temperature monitoring.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Comprehend the knowledge of basic concepts and parameters of Op-Amp-741.
2. Use of Op-Amp for implementation of linear applications.
3. Use of Op-Amp for implementation of non-linear applications.
4. Explore various types of Filters
5. Analysis of various analog circuits using Voltage regulator IC723.
6. Comprehend the knowledge of Timers, PLL and its applications.

Unit No.	Contents	No. of lectures
1	**Operational amplifier:** Block diagram of Op-Amp, differential amplifier configurations using BJT, constant current source, level shifting, transfer characteristics, frequency response, study of ICuA741, Op-Amp parameters.	06
2	**Linear applications of Op-Amp:** Theory & Design of Inverting and non-inverting amplifiers, scaling, summing, differential amplifier, integrator and differentiator, Basic principle of oscillators, Types of sinusoidal RC oscillators, Design of RC- phase shift and Wein bridge oscillator using IC 741.	06
3	**Non Linear Applications of Op-Amp:** Theory & Design of Op-amp IC 741 based comparator, zero-crossing detector, window detectors, Schmitt trigger, Astable multivibrator as square and triangular wave generator, Monostable multivibrator, Bistable multivibrator.	06
4	**Active filters:** Design of Butterworth first and second order low pass, high pass, Band pass, Band reject, all pass filter, design of notch filter, Design of instrumentation amplifier, bridge amplifier, temperature Controller/indicator using RTD.	06
5	**Voltage regulators** Design of fixed and variable Voltage regulators using IC 723 and LM 317, Design of fixed Voltage regulators using 78XX and 79XX ICs	06
6	**Timer IC 555 and PLL IC 565** Introduction to IC 555, IC 555 based design of Astable, Monostable multivibrator, **PLL:** Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC LM 565 and its application.	06

Text Books:

1. OP-AMP and Linear Integrated Circuits, R.A. Gayakwad Pearson Education Publications.
2. Linear Integrated Circuits, D. Roy Choudhury, New Age International Publications.
3. Integrated Circuits, K R Botkar, Khanna Publications.

Reference Books:

1. OPAMPS, Design, Application, and Troubleshooting, DavidL.Terrell, Butterworth-Heinemann, Elsevier.
2. Analysis and Design of Analog Integrated Circuits, Gray and Meyer, Wiley Intl. Publication.
3. Electronic Circuit Design, S.N. Talbar, Dr. T.R. Sontakke, Sadhu Sudha Prakashan.

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PROGRAM CORE COURSE-III (PCC-II)

4EK210PC OBJECT ORIENTED PROGRAMMING

Course Requisite: Computer Programming

Course Objectives:

Throughout the course, students will be expected to demonstrate their understanding:

1. To explore the principles of Object Oriented Programming (OOP) such as data abstraction, encapsulation, inheritance and polymorphism.
2. To use the object-oriented paradigm in program design.
3. To provide programming insight using OOP constructs.
4. To lay a foundation for advanced programming.

Course Outcomes:

On completion of the course, the students will be able to-

1. Apply Object Oriented approach to design software.
2. Implement programs using classes and objects.
3. Specify the forms of inheritance and use them in programs.
4. Analyze polymorphic behavior of objects.
5. Design and develop GUI programs.
6. Develop Applets for web applications.

Unit No.	Contents	No. of lectures
1	**Introduction to Object Oriented Programming** Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control.	07
2	**Classes and Objects** Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.	07
3	**Inheritance, Interfaces and Packages** Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package	07
4	**Exception handling and Input/ Output** Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.	**07**
5	**Applets** Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.	**07**
6	**Event Handling:** Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.	**07**

Text Books:

1. Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, “Java How to Program” Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer‟s Guide to Java Certification, 3rdEdition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners,(SPD),2010.

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PART TWO-675

PROGRAM CORE COURSE-III (PCC-III)

4EK211PC DIGITAL CIRCUITS

Course Objectives:

To make the students understand • The fundamental principles of two-valued logic and various devices used to implement logical operations on variables. • Boolean algebra, Karnaugh maps and its application to the design and characterization of digital circuits. • To analyze logic processes and implement logical operations using combinational logic circuits. • The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits. • Concepts of sequential circuits and to analyze sequential systems in terms of state machines. • System design approach using programmable logic devices.

Course Outcomes:

On completion of the course, learner will be able to –

CO1: Identify and prevent various hazards and timing problems in a digital design.
CO2: Use the basic logic gates and various reduction techniques of digital logic circuit.
CO3: Analyze, design and implement combinational logic circuits.
CO4: Analyze, design and implement sequential circuits
CO5: Differentiate between Mealy and Moore machines.
CO6: Analyze digital system design using PLD.

Unit No.	Contains	No. of Lecturers
1	**Digital Logic Families** Classification and Characteristics of digital Logic Families: -Speed, power dissipation, figure of merit,fan in, fan out, current, voltage, noise immunity, operating temperatures and power supply requirements. TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic: CMOS inverter, NAND, NOR gates,unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL.	04
2	**Combinational Logic Design** Definition of combinational logic, canonical forms, Standard representations for logic functions, kmap representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Introduction to Quine- McCluskey method, Quine McCluskey using dont care terms, Reduced prime implicants Tables.	08
3	**Combinational Circuits** Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees,De-multiplexers and their use in combinational logic designs, Decoders, Demultiplexer trees.	06
4	**Sequential Logic Design** 1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, hold and setup time and metastability. Excitation Table for flip flops. Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.	08
5	**State Machines** Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector.Introduction to Algorithmic state machines- construction of ASM chart and realization for sequential circuits.	07
6	**Programmable Logic Devices** Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, General Architecture of FPGA and CPLD. Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM ROM, EPROM, EEPROM, NVRAM, SRAM, and DRAM. Designing combinational circuits using PLDs.	08

Text Books:

1. R.P. Jain, "Modern digital electronics" , 3rd edition , 12th reprint Tata McGraw HillPublication,2007.
2. Thomas Floyd, "Digital Electronics", 11th Edition.
3. M. Morris Mano, "Digital Logic and Computer Design" 4the dition,Prentice Hall of India,2013.
4. Taub and Schilling, "Digital Principles and Applications," TMH.

Reference Books:

1. Anand Kumar, "Fundamentals of Digital Circuits" 1st edition, Prentice Hall of India, 2001
2. J. F. Wakerly, "Digital Design- Principles and Practices," 3rd Edition, Pearson
3. M. M. Mano, "Digital Design," Prentice Hall India.

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PART TWO-676

PROGRAM CORE COURSE– I (PCC-I)
4EK212PC ANALOG CIRCUITS - LAB.

Course Requisite:

1. Electronics Devices and Circuits.
2. Analog Circuits.

Course Objectives:

1. To verify operation of various wave shaping circuits.
2. To demonstrate linear and non-linear applications of Op-Amp.
3. To analyze multivibrator circuits using BJT and Op-Amp.
4. To understand functions and characteristics of PLL.

Course Outcomes:

After successfully completing the course, the students will be able to:

1. Implement wave shaping circuits using passive components, diode and BJT and perform their analysis.
2. Demonstrate linear and non-linear applications of Op-Amp.
3. Implement PLL in certain applications.

Expt. No	Experiment
1	To verify Op-Amp IC 741 as an inverting and non- inverting amplifier with a specific gain value
2	Design of summing amplifier using IC 741.
3	To demonstrate integrator and differentiator circuit using Op-Amp IC 741
4	To verify RC- phase shift oscillator using Op-Amp IC 741.
5	To verify Op-Amp IC 741 as a Schmitt trigger and calculate the hysteresis voltage.
6	To verify operation of a stable multivibrator using Op-Amp IC 74
7	To plot frequency response of first order Butterworth LPF for a specific pass-band gain and cut-off frequency.
8	To verify characteristics of PLL.
9	Application of PLL as AM detector/FM detector/frequency translator (Any one application)
10	Design transistorized series voltage regulator
11	Design a low voltage variable regulator to 7 V using IC 723
12	Design and setup a Wien-bridge oscillator
13	Design the square and triangular wave generator using IC 741.
14	Design a Butterworth high pass filter with specifications

* Minimum 08 experiments should be conducted out of above enlisted.

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PROGRAM CORE COURSE– I (PCC-II)

4EK213PC OBJECT ORIENTED PROGRAMMING - LAB. (PCC-II)

Course Pre-requisite:
Basic Computer Programming.

Course Objectives:
Design, implement, test, and debug simple programs in an object-oriented programming language.

- To develop the knowledge of object-oriented paradigm in the Java programming language.
- To evaluate classical problems using java programming.
- To develop software development skills using java programming for real world applications.

Course Outcomes :
On completion of the course, the students will be able to-

1. Design, implement, test, and debug simple programs in an object-oriented programming language.
2. Interpret the basics of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
3. Build applications in Java by applying concepts like interfaces, packages and exception handling.
4. Make use of Java concepts like API, Applets, AWT.

Expt. No	Experiment
1	Introduction to Object Oriented Programming and installation of JDK. Write a program to print a message "Hello World..."
2	Develop a program to explain use of Operators in java.
3	Develop a Program to study and implement Looping Statements belonging to Java.
4	Develop a Program to study and implement Selection Statements belonging to Java.
5	Develop a program to study and implement some Pyramid.
6	Develop a program to demonstrate the concept of Class, Method and Object.
7	Develop a program to study and implement the concept of Method Overloading.
8	Develop a program to study and implement concept of Constructor in Java.
9	Develop a program to study and implement concept of Constructor Overloading in Java.
10	Develop a program to study and implement the Array in Java.
11	Develop a Program on various ways to accept data through keyboard(Command Line Argument)
12	Develop a program to study and implement the concept of Inheritance.
13	Develop a program to study and implement the concept of Method Overriding.
14	Develop a program to study and implement the Abstract Class.
15	Develop a program to study and implement the concept of Interface in Java.
16	Develop a program to study and implement Exception Handling Mechanism in Java.
17	Develop a program to study and implement Java I/O.
18	Develop a program to study and implement simple Applet in java.
19	Develop a program on Applet to demonstrate Graphics, Font and Color class.
20	Develop a Program on passing parameters to applets
21	Develop a Program to create GUI application without event handling using AWT controls

Multidisciplinary Minor –II

4EK214MD - DATA STRUCTURES AND PROBLEM SOLVING

Pre-requisite: Basic understanding of programming (preferably in C or Python).

Course Objectives:

- To introduce fundamental data structures and their applications.
- To develop problem-solving skills through efficient use of data structures.
- To improve algorithmic thinking for common computational tasks.
- To expose students to practical scenarios where data structures are applied in engineering contexts.

Course Outcomes (COs):

1. CO1: Understand and differentiate various data structures and their use cases. (Unit 1)
2. CO2: Apply linear and non-linear data structures in solving engineering problems. (Unit 2)
3. CO3: Analyze algorithm performance and implement solutions using appropriate structures. (Unit 3)

Unit No.	Contents	No. of lectures
1	**Introduction to Data Structures** Concept and Classification of Data Structures, Abstract Data Types (ADT), Arrays, Strings, and Linked Lists, Applications: Polynomial Representation, Sparse Matrices.	07
2	**Linear and Non-linear Structures** Stacks and Queues: Operations and Applications (Infix to Postfix, Recursion, Job Scheduling) Trees: Binary Trees, Tree Traversals, Binary Search Trees, Applications in Expression Trees, Directory Structures.	08
3	**Searching, Sorting & Hashing** Searching Techniques: Linear and Binary Search, Sorting Algorithms: Bubble, Selection, Insertion, Merge Sort, Hashing and Collision Resolution Techniques, Time and Space Complexity Basics.	07

Text Book(s):

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, McGraw Hill Education.
2. Reema Thareja, "Data Structures Using C", Oxford University Press, 2nd Edition, 2014.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, 2008.
2. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw-Hill.
3. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", CareerMonk Publications.
4. Robert Lafore, "Data Structures and Algorithms in C++", Pearson Education.
5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education.
6. Thomas H. Cormen et al., "Introduction to Algorithms", MIT Press (for higher interest).

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VOCATIONAL SKILL ENHANCEMENT COURSE-III (VSEC-III)

4EK215VS SENSORS & ACTUATORS

Prerequisite: Fundamental of Electronics

Course Objectives:

- To understand principles of sensors and actuators
- To learn their applications in engineering systems
- To develop interfacing and practical implementation skills

Course Outcomes (COs):

CO1: Understand sensor and actuator working principles
CO2: Select appropriate devices for applications
CO3: Interface sensors with controllers
CO4: Develop basic automation and IoT systems
CO5: Understand the need for signal conditioning in sensor systems
CO6: Analyze the role of sensors in IoT and wireless sensor networks

Unit No.	Contents	No. of lectures
1	**Introduction to Sensors and Transducers** Definition of sensor, transducer, actuator, Classification (active/passive, analog/digital) Characteristics: accuracy, sensitivity, resolution, linearity Static and dynamic characteristics	02
2	**Temperature and Light Sensors** Temperature sensors: RTD, Thermistor, Thermocouple, Light sensors: LDR, Photodiode, Phototransistor , Applications	07
3	**Position, Pressure and Motion Sensors** Position sensors: Potentiometer, LVDT, Pressure sensors: Strain gauge, Piezoelectric sensor, Motion sensors: Accelerometer, Gyroscope	08
4	**Actuators** Types: Electrical, Mechanical, Hydraulic, Pneumatic, DC motor, Stepper motor, Servo motor, Relay and solenoid	02
5	**Sensor Interfacing and Applications** Signal conditioning (amplifiers, filters, ADC), Microcontroller interfacing, IoT-based sensing systems, Applications: industrial, automotive, smart homes	02
6	**Smart Sensors and Emerging Technologies (New Unit)** Concept of smart sensors, Features: Self-calibration, Signal processing capability, Communication interfaces, Introduction to MEMS sensors, Wireless sensor networks (WSN), Role of sensors in: Internet of Things (IoT), Automation and robotics, Wearable devices	02

Text Books:

1. Sensors and Transducers – D. Patranabis, **2nd Edition**, PHI Learning Pvt. Ltd.
2. A Course in Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney .**18th Edition** (commonly used in engineering colleges)

Reference Books:

1. Measurement Systems: Application and Design – Ernest O. Doebelin, **5th Edition**, Tata McGraw-Hill
2. Transducers and Instrumentation – D. V. S. Murty, **2nd Edition**, PHI Learning
3. Instrumentation Devices and Systems – C. S. Rangan, Latest/standard edition (Tata McGraw-Hill; widely used reference)
4. Sensor Technology Handbook – Jon S. Wilson, **1st Edition**, Elsevier (for advanced learning)

LABORATORY ON SENSORS & ACTUATORS

Expt. No.	Experiment
01	Study and calibration of thermistor for temperature measurement.
02	Characteristics of RTD (Resistance Temperature Detector).
03	Interfacing LDR with microcontroller for automatic light control.
04	LDR characteristics and light intensity measurement.
05	Temperature measurement using LM35 sensor with display.
06	Interfacing ultrasonic sensor for distance measurement.
07	Signal conditioning of sensor output using op-amp.
08	ADC interfacing for analog to digital conversion of sensor signals.
09	DC motor control using relay based switching.
10	Servo motor interfacing for position control using PWM.
11	Interfacing PIR sensor for motion detection system.

[Minimum (08) Eight experiments should be conducted out of the above enlisted.]

OPEN ELECTIVE- II (OE-II)
4EK216OE (i) INTELLECTUAL PROPERTY RIGHTS

Course Prerequisite:

Basic understanding of communication skills, general ethics, and awareness of creative work (projects, research, design, coding, etc.)

Course Objectives:

1. To provide students with foundational knowledge of Intellectual Property Rights (IPR) and their significance in innovation and research.
2. To introduce different forms of intellectual properties such as patents, copyrights, trademarks, and designs.
3. To create awareness about the legal and ethical aspects of protecting intellectual creations and innovations in engineering and beyond.

Course Outcomes:

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

1. Explain the significance of intellectual property in research, development, and innovation.
2. Identify various types of intellectual property and understand their application in different domains.
3. Demonstrate basic knowledge of procedures involved in protecting intellectual property and the roles of regulatory bodies.
4. Relate IPR knowledge to their project work, industrial applications, and entrepreneurship.

Unit No.	Contains	No. of Lecturers
1	**Introduction to Intellectual Property Rights** Creativity, Innovation, and their Role in Development, What is Intellectual Property?, Types of Intellectual Property: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, and Geographical Indications, Importance of IPR in Engineering, Research, Startups, and Academia, Examples and Case Studies from various engineering disciplines.	08
2	**Patent, Copyright, and Design Protection** **Patent**: What can be patented? Basic criteria (novelty, utility, non-obviousness), Simple steps of Patent Filing in India, Use of patents in project work or research, **Copyright**: For literature, music, software codes, and digital content, **Industrial Design**: Protection of new designs and their aesthetic value, Ownership, Licensing, and Rights of Creators.	07
3	**Trademarks, Geographical Indications & IPR in the Digital Era** **Trademarks**: Brand names, logos, slogans – importance in business and marketing, **Geographical Indications**: Indian examples (e.g., Darjeeling Tea, Nagpur Orange), Role of IPR in Startups and Product Commercialization, Government Initiatives: National IPR Policy 2016, Startup India, Atmanirbhar Bharat, Career Opportunities in IPR, Case Studies and Recent Trends.	07

Text Books:

1. K. V. Nithyananda (2019), “Intellectual Property Rights: Protection and Management”, Cengage Learning India.
2. P. Neeraj and D. Khusdeep (2014), “Intellectual Property Rights”, PHI Learning.

Reference Books:

1. Deborah E. Bouchoux, “Intellectual Property for Paralegals”, 4th Edition, Cengage Learning, 2012.
2. M. M. S. Karki, “Intellectual Property Rights: Basic Concepts”, Atlantic Publishers, 2009.
3. V. K. Ahuja, “Law relating to Intellectual Property Rights”, Lexis Nexis, 2017.
4. Prabuddha Ganguli, “Intellectual Property Rights – Unleashing the Knowledge Economy”, Tata McGraw Hill, 2001.

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PART TWO-681

OPEN ELECTIVE- II (OE-II)
4EK216OE (ii) INFORMATION SYSTEMS FOR ENGINEERS

Prerequisites:

- Basic understanding of engineering processes and workplace practices.
- Familiarity with computer usage and basic productivity tools (Word, Excel, etc.).

Course Objectives:

1. To introduce the fundamental concepts of Information Systems (IS) and their relevance in engineering and business domains.
2. To explore how engineers can use IS for decision-making, automation, and efficiency.
3. To familiarize students with various types of information systems including MIS, ERP, and industrial systems.
4. To understand the challenges, risks, and future trends associated with the implementation of MIS.

Course Outcomes (COs): After successful completion of the course, students will be able to:

1. Understand the basic structure and components of Information Systems used in engineering.
2. Identify and evaluate applications of Information Systems across different engineering disciplines.
3. Demonstrate understanding of ERP, MIS, and database systems and their integration with engineering workflows.

Unit No.	Contents	No. of lectures
1	**Basics of Information Systems in Engineering** Introduction to Information Systems: Definition, Need, and Importance, Components of IS: Hardware, Software, Data, People, Processes, Types of IS: Transaction Processing Systems (TPS), Management Information Systems (MIS), Decision Support Systems (DSS), Role of IS in different Engineering Domains (Manufacturing, Civil, Electrical, etc.).	07
2	**Enterprise Systems and Engineering Applications** Overview of Enterprise Resource Planning (ERP) Systems, Functional Modules in ERP: Finance, Production, Inventory, HR, Industrial Automation Systems & SCADA, Role of IS in Supply Chain, Maintenance, Quality, and Smart Manufacturing (Industry 4.0).	08
3	**Emerging Trends and Case Studies in IS** Cloud-Based Information Systems, Role of IoT and Data Analytics in Engineering IS, Engineering Workflow Automation with IS Tools (Examples: AutoCAD Vault, PLM, BIM), Case Studies: Use of IS in Smart Cities, Energy Management, Water Resource Planning, Challenges in IS Implementation: Data Security, Change Management, Cost.	08

Text Books:

1. Laudon & Laudon, Management Information Systems: Managing the Digital Firm, Pearson Education, 2021
2. James A. O'Brien, Introduction to Information Systems, McGraw-Hill, 2020.

Reference Books:

1. Rainer & Prince, Introduction to Information Systems, Wiley India, 2019
2. Turban et al., Information Technology for Management, Wiley, 2021
3. Monk & Wagner, Concepts in Enterprise Resource Planning, Cengage Learning, 2016
4. Mahadeo Jaiswal & M. Mital, Management Information Systems, Oxford University Press, 2015
5. Rajesh Ray, Enterprise Resource Planning, Tata McGraw Hill, 2011
6. Ghosh, Management Information Systems, PHI Learning, 2014.

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4EK217EM ENGINEERING ECONOMICS

Course Objectives:

1. To familiarize the basic concepts of Engineering Economics and Production.
2. To learn different types of cash flow and Engineering alternatives.
3. To learn depreciation analysis and Banking system.

Course Outcomes: After successfully completing the course, the students will be able to:

1. Describe the concepts of Engineering Economics and Production.
2. Explain the different types of cash flow and Engineering alternatives.
3. Understand the depreciation analysis and Banking system.

Unit No.	Contents	No. of lectures
1	Definition and Scope of Engineering Economics, Principles of Engineering Economics, Micro-economics Vs Macro-economics, Laws of diminishing utility analysis, derivation of demand curve and law of Demand. **Theory of Production:** Theory, Importance, Isoquants and its properties, Law of variable proportions, Cost of Production and Cost of Curves, the law of supply.	**08**
2	Time value of Money, Techniques for adjusting time value of money, Types and components of cash flow, cash flow diagrams, Uses, significance and limitation of Cash flow statement. Evaluation of Engineering alternatives, Present worth method, Future worth Method, Rate of return method, Project evaluation and Cost benefit analysis.	**08**
3	Depreciation Analysis, Causes of depreciation, Depreciable property, depreciation Methods, Break even analysis, determination of breakeven point, Breakeven point in terms of quantity, sales and as percentage of capacity. Commercial Banking, Functions of Commercial Banks, types of banks, balance sheet of a bank, New developments in banking system.	**08**

Text Book:

1. Engineering Economics and Costing, Second Edition, PHI, 2010 by Sasmita Mishra.

References:

1. Engineering Economic Analysis, Volume 2, By Donald G. Newnan, Ted Eschenbach, Jerome P. Lavelle 2004.
2. Engineering Economics, PHI Learning, By R. Panneerselvam · 2013

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