Scheme of Instruction and Syllabus

Of

B.E. / B.TECH. I & VIII SEMESTERS

FOR

DEPARTMENT OF CIVIL ENGINEERING
R26- Regulation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMUS)
DEPARTMENT OF CIVIL ENGINEERING

INSTITUTE VISION AND MISSION

Vision

To be a centre of excellence in technical education and research.

Mission

To address the emerging needs through quality technical education and advanced research.

DEPARTMENTVISION AND MISSION

Vision

To strive for excellence in academics, research and consultancy in the field of Civil Engineering and contribute to the sustainable development of the country by producing quality Civil Engineers with professional and ethical values.

Mission

- Maintaining high academic standards to develop analytical thinking and independent judgment among the students so that they are fit for industry and higher studies.
- Promoting skills and values among the students to prepare them as responsible global citizens who can solve complex problems.
- Preparing the students as good individuals and team members with professional attitude, ethics, concern for environment and zeal for lifelong learning who can contribute to society.

PROGRAM EDUCATIONAL OBJECTIVES:

The PEOs are to facilitate the graduating students to

PEO1: Acquire basic knowledge and expertise necessary for professional practice in Civil Engineering for higher studies and research.
PEO2: Attain and practice technical skills to identify, analyze and solve complex problems and issues related to Civil Engineering.
PEO3: Possess a professional attitude as an individual or a team member to work for the betterment of the society and environment.
PEO4: Work with professional ethics as refined technocrats with a thirst for lifelong learning.

PROGRAM SPECIFIC OUTCOMES:

The graduates of this program will:

1. Effectively apply engineering fundamentals for the development and management of eco-friendly Civil engineering systems which benefit the society at large.
2. Develop the ability to provide solutions to complex problems in civil engineering through individual and team work with a spirit for lifelong learning
3. Develop the competence to plan, build and maintain sustainable infrastructural facilities like housing, water management, transportation and geotechnical services.

PROGRAM OUTCOMES:

Engineering graduate will be able to:

1. Engineering Knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.
2. Problem Analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
3. Design/ development of Solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
4. Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
5. Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
6. The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
7. Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws
8. Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
10. Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. Life-Long Learning:	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

About the Department:

The Department of Civil Engineering was established in the Year 1979 with the inception of the Institute. The Department offers a Four-Year Bachelor's Degree Program in Civil Engineering and Two-Year Master's Degree Program in Structural Engineering. In total there are about 500 Students pursuing Bachelor's Degree and 50 Students pursuing Master's Degree in the Department. Many of the Faculty Members hold Higher Degrees from reputed Institutions from India like IITs, NITs, IIITH and State Universities and Abroad. The Department of Civil Engineering has three missions such as excellence in Teaching and Research; Relevance to Industry and Society; contribution to sustainable development. The Department is well equipped with State-of-the-Art laboratories to cater the needs of Teaching, R&D and Consultancy. The Faculty of the Department strive hard to impart the latest technical knowledge to the students and conduct quality research. The faculty offer technical services on live engineering problems to various Government and Private organizations.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. –Civil Engineering as per AICTE Model Curriculum 2026-27

DEPARTMENT OF CIVIL ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC02	Matrix Theory and Advanced Calculus	3	1	-	3	40	60	4
2	26CYC01	Material Chemistry	3	-	-	3	40	60	3
3	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4	26CSC01	Problem solving and Programming using C	3	-	-	3	40	60	3
5	26ADC01	Artificial Intelligence Foundations and Applications	2	-	-	3	40	60	2
PRACTICALS									
6	26CYC02	Material Chemistry Lab	-	-	3	3	50	50	1.5
7	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	26CSC02	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
9	26MEC01	Robotics and Drones Lab	-	1	2	3	50	50	2
10	26MBC02	Community Engagement	-	-	2	-	50	-	1
Total			**14**	**02**	**12**	**-**	**450**	**500**	**22**
Clock Hours Per Week: 28									

L: Lecture **T: Tutorial** **D: Drawing**

P: Practical CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

26MTC02

MATRIX THEORY AND ADVANCED CALCULUS

(For CIVIL)

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To develop proficiency in solving system of linear equations using matrix methods.
2. To provide a clear understanding of eigenvalues, eigenvectors and their applications.
3. To explain mean value theorems and their geometrical interpretations.
4. To develop the ability to use partial derivatives for analyzing functions of two variables and determining their extreme values.
5. To introduce and apply double and triple integral concepts.

Course Outcomes: Upon completing this course, students will be able to:

1. Apply matrix methods to solve system of linear equations.
2. Determine eigenvalues and eigenvectors and analyze the nature of quadratic forms.
3. Interpret and analyze mean value theorems and their geometrical significance, including curvature.
4. Determine extreme values of functions of two variables using partial derivatives.
5. Evaluate double and triple integrals and apply them in relevant problems.

CO-PO Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	2	2	1	-
CO2	3	3	2	2	1	-	-	-	-	-	2	3	1	-
CO3	3	3	1	2	1	-	-	-	-	-	2	2	1	-
CO4	3	3	2	2	1	-	-	-	-	-	2	2	1	-
CO5	3	3	2	2	2	-	-	-	-	-	2	3	1	-

UNIT-I: Matrices-I

Linear system of equations**,** Echelon form, Rank of a matrix and consistency, solution of Non-homogeneous system of equations, solution of homogeneous system of equations, Linear dependence and independence of vectors. Solution of system of linear equations by Factorization method (Doolittle's method).

UNIT-II: Matrices-II

Eigenvalues, Eigenvectors, Properties of Eigenvalues and Eigenvectors, Cayley Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-III: Differential Calculus

Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's Mean value theorem (without proofs) and their geometrical interpretations. Curvature, Radius of curvature, Centre of curvature, Evolute and Involute (Cartesian curves).

UNIT-IV: Multivariable calculus

Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobian, Taylor's expansion of functions of two variables, Maxima and Minima of functions of two variables.

UNIT-V: Multiple Integrals

Introduction of double integral, Evaluation of double integral, Evaluation of double integral in polar coordinates, Change of order of integration, Triple integral, Change of variables, Area by double integration, Volume as a

triple integral.

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. N.P. Bali and Dr. Manish Goyal, "A text book of Engineering Mathematics", 9th edition, Laxmi Publications, 2017.

Suggested Reading:

1. B.V.Ramana., "Higher Engineering Mathematics", 11th Reprint, Tata McGraw-Hill, New Delhi, 2010.
2. R.K.Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2016.

Online Resources:

Course Code	Course Name	Resource Link
26MTC02	Matrix Theory and Advanced Calculus	1.https://nptel.ac.in/courses/111107112 [(Unit-I&II: Week-1&3)] 2.https://nptel.ac.in/courses/111105160 [(Unit-III,IV&V: Week-2,3,4,5,9&10)]

26CYC07

MATERIAL CHEMISTRY

(Civil Engineering)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to

1 Impart the knowledge of industrial materials in engineering applications.
2 Develop concepts of electrochemical principles and corrosion mechanisms for industrial applications.
3 Explore the fundamental concepts, synthesis and engineering applications of polymers.
4 Create awareness about wastewater treatment and environmental protection.
5 Discuss the applications of quantum dots and nanomaterials in engineering field.

Course Outcomes: After successful completion of the course, the student will be able to

1 Evaluate the quality and efficiency of industrial materials based on the standards & requirements.
2 Apply electrochemical principles to calculate cell potentials and predict corrosion behavior.
3 Illustrate the synthesis, properties, and applications of advanced engineering polymers.
4 Analyze water quality parameters and select appropriate domestic and industrial treatment techniques.
5 Apply fundamental concepts of quantum confinement effect and nanomaterials in modern technology.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	3	-	-	-	-	2	2	1	2
CO2	3	2	2	-	-	3	-	-	-	-	2	2	2	2
CO3	3	2	2	-	-	2	-	-	-	-	2	2	2	2
CO4	3	2	3	-	-	3	-	-	-	-	2	3	1	3
CO5	3	2	2	-	-	2	-	-	-	-	2	2	2	2

Unit I: Industrial Materials: Cement and Lubricants

Cement: Classification of cement, chemical composition and manufacturing of portland cement (raw materials, mixing raw materials for dry and wet process, burning, grinding and packing), setting and hardening of Portland cement. Reactions involved during setting of cement.

Refractories: Classification, criteria of good refractory materials. Conditions for failure of a refractory materials.

Lubricants: Definition and characteristics of a good lubricant- classification of lubricants with examples. Mechanism of lubrication- thick film, thin film and extreme pressure lubrication. Additives and selection of lubricants. Properties- viscosity, cloud point, pour point, flash and fire point. Saponification number-definition and significance.

Unit II: Electrochemistry and Corrosion

Electrochemistry: Electrode potentials, Cell potentials and Cell emf. Electrochemical series and its applications. Reference electrodes: construction and working of the standard hydrogen electrode (SHE) and the saturated calomel electrode (SCE). Nernst equation and its applications - numericals. Potentiometric acid base and redox titrations (principle and graphs).

Corrosion: Introduction to corrosion, types of corrosion – chemical and electrochemical corrosion, mechanism of electrochemical corrosion by absorption of oxygen and evolution of hydrogen. Differential aeration corrosion, galvanic corrosion. Factors affecting corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of corrosion product – solubility and volatility of corrosion product, nature of corroding environment – temperature, humidity and p^H). Corrosion control methods: Cathodic protection, sacrificial anodic protection and impressed current cathodic protection.

Unit III: Materials in Engineering and Technology

Polymers: Monomer, polymer, polymerization, degree of polymerization. Synthesis, properties and applications of thermoplastic polymers (PVC and PTFE) and thermosetting polymers (Bakelite, Kevlar). Elastomers- natural rubber, vulcanization of rubber, process and applications.

Conducting polymers: Definition, classification and mechanism of conduction in (p-doped and n-doped) polyacetylene and their engineering applications.

Bio-degradable polymers: Preparation and applications of poly lactic acid and poly vinyl alcohol.

UNIT–IV: Water Chemistry

Hardness of water: Types, units of hardness and disadvantages of hard water. Alkalinity of water and its estimation. Numerical problems on hardness of water and alkalinity. Boiler troubles – scales and sludge formation, causes, effects and prevention. Softening of water by ion exchange method. Desalination of water by reverse osmosis and electro dialysis method. Specifications of potable and industrial water. Disinfection of water by chlorination method, breakpoint chlorination. BOD and COD- definition, estimation (only brief procedure) and significance. Industrial wastewater treatment by using Zero Liquid Discharge (ZLD) method.

UNIT-V: Quantum dots and Nanomaterials

Nanomaterials: Introduction to nanomaterials and their classification as 0D, 1D, 2D and 3D materials. General applications of nanomaterials. Basic chemical method of preparation: sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (principles only).

Quantum dots: Definition and classification of quantum dots. Concept of quantum confinement. Size dependent optical properties (absorption and photoluminescence). Core and core shell quantum dots-surface capping and functionalization with emphasis on stability. Applications in LEDs, solar cells, bio-imaging and sensing. Raman Spectroscopy (Principle only).

Composite materials: Definition and classification of composites- Particle reinforced, fibre reinforced - glass fibre reinforced and carbon fibre reinforced composites and their applications.

TEXT BOOKS

1 P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi, 17th edition (2025).
2 A Textbook of Polymer Science and Technology, Shashi Chawla, Dhanpat Rai & Co. (2014)
3 G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2016).

SUGGESTED READINGS

1. B. S. Bahl, G.D. Tuli, Arun Bahl (Author), “Essentials of Physical Chemistry”, S. Chand & Co. Ltd, 28th edition (2022).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, S. Nagin Chand & Company Ltd., 47th edition (2019).
3. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2018.

26EEC01

BASIC ELECTRICAL ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to

1. Understand the behavior of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. Comprehend the basic principle of operation of AC and DC machines
3. Infer about different types of cables, wires, safety rules, sensors and methods of Earthing,

Course Outcomes: After the completion of this course, the student will be able to

1. Understand the concepts of Kirchhoff's laws and their application of various theorems to get solutions of simple DC circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single-phase transformers
4. Describe the construction, working principle of DC machine and 3-phase Induction motor.
5. Acquire knowledge of electrical wires, cables, earthing, and electrical safety precautions to be followed in electrical installations, including electric shock protection, energy calculations, and sensors.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	1	2	-	3	2	2	1
CO2	3	3	2	-	-	-	-	1	2	-	3	2	2	1
CO3	3	3	2	1	-	-	-	1	2	-	3	2	1	2
CO4	2	1	-	-	-	-	-	1	2	-	3	2	2	2
CO5	2	-	2	-	-	-	-	1	2	-	3	3	2	3

1 - Slightly; 2 - Moderately; 3 - Substantially

UNIT-I

DC Circuits: Electrical Circuit Elements: R, L and C, voltage and current sources, Kirchhoff current (KCL) and voltage laws (KVL), Analysis of simple circuits with DC excitation: Nodal Analysis, Mesh Analysis, Superposition, Thevenin's and Norton's Theorems.

UNIT-II

AC Circuits: Single Phase AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC.

Three phase balanced circuits: Introduction, Comparison of Single phase and Three Phase System, voltage and current relations in star and delta connections (Elementary treatment only)

UNIT-III

Single Phase Transformer: Construction, Working Principle, EMF Equation, Comparison of Ideal and Practical Transformer, Losses, OC and SC tests and Efficiency.

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Applications DC Motors: Principle of operation, Classification, Torque Equation, Characteristics & Speed control of DC Shunt Motor, Applications. Three Phase Induction Motors: Principle of operation, Applications

UNIT-V

Electrical Installations and Sensors: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, and first aid for electric shock.

Components of LT Switchgear: Fuse, MCB and Earthing (Elementary Treatment only), Elementary

calculations for energy consumption.
Sensors: Introduction, Working Principle, Types-Temperature, Humidity, and Motion (Elementary treatment only).

TEXTBOOKS:

1. B. L. Theraja & A. K. Theraja, Electrical Technology in S.I units (Volume-1 and Volume-2), S. Chand Publishing, 2021.
2. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd edition, 2019.
3. Wadhwa, C L, "Basic Electrical Engineering", New Age International Publishers, 5th edition, 2023.
4. Jacob Fraden," Handbook of Modern Sensors (Physics, Designs, and Applications)" Fifth Edition, 2016.

SUGGESTED READING:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,4th edition, 2019.
2. S.K. Sahdev, "Basic Electrical Engineering", Pearson Education, 2015.
3. P.V. Prasad, S. S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2012.

ONLINE RESOURCES:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Basic Electrical Circuits	Prof. Nagendra Krishnapura	IIT Madras
2	Electrical Machines	Prof. Anirban Sengupta	IIT Kanpur
3	Electric Circuits	Prof. S. C. Dutta Roy	IIT Delhi
4	Basic Electrical Technology	Prof. D. P. Kothari	IIT Delhi
5	Introduction to Electrical Engineering	Prof. S. K. Sharma	IIT Kanpur

26CSC01

PROBLEM SOLVING AND PROGRAMMING USING C

Instruction	3L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisites: Basic high school mathematics.

Course Objectives: This course aims to

1. Understanding the steps in problem solving and formulation of algorithms to problems.
2. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
3. Develop intuition to enable students to come up with creative approaches to problems.

Course Outcomes: After the completion of this course, the student will be able to

1. List and outline the steps to develop algorithmic solutions and identify flowchart symbols.
2. Illustrate programming concepts such as variables, data types, conditionals, loops, print statements, and functions.
3. Develop algorithms using recursion and iteration techniques.
4. Analyze the use of arrays, pointers, initialization, and dynamic memory allocation.
5. Evaluate and develop large-scale programs using multiple files, header files, and make utilities.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	1	1	2	-
CO2	3	1	1	-	1	-	-	-	-	-	1	1	2	-
CO3	3	1	1	-	1	-	-	-	-	-	1	1	3	-
CO4	3	1	1	-	1	-	-	-	-	-	1	1	3	-
CO5	3	1	1	-	1	-	-	-	-	-	1	2	3	1

1-Slightly, 2-Moderately, 3-Substantially

UNIT-I

Introduction: Introduction to Programming, Idea of Algorithm, Representation of Algorithm, Flowchart, from algorithms to programs, source code.

Basics of C: Background, Structure of a C Program, Datatypes, Tokens, Operators and Expressions- Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions, Input and Output Functions.

UNIT-II

Control Statements: Conditional Execution -Selection Statements, Conditional Operator, Switch statement**.** Iteration Execution - While Construct, For Construct, do-while Construct Goto Statement, Special Control Statements, Nested Loops.

Arrays: One-Dimensional Arrays-Declaration, Initialization, internal representation. Multidimensional Arrays.

UNIT–III

Strings: Strings: One-dimensional Character Arrays, Arrays of Strings: Two-dimensional Character Array.

Search and Sorting: Searching algorithms-linear, binary searching. Sorting algorithms- bubble sort, selection sort.

Functions: Concept, Uses, Prototype, Declaration, Parameter passing techniques, Passing Arrays to Functions, Storage Classes, Recursion.

UNIT-IV

Pointers: Declaring a Pointer, Initializing Pointers, Indirection Operator and Dereferencing, Arrays and Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointers to an Array, Two-dimensional Arrays and Pointers, Pointers to Functions and Dynamic Memory Allocation.

UNIT–V

User-defined Datatypes: Structures- Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Typedef, Nesting of Structures, Arrays and Structures. Union, Enumeration Types.

Files: Using Files in C, Declaration of File Pointer, Working with Text Files, Character Input and Output, Working with Binary Files, Sequential Versus Random File Access, File Record. C Preprocessor Directives.

Text Books:

1 Pradip Dey and Manas Ghosh "Programming in C 2/e", 2nd Edition, Oxford University Press, 2012.
2 B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language", 2nd Edition (Paperback), Prentice Hall India, 2018.

Suggested Reading:

1 B.A.Forouzan and Hassan Afyouni "A Structured Programming Approach in C", 4th Edition, Cengage Learning, 2024.
2 E. Balaguruswamy, "Programming in ANSI C", 9th Edition, Tata McGraw-Hill, 2024.
3 Paul Deitel and Harvey Deitel, "C: How to Program", 9th Edition, Pearson, 2022.

Online Resources:

1 https://onlinecourses.nptel.ac.in/noc22_cs40/preview.
2 https://archive.nptel.ac.in/courses/106/105/106105171/.

26ADC01

ARTIFICIAL INTELLIGENCE FOUNDATIONS AND APPLICATIONS

Instruction	2L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: NIL

Course Objectives: This course aims to:

1 Provide a foundational understanding of Artificial Intelligence and its evolution
2 Introduce key AI subfields and their real-world applications across industries
3 Explain the impact of AI on society, including ethical and fairness considerations
4 Study emerging trends such as Generative AI and future directions

Course Outcomes: Upon completion of this course, students will be able to:

1 Understand the basic concepts and evolution of Artificial Intelligence
2 Illustrate major AI subfields and their functionalities
3 Develop and describe applications of AI in various domains
4 Elaborate ethical issues, bias, and societal impacts of AI systems
5 Demonstrate emerging trends such as Generative AI and their future implications

CO-PO Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	3	-	-	-	-	-	-	-	-	-	2	2	2
CO3	2	3	-	-	-	2	-	-	-	-	-	2	3	3
CO4	2	2	-	-	-	2	2	3	-	-	-	2	2	2
CO5	2	2	-	-	-	2	2	2	-	-	-	2	3	2

UNIT - I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Evolution of Artificial Intelligence: early developments and growth of AI. Definition and scope of AI. Core components of AI: Machine Learning, Pattern Recognition, Natural Language Processing, and Computer Vision. Concept of Artificial General Intelligence (AGI)

UNIT - II

AI SUBFIELDS AND TECHNOLOGIES

Introduction to AI subfields: **Computer Vision** - object detection, facial recognition, medical imaging, **Natural Language Processing** - text classification, translation, summarization, **Machine Learning** - classification, regression, clustering, recommendation systems, **Robotics**- types and components, and **Knowledge Engineering** - representation and reasoning.

UNIT - III

APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Applications of AI in various domains: **Healthcare** - diagnosis, drug discovery, **Finance** - risk management, trading, **Retail** - personalization, customer support, **Agriculture** -precision farming, **Education** - personalized learning, and **Transportation** -traffic management. Challenges in applying AI in real-world scenarios.

UNIT - IV

ETHICS, BIAS AND FAIRNESS IN AI

Ethics in AI systems. Types of bias and fairness issues. Transparency and explain ability. Accountability of AI systems. Privacy and data protection concerns. Security risks in AI systems.
Inclusivity, sustainability, robustness, and reliability.

UNIT – V

GENERATIVE AI AND FUTURE DIRECTIONS

AI in research and interdisciplinary domains. Introduction to Generative AI and its evolution. Emerging trends and future directions of Artificial Intelligence. Social implications and impact of AI.

Text Books:

1. *AI for Everyone: A Beginner's Handbook for Artificial Intelligence*, First Edition, Pearson India, 2023.

Suggested Reading:

1. Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Fourth Edition, Pearson, 2021.
2. Melanie Mitchell, *Artificial Intelligence: A Guide for Thinking Humans*, First Edition, Farrar, Straus and Giroux, 2019.

Web Resources:

1. Government of India, Press Information Bureau (PIB), YUVA AI for ALL Initiative Available: https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=2191334.
2. FutureSkills Prime (MeitY & NASSCOM), AI Learning Platform. Available: https://futureskillsprime.in.
3. India AI Mission (Government of India AI Initiative). Available: https://indiaai.gov.in

26CYC08

MATERIAL CHEMISTRY LAB

(Civil Engineering)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: This course aims to

1 Impart fundamental knowledge in handling the equipment/glassware and chemicals in chemistry laboratory.
2 Provide the knowledge in both qualitative and quantitative chemical analysis.
3 Get familiarized with the principles of various determination techniques.
4 Understand and apply the various instrumental methods to analyse the chemical compounds.
5 Interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes: At the end of the course, student will be able to

1 Identify the basic chemical methods to analyze the substances quantitatively & qualitatively.
2 Develop analytical thinking and problem-solving skills in identifying unknown samples.
3 Estimate the amount of chemical substances by volumetric analysis.
4 Calculate the concentration and amount of various substances using instrumental techniques.
5 Develop the basic drug molecules and polymeric compounds.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	2	-	-	-	-	2	1	2	1
CO2	3	3	2	2	-	2	-	-	-	-	2	1	3	1
CO3	3	2	3	2	-	2	-	-	-	-	2	1	2	2
CO4	3	2	2	2	-	2	-	-	-	-	2	1	2	2
CO5	3	2	3	2	-	2	-	-	-	-	2	2	2	1

List of Laboratory Experiments:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Determination of viscosity of sample oil by Ostwald's Viscometer.
3. Estimation of temporary, permanent and total hardness of water using EDTA solution.
4. Determination of Alkalinity in the given water sample.
5. Determination of concentration of given $KMnO_4$ solution by colorimetric Method.
6. Determination of concentration of given $K_2Cr_2O_7$ solution by colorimetric Method.
7. Estimation of amount of HCl conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids conductometrically using NaOH solution.
9. Estimation of amount of HCl potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution.
11. Preparation of Zinc Oxide Nanoparticles.
12. Determination of chemical oxygen demand (COD) of industrial waste water sample.
13. Determination of strength of cement (Chemical aspect).

Text Books

1. J. Mendham and Thomas, "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi, 6^{th} edition. 2017.

2. Senior practical physical chemistry by B. D. Khosla, V. C. Garg & A.Gulati, R. Chand & Co., New Delhi (2011).

Suggested Readings

1. Dr. Subdharani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2020.
2. S.S. Dara, "A Textbook on experiment and calculation in engineering chemistry", S. Chand and Company, 9th revised edition, 2015.

26CSC02

PROBLEM SOLVING AND PROGRAMMING USING C LAB

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisites: Basic high school mathematics.

Course Objectives: This course aims to

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.

Course Outcomes: After the completion of this course, the student will be able to

1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Analyze programs using arrays, structures and pointers.
4. Evaluate problems in a modular approach using functions.
5. Develop file operations with simple text data.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	1	1	1	-	-	-	-	-	1	-	1	2	1
CO2	3	2	1	2	-	-	-	-	-	-	-	2	3	2
CO3	3	2	1	2	-	-	-	-	-	-	-	2	3	2
CO4	3	2	1	2	-	-	-	-	-	-	-	2	3	2
CO5	3	1	-	1	-	-	-	-	-	-	-	2	3	2

1-Slightly, 2-Moderately, 3-Substantially

LABORATORY / PRACTICAL EXPERIMENTS:

1 Introducing to IDE Eg: Visual Editor, TurboC, DevC++, Visual Studio etc.,
2 Implement programs using arithmetic, relational, bitwise, conditional, logical, and ternary operators.
3 Implement programs using control statements (sequential, selection and iteration).
4 Implement programs using user defined functions and Recursion.
5 Implement Programs using one dimensional arrays.
6 Implement programs on two dimensional arrays with and without using functions.
7 Implement programs on String manipulation (with and without using string library functions).
8 Implement programs on sorting and searching using iteration and recursion. (Bubble Sort, Selection Sort, Linear Search, Binary Search)
9 Implement programs using pointers and dynamic memory allocation.
10 Implement programs using Structures.
11 Implement file handling programs (Modes, Operations, Access).

Text Books:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e", 2nd Edition Oxford University Press, 2012.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language", 2nd Edition (Paperback), Prentice Hall India, 2018.

Suggested Reading:

1. B.A.Forouzan and Hassan Afyouni "A Structured Programming Approach in C", 4th Edition, Cengage Learning, 2024.
2. E. Balaguruswamy, "Programming in ANSI C", 9th Edition, Tata McGraw-Hill, 2024.
3. Paul Deitel and Harvey Deitel, "C: How to Program", 9th Edition, Pearson. 2022.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

26MEC01

ROBOTICS AND DRONES LAB
(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction	1T + 2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Objectives: The objectives of this course are to:

1. Develop a fundamental understanding of robotics, Arduino programming, and electronic circuit interfacing used in autonomous systems.
2. Gain practical knowledge of interfacing various sensors such as ultrasonic sensors, IR sensors, and LiDAR sensors with microcontrollers for data acquisition in robotic and drone applications.
3. Acquire proficiency in controlling different types of actuators including servo motors, stepper motors, DC motors, and BLDC motors for robotic and drone movement.
4. Understand the structure, components, and working principles of drones, and develop the ability to assemble basic quadcopter system.
5. Apply basic computer vision techniques using Python and OpenCV for image processing tasks relevant to drone-based applications.

Outcomes: After completion of the course, students will be able to:

1 Understand the fundamentals of robotics, Arduino programming, and electronic interfacing required for autonomous systems.
2 Interface and utilize sensors such as ultrasonic, IR, and LiDAR sensors to collect and process environmental data for robotic and drone applications.
3 Demonstrate the ability to control various actuators including servo motors, stepper motors, DC motors, and BLDC motors for implementing robotic movements.
4 Assemble and understand the operation of drone systems including mechanical, electrical, and control components required for drone flight.
5 Apply Python and OpenCV techniques for basic image processing tasks such as RGB extraction, shape creation, and region of interest (ROI) extraction (or) to develop simple autonomous systems.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	1	2	2	1	2	2	2	1
CO2	2	3	2	3	2	1	1	1	1	1	2	3	3	2
CO3	2	2	3	2	2	1	1	2	1	1	2	2	2	2
CO4	2	2	3	2	2	1	1	3	2	2	2	2	3	2
CO5	2	2	2	2	3	1	1	1	2	1	3	3	3	2

Lab Exercises:

1 a. Interface Arduino with LEDs to do traffic light simulation

b. Design and implement a system to interface an Arduino board with a seven-segment LED display to show decimal digits from 0 to 9. The Arduino should be programmed to sequentially display each number with a fixed time delay between transitions.

2 a. Interface Arduino with Electronic Devices such as Push Button to control piezo buzzer.
b. Interface Arduino with Electronic Devices such as Potentiometer to control blinking time of LED

3 Interfacing Arduino with Ultrasonic Distance Sensor and Displaying Sensor Data on Serial Monitor.
4 Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor.
5 Implement a system using Arduino to control the precise movement of a Servo Motor.
6 Control and operate a Stepper Motor using Arduino for precise and sequential motion.
7 Construct a two-wheel robot using DC motors controlled by Arduino. Program the robot to: (i) Move forward with controlled acceleration (ii) Move backward with controlled deceleration.
8 Controlling a BLDC motor of a drone using a Servo Tester.
9 Attach a propeller to a BLDC motor and measure the wind speed using an Anemometer.

10	Measure the distance between an obstacle and the drone using a TF-Mini LiDAR Range Sensor.
11	Assemble the mechanical and electrical subsystems of a quadcopter drone by integrating frame arms, BLDC motors, ESCs, power distribution system, and connectors. Verify electrical continuity and correct motor-ESC connections.
12	Integrate drone control components including flight controller, radio receiver, GPS module, battery, and propellers. Study of Drone Take-off, Flight, and Landing Basics.
13	Open CV for Image Processing in Drones: (i) Extraction of RGB values of a pixel (ii) Creation of coloured shapes and saving images (iii) Extraction of Region of Interest (ROI).
14	Open-Ended Autonomous System Project.

Note:

Students shall complete any 10 out of the 14 experiments. The Experiment No. 14 (Open-Ended Project) is mandatory and carries 10 marks in CIE.

Text Books:

1. J. M. Hughes, *Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers*. Sebastopol, CA: O'Reilly Media, 2016.
2. S. Monk, *Programming Arduino: Getting Started with Sketches*. New York, NY: McGraw-Hill, 2022.
3. D. McGriffy, *Make: Drones: Teach an Arduino to Fly*. San Francisco, CA: Maker Media, 2016.

Suggested Reading:

1. https://www.geeksforgeeks.org/robotics-introduction/
2. https://dronebotworkshop.com/

26MBC02

COMMUNITY ENGAGEMENT

Instruction	2 Hours per week
Duration of SEE	Nil
SEE	50 Marks
CIE	
Credits	1

Course Objectives: The main Objectives of this Course are to:

1 Develop an understanding of rural life, culture, and socio-economic conditions.
2 Expose students to rural livelihoods, local economic systems, and entrepreneurship opportunities.
3 Familiarize students with rural institutions, governance mechanisms, and development programmes in India.
4 Promote community engagement, social responsibility, and experiential learning through field-based activities.
5 Enable students to analyse community issues and contribute to sustainable rural development solutions.

Course Outcomes: After the completion of this Course, Student will be able to:

1. Understand rural society, culture, and development issues.
2. Demonstrate empathy and social responsibility towards communities.
3. Analyse rural livelihood systems and economic activities.
4. Evaluate the role of rural institutions and government programmes.
5. Participate in community-based activities and suggest improvements.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	2	2	-	3	1	2	-	-	2	2	2	2
CO2	-	1	2	2	-	2	-	2	1	-	1	3	2	2
CO3	-	1	1	2	-	3	1	3	1	2	1	2	3	2
CO4	2	2	3	2	-	2	1	2	2	1	-	3	2	3
CO5	1	2	2	1	-	2	-	1	-	1	1	3	3	3

Module I Appreciation of Rural Society
Rural lifestyle and social structure, Caste and gender relations, Rural values and traditions, Rural infrastructure.

Module II Understanding Rural Economy and Livelihood
Agriculture and allied activities, Rural entrepreneurship, Non-farm livelihoods and artisans, Rural markets and credit systems, Farmer Producer Organizations (FPOs).

Module III Rural Institutions
Panchayati Raj system (Gram Sabha, Gram Panchayat), Self-Help Groups (SHGs), Role of NGOs in rural development

Module IV Rural Development Programmes
Overview of rural development in India, Key government schemes, Mahatma Gandhi National Rural Employment Guarantee (MGNREGA) Scheme, National Rural Livelihood Mission (NRLM), Pradhan Mantri Awas Yojana (PMAY), Swachh Bharat, Skill India, Ayushman Bharat.

Text Books:

1 Singh, Katar, "Rural Development: Principles, Policies and Management", 3rd Edition, Sage Publications, New Delhi, 2016.
2 Desai, Vasant, "Rural Development in India", 2nd Edition, Himalaya Publishing House, 2020.
3 Chambers, R., "Rural Development: Putting the last first", 1st Edition, Routledge, 2014.
4 Helen Sheil, "Growing and Learning in Rural Communities" 2nd Edition, 2024.

Suggested Readings & Journals:

1. Seth Appiah-Opoku, Usha Iyer-Raniga, "Contemporary Rural Development Programs", 1st Edition, 2025.

2. Journal of Rural development, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hyderabad.
3. Indian Journal of Social Work, Tata Institute of Social Sciences (TISS), Mumbai.
4. Manjeet Singh Nain. (2026). Editorial. Indian Journal of Extension Education, 62(2).
5. Kurukshetra Journal, Ministry of Rural Development, Government of India.

Online Resources:

1. https://www.rural.gov.in/
2. https://nirdpr.org.in/
3. https://sdgs.un.org/goals
4. https://onlinecourses.nptel.ac.in/e-learning
5. https://idronline.org/

SEMESTER –II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC05	Applied Vector Calculus and Differential Equations	3	1	-	3	40	60	4
2	26PYC05	Engineering Physics	3	-	-	3	40	60	3
3	26CEC01	Engineering Mechanics	3	1	-	3	40	60	4
4	26EGC01	Communicative English	2	-	-	3	40	60	2
PRACTICALS									
5	26PYC06	Engineering Physics Lab	-	-	3	3	50	50	1.5
6	26CSC38	Python Programming Workshop	-	-	3	3	50	50	1.5
7	26MEC41	Engineering Drawing	-	1	3	3	50	50	2.5
8	26MEC04	Engineering Workshop and 3D Printing	-	-	3	3	50	50	1.5
9	26EGC02	Communication Skills Lab	-	-	2	-	50	50	1
Total			**11**	**03**	**14**	**-**	**410**	**490**	**21**
Clock Hours Per Week: 28									

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**

CIE- Continuous Internal Evaluation **SEE - Semester End Examination**

26MTC05

APPLIED VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS

(For CIVIL)

Instruction	3L+1T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To develop skills in solving first-order differential equations using appropriate methods.
2. To extend the understanding of higher-order differential equations and their solution techniques.
3. To introduce Laplace transform techniques and their applications in solving differential equations.
4. To develop understanding of scalar and vector functions along with their physical interpretations.
5. To introduce and apply vector calculus concepts including line, surface and volume integrals.

Course Outcomes: Upon completing this course, students will be able to:

1. Solve first-order linear differential equations using appropriate methods.
2. Solve higher-order linear differential equations using standard techniques.
3. Apply Laplace transforms to solve differential equations effectively.
4. Apply vector differential operators to scalar and vector functions.
5. Evaluate line, surface and volume integrals using Green's, Gauss and Stoke's theorems.

CO-PO Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	2	2	1	-
CO2	3	2	1	1	1	-	-	-	-	-	2	3	1	-
CO3	3	3	2	2	2	-	-	-	-	-	2	3	1	-
CO4	3	3	2	2	1	-	-	-	-	-	2	3	1	-
CO5	3	3	2	2	2	-	-	-	-	-	2	3	1	-

UNIT-I:

First Order Ordinary Differential Equations: Exact differential equations, Differential Equations reducible to exact equations, Linear equation, Bernoulli's equation, Clairaut's equation, Orthogonal trajectories (Cartesian and polar curves) and LR circuits.

UNIT-II:

Higher Order Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding the Complementary function, Particular Integral and General solution. Method of variation of parameters, Solution of Cauchy's homogeneous linear equation and LCR circuits.

UNIT-III:

Laplace Transforms: Laplace Transform of Elementary functions, Linearity property, First Shifting property, Change of scale property. Laplace Transform of Periodic functions, Transforms of derivatives, integral's, Multiplication by t^n and division by t. Evaluation of Integrals by Laplace Transforms. Inverse Laplace transform of elementary functions, Inverse Laplace Transform by Method of partial fractions, Convolution theorem (Without proof) and related problems, Solution of Ordinary Differential Equations by Laplace Transform method.

UNIT-IV:

Vector Differential Calculus: Scalar and Vector point functions, operator Del, Del applied to scalar point function-Gradient, Directional derivative, Del applied to vector point function-Divergence, Curl, Solenoidal vectors and Irrotational vectors, Del applied twice to point functions.

UNIT-V:

Vector Integral Calculus: Line integral, circulation, work done by force, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stoke's theorem (without proof) and verification Gauss divergence theorem (without proof).

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

Suggested Reading:

1. N.P. Bali and Dr. Manish Goyal, "A text book of Engineering Mathematics", 9th edition, Laxmi
2. Publications, 2017.
3. R.K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016.

Online Resources:

Course Code	Course Name	Resource Link
26MTC05	Applied Vector Calculus and Differential Equations	1. https://nptel.ac.in/courses/111105160 [(Unit-I,II,IV&V: Week-6,7, 9, 10,11&12)] 2.https://nptel.ac.in/courses/111106139 [(Unit-III: Week-2,3,4,&5)]

26PYC05

ENGINEERING PHYSICS
(Civil & Mechanical)

Instruction	3LHours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of the course is to make the student

1. Acquire knowledge about physics of oscillations and rotational motion.
2. Understand the physical properties of crystalline and magnetic materials.
3. Aware of characteristic properties of dielectric and thermoelectric materials.
4. Familiarize with non-destructive testing techniques.

Course Outcomes: At the end of the course, the student will be able to

1. Analyse oscillatory systems using damping and resonance principles.
2. Understand and apply the concepts of rigid body dynamics.
3. Analyse crystal structures, defects, and characterization techniques.
4. Apply dielectric and magnetic material behaviour for engineering applications.
5. Recognize various non-destructive testing techniques and thermoelectric materials in engineering applications.

CO-PO Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	1	1	1	2	1	3	2
CO2	3	3	2	2	2	2	2	1	1	1	2	1	3	2
CO3	3	3	2	3	2	2	2	1	1	1	2	2	3	3
CO4	3	3	2	2	2	2	2	1	1	1	2	2	3	3
CO5	3	3	2	2	3	2	3	1	1	1	2	2	3	3

UNIT-I

Oscillations: Harmonic oscillator – Damped harmonic motion – over damped, critically damped and under damped oscillators – Logarithmic decrement, Relaxation time, Quality factor – Forced oscillations and resonance.

UNIT-II

Rigid body Dynamics: Definition of rigid body – Angular momentum and torque – Equation of motion for a rotating rigid body – Inertia tensor (qualitative) and its properties – Euler's equations and applications: law of energy conservation and law of conservation of angular momentum.

UNIT-III

Crystallography & Characterization Techniques: Crystal systems – Bravais lattices – Lattice planes – Miller indices – Bragg's law – Experimental determination of lattice constant of a cubic crystal by powder X-ray diffraction method – Structure of NaCl – Characterization Techniques : AFM, SEM, TEM.

Crystal Imperfections: Classification of defects – Point defects – Concentration of Schottky and Frenkel defects.

UNIT-IV

Dielectric Materials: Introduction – Dielectric polarization – Types of dielectric polarization (qualitative): electronic, ionic polarizations, orientation and space-charge polarizations – Frequency and temperature dependence of dielectric polarization – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

Magnetic Materials: Classification of magnetic materials: dia, para, ferro, anti-ferro and ferrimagnetic materials – Weiss molecular field theory – Domain theory – Hysteresis curve – Soft and hard magnetic materials.

UNIT-V

Thermoelectricity: Introduction – Seebeck effect – Thermocouple – Thermoelectric series – Peltier effect – Thomson effect – Thermoelectric power and generation – Figure of merit – Applications of thermoelectric materials –Thermoelectric cooling.

Non-Destructive Testing: Introduction to non-destructive testing (NDT) – Importance of NDT techniques – Destructive versus Non-Destructive techniques – Types of NDT techniques – Visual testing (direct and remote visual inspection) – Ultrasonic testing (UT) – Principle of UT – UT probes (normal beam probe, angle beam probe, transmitter-receiver probe) – UT inspection methods (pulse echo, transmission and angle beam pulse echo techniques) – Ultrasonic pulse echo testing – NDT advantages, limitations and applications.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, DhanpatiRai Publications, 2011.

Suggestd Reading:

1. R. Murugeshan and KiruthigaSivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, SciTech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

26CEC01

ENGINEERING MECHANICS

Instruction	3L+1THours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives: This course aims to

1. Understand the resolution of forces and to obtain resultant of all force systems.
2. Understand equilibrium conditions of static loads for smooth surfaces.
3. Understand the principles of friction and applications, and Analysis of simple trusses
4. Obtain centroid, centre of gravity for various regular and composite areas and bodies.
5. Obtain Moment of inertia for various regular and composite areas.

Course Outcomes: Upon completion of this course, students will be able to

1. Calculate the components and resultant of coplanar forces system.
2. Draw free body diagrams to analyze the forces in the given structure.
3. Understand the mechanism of friction and can solve friction problems and analyse simple trusses
4. Determine the centroid of lines, plane areas, composite areas and centre of gravity of bodies.
5. Determine moments of inertia of plane and composite areas.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	2	-	-

UNIT- I:

Resolution and Resultant of Force System: Assumptions – Principles of Mechanics, Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system

UNIT-II:

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems, Lami's theorem - applications. Problems on general case of coplanar force systems.

UNIT- III:

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge friction.

Analysis of Simple Trusses: Introduction to trusses, Assumptions, analysis of simple trusses using method of joints and method of sections.

UNIT- IV:

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappu's and its applications. Centroids of Volumes, Center of gravity of elementary and composite bodies.

UNIT- V:

Moment of Inertia: Definition of Moment of Inertia, Area Moment of Inertia, Polar Moment of Inertia, Radius of gyration, Transfer theorem, Moment of Inertia of elementary & composite areas.

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer's Engineering Mechanics, BS Publications,

Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

Suggested Reading:

1. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
2. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
3. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010.

E Resources:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://archive.nptel.ac.in/courses/112/106/112106180/

26EGC01

COMMUNICATIVE ENGLISH

(BE/B.Tech - Common to all Branches)

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Basic knowledge of English grammar and vocabulary and communicative abilities.

Course Objectives: The course is taught with the objectives of enabling the students to:

1. Improve their understanding of communication skills to apply in real life situations.
2. Equip themselves with Reading Comprehension strategies and texts and textuality
3. Enhance their writing skills through paragraphs, précis and essays by using cohesive devices for structural coherence.
4. Build tone and tonality for professional use through meaningful sentences.
5. Demonstrate knowledge of drafting formal reports to define, describe and classify the processes by following a proper structure.

Course Outcomes: After successful completion of the course the students will be able to:

1. Create the awareness of communication skills in life and use in real life situations.
2. Apply effective reading techniques through critical reading exercises to reading comprehension and to support lifelong learning.
3. Develop; independently write well-structured coherent paragraphs through précis writing.
4. Construct sentences clearly and comprehensively to write effective business letters and draft emails for a better professional communication.
5. Distinguish formal and informal reports and draft formal reports.

CO PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	2	2	2	3	3	3	1	2	1
CO2	-	-	-	-	1	2	2	1	1	2	2	1	3	1
CO3	-	1	-	-	-	2	2	1	1	2	1	1	3	1
CO4	-	1	-	-	-	1	2	2	2	2	2	2	3	2
CO5	-	1	-	1	1	2	2	2	2	2	2	2	3	2

UNIT-I:

Dynamics of Communication: Introduction to communication; Process of communication; Types of communication: verbal and non-verbal; Barriers to communication; Intrapersonal, Interpersonal communication; Johari Window. Listening, Speaking, Reading, Writing, Communication, Study skills & Literary Appreciation.

Vocabulary & Grammar: The concept of Word Formation - Root words, Use of prefixes and suffixes to form derivatives, Standard abbreviations. Construction of Sentences

Reading Task I: Rene Descartes' "*I think therefore, I am*"

UNIT-II:

Introduction to Reading: The Reading process, purpose, Analysis of different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice with Critical Reading passages

Vocabulary and Grammar: Use of Synonyms and Antonyms, Tenses.

Reading Task II: Bertrand Russell's" *Knowledge and Wisdom*" (Essay)

UNIT-III:
Introduction to Writing Skills: Paragraph Writing. – Structure and features of a paragraph; Précis writing

Vocabulary & Grammar: Use of Discourse Markers, Cohesion and Coherence in writing

Reading Task III: Rudyard Kipling's "*If"*

UNIT-IV:
Professional Writing Skills: Professional Communication: Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails.

Vocabulary and Grammar: Phrasal verbs, Subject-verb agreement in sentences

Reading Task IV: Chetan Bhagath's "*The Cut-off*"

UNIT-V:
Professional Writing Skills: Engineering Specific Input: Report writing – Importance, structure, elements & styles of formal reports; Writing a formal report.

Vocabulary and Grammar: Words often Confused, Common Errors.

Reading Task IV: *Nightfall in the City of Hyderabad* by Sarojini Naidu

Text Books:

1. Sanjay Kumar &PushpLata, "English Language and Communication Skills for Engineers", Oxford University Press, 2018.
2. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.

Suggested Readings:

1 Ashraf, M Rizvi, "Effective Technical Communication", Tata McGraw-Hill, 2006.
2 Michael Swan,"Practical English Usage", Oxford University Press, 4th Edition,2016.
3 Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice" 3rd Edition, Oxford University Press, 2015.
4 Communicative English and Employability Skills, Dr. B. Vijaya, Orient Blackswan, 2026

26PYC06

ENGINEERING PHYSICS LAB
(Civil & Mechanical)

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: The objectives of the course is to make the student

1. Apply the concepts of physics while conducting the experiments.
2. Learn the functioning of thermoelectric materials.
3. Understand the properties of magnetic and dielectric materials.
4. Capable of measuring mechanical properties of solids and liquids.
5. Understand the motion electrons in electric and magnetic fields.

Course Outcomes: At the end of the course, the student will be able to

1. Estimate the error in an experimental measurement.
2. Make use of thermoelectric materials in engineering applications.
3. Recall the physical properties of dielectrics and magnetic materials.
4. Find the mechanical properties of solids and liquids.
5. Demonstrate the motion of electrons in electric and magnetic fields.

CO-PO Articulation Matrix:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	–	3	–	2	–	1	1	2	1	1	3	2
CO2	2	2	3	2	2	2	3	2	2	2	2	2	3	2
CO3	3	2	–	3	2	2	–	1	1	2	1	2	3	3
CO4	3	3	–	3	2	2	–	1	2	2	2	2	3	3
CO5	3	3	–	3	3	2	–	2	2	2	2	1	3	2

List Of Experiments:

1.	Error Analysis :	Estimation of errors in the determination of time period of a torsional pendulum
2.	Flywheel :	Determination of moment of inertia of given flywheel
3.	Compound Pendulum :	Determination of acceleration due to gravity
4.	Young's Modulus :	Determination of Young's modulus of the given steel bar/wooden scale by non-uniform bending method
5.	Helmholtz's Resonator :	Determination of resonating volume of air and neck correction
6.	Melde's Experiment :	Determination of frequency of the electrically maintained vibrating bar/fork
7.	Viscosity of Liquid :	Determination of viscosity of a given liquid by oscillating disc method
8.	Dielectric Constant :	Determination of dielectric constant of given PZT sample
9.	M & H Values :	Determination of magnetic moment M of a bar magnet and absolute value H of horizontal component of earth's magnetic field
10.	B-H Curve :	Determination of hysteresis loss of given specimen
11.	Thermoelectric Power :	Determination of thermoelectric power of given sample
12.	e/m of an electron :	Determination of specific charge of an electron by J.J. Thomson method
13.	Ultrasonic Interferometer :	Determination of velocity of ultrasonic waves in water using Ultrasonic Interferometer

NOTE: A minimum of TWELVE experiments should be done.

26MEC41

ENGINEERING DRAWING
(Common to Mechanical and Civil Engineering)

Instruction	1T + 3D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Prerequisite: Nil

Course Objectives: This course aims to

1. Understand engineering drawing principles, standards, and conventions and develop proficiency in constructing conic sections for engineering applications.
2. Develop the ability to visualize and represent points and straight lines in different positions using the principles of orthographic projection.
3. Develop the ability to visualize and draw orthographic projections of plane surfaces and Solids in different orientations with respect to the reference planes.
4. Develop the ability to visualize, project, section, and develop engineering solids in different orientations with respect to the reference planes.
5. Develop the ability to visualize three-dimensional objects and represent them using isometric projection techniques.

Course Outcomes: Upon completion of this course, students will be able to

1. Apply engineering drawing principles and standards to construct conic sections accurately for engineering applications.
2. Understand orthographic projections of points and straight lines.
3. Construct and interpret orthographic projections of plane surfaces and Solids.
4. Draw projections of sectional solids and true shapes of sections, and develop the surfaces of common engineering solids accurately.
5. Create an isometric projections and views.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	1	2	1	1	1	2	1	1	2	1	1
CO2	3	2	1	1	2	1	1	1	2	1	1	2	1	1
CO3	3	2	2	1	2	1	1	1	2	1	1	2	1	1
CO4	3	2	3	1	2	1	1	1	2	1	1	3	1	1
CO5	2	1	3	1	3	1	1	1	2	1	1	3	1	1

List of Exercises:

1. Practice engineering drawing standards, drawing instruments, lettering techniques, and dimensioning conventions.
2. Construction of Conic Sections by General method.
3. Orthographic projection: Principles, conventions, Projection of points.
4. Projection of straight lines in simple position, inclined to one plane & both the reference planes (without traces and mid-point).
5. Projection of perpendicular planes.
6. Projection of solids in simple position.
7. Projection of solids with axis Inclined to one plane.
8. Sections of Prisms and Pyramids in simple position.
9. Development of the surfaces of a right regular prism and a cone in simple positions.
10. Isometric projections of regular solids.
11. Conversion of isometric views to orthographic views and vice-versa

Text Books:

1 N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishing House Pvt. Ltd., 55th Edition, 2025.
2 K.Venugopal and V. Prabhu Raja, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd, Revised edition, 2015.
3 3. Basanth Agrawal and C.M. Agrawal, "Engineering Drawing", McGraw-Hill Education (India) Pvt. Ltd, 2021.

Suggested Reading:

1 Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson Education, 2020.
2 K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications (India) Pvt. Ltd., 2021.

26CSC38

PYTHON PROGRAMMING WORKSHOP

(For Civil, Mechanical, EEE, ECE, ECE-EVL (VLSI), Chemical, Biotech)

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Basic Computer Skills, Interest in Problem Solving, Basic Mathematical Skills.

Course Objectives: This course aims to

1. Master the fundamentals of writing Python scripts.
2. Learn Python elements such as variables, flow controls structures, functions and modules.
3. Discover how to work with lists and sequence data, and files.

Course Outcomes: After the completion of this course, the student will be able to

1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to design and build the solutions.
3. Develop the solutions with modular approach using functions to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of Standard Template Libraries and modules to build file handling / Searching / sorting applications.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	1	1	-	-	-	-	-	2	1	2	1
CO2	3	3	3	1	1	1	-	-	-	-	2	2	3	2
CO3	3	3	3	1	2	1	-	-	-	-	2	2	3	3
CO4	3	3	3	1	1	1	-	-	-	-	2	2	3	2
CO5	3	3	3	1	2	1	-	-	-	-	2	2	3	3

1-Slightly, 2-Moderately, 3-Substantially

Laboratory / Practical Experiments:

1. Explore various Python Program Development Environments. eg: Vscode, IDLE, PyCharm, anaconda etc.,
2. Design Flowcharts using raptor / draw.io tools.
3. Simple scripts to demonstrate the use of various data types and operators.
4. Demonstrate the use of control structures.
5. Experiments using Comprehensions with List, Dictionary, Set.
6. Implementation using Functions, Lambda functions and parameter passing.
7. Experimentation with Arrays using array and numpy modules.
8. Experiments using Searching and Sorting techniques.
9. Simple scripts to demonstrate the use of built-in modules.(Ex: math, random).
10. Demonstration of File Handling.

Text Books:

1. Jeeva Jose, "Taming Python by Programming", 2nd Edition, 2019, Khanna Book Publications.
2. Reema Thareja, "Python Programming", 1st Edition, 2017, Oxford Press.

Suggested Reading:

1. Zed A. Shaw, “Learn Python3 the Hard Way”, 1st Edition, 2018, Pearson Education Inc.
2. R.S. Salaria, “Programming in Python”, 1st Edition, 2024, Khanna Publishing House.
3. Yashavant Kanetkar and Aditya Kanetkar, “Let Us Python”, 1st Edition, 2019, Edition, BPB Publications.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_cs01/preview.
2. https://www.coursera.org/specializations/python.
3. https://www.python.org.
4. https://www.visual-paradigm.com/tutorials/decision-table-in-action.jsp.

26MEC04

ENGINEERING WORKSHOP & 3D PRINTING

(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Nil

Course Objectives: This course aims to:

1. Give a feel of Engineering Practices and develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive and team work attitude to get things right the first time.
3. Provide basic knowledge of steel, plastic, composite, and other materials for suitable applications.
4. Study of principle and hands on practice on techniques of fabrication, manufacturing, and allied skills.
5. Advance important, hard and pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: Upon completion of this course, students will be able to

1 Students will be able to fabricate a square tray and perform a lap joint on mild steel using proper marking, , welding, and finishing techniques.

2 Apply house-wiring techniques to construct and verify single-point, series, parallel, and staircase circuits.

3 Apply pipe fitting techniques to thread, assemble, and verify GI pipe systems as per given diagrams.

4 Perform 3d modeling using solid works software and pre-processing operations on STL files for 3D printing, also understand reverse engineering process.

5 Conceptualize and produce simple device/mechanism of their choice.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	-	-	1	-	-	-	1	2	3	2
CO2	1	-	1	-	-	-	-	-	-	-	1	1	2	2
CO3	1	-	1	-	-	1	-	-	-	-	1	2	3	3
CO4	1	-	1	-	-	1	-	-	-	-	1	2	3	3
CO5	2	2	2	1	3	1	1	1	2	-	2	2	3	3

Lab Experiments

Group 1: Workshop Practice

1 To make a square tray from the given sheet metal
2 Fabricate a funnel from the given sheet metal and join it using soldering.
3 Wiring of Single Light Point and Socket with Switches, and Series–Parallel Connection of Two Light Points with Verification.
4 Stair case wiring of one light point controlled from two different places independently using two 2way switches.

5 To make external threads for GI/uPVC pipes using die and connect the GI/uPVC pipes as per the given diagram using taps, couplings, and bends.
6 Assemble GI/uPVC pipes as per the diagram using fittings, install a shower, tap, and valves, and demonstrate operation with a water connection.

Group 2: Additive Manufacturing /3D Printing

1. Introduction to Additive manufacturing and modeling Software
2. To create a 3D CAD model (Door Bracket and Door handle) using modeling software.
3. To perform preprocessing operations and print a door bracket model using an extruder type 3D printer.
4. To create a 3D CAD model using Reverse engineering.
5. To demonstrate Engraving, Drilling and Cutting operations on printed circuit boards using CNC PCB Mate.
6. To design an innovative component using the CAD software/print the selected innovative component using a 3D printer.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Sabrie Soloman , "3D Printing & Design ", 1st edition, Khanna Publishing House,2020

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology.
2. Oliver Bothmann, 3D Printers: A Beginner's Guide, January 1, 2015.

26EGC02

COMMUNICATION SKILLS LAB

(BE/B.Tech - Common to all Branches)

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Basic Knowledge of English Communication.

Course Objectives: This course will introduce the students

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation through computer-aided multi-media instruction.
2. To the significance and application of word stress and intonation.
3. To sufficient practice in listening to English spoken by educated English speakers in different socio-cultural and professional settings.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to use language appropriately, to discuss in groups and make presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Produce speech with clarity and confidence using correct word stress, and intonation.
3. Achieve improved ability to listen, understand, analyse, and respond to English spoken in various settings.
4. Determine the context and speak appropriately in various situations.
5. Design effective posters collaboratively through creative decisions, give presentations, and efficiently participate in Group discussions.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	1	-	1	1	2	1
CO2	-	-	-	-	-	1	-	1	2	-	1	1	2	1
CO3	-	-	-	-	-	1	1	1	2	-	1	1	3	1
CO4	1	1	1	1	1	1	2	2	3	-	1	2	3	2
CO5	-	1	1	1	1	2	2	2	3	1	2	2	3	2

Exercises

Computer-Aided Language Learning Lab

1. **Introduction to English Phonetics**: Introduction to English Phonetics and organs of speech.
2. **Sound System of English**: Speech sounds- Vowels and Consonants - Basic phonetic transcription practice.

3. **Syllable Division and Word stress**: Introduction to syllables- structure of syllables - Rules of word stress.
4. **Intonation**: Types of Intonation, Practice in Articulation – MTI – Common Errors in pronunciation.
5. **Listening Skills**: understanding Listening- types of listening- Practice in Listening comprehension texts.

Interactive Communication Skills Lab

1. **Role Play -** Practicing the nuances of situational language, simulating the real-world conversations in a designed environment.
2. **Group Discussions -** Understanding the Dynamics and techniques of a Group Discussion, and Non-Verbal Communication.
3. **Debate -** Learning speaking dynamics in a formal discourse, discussion and oral addresses.
4. **Poster Presentation –** Working on a Theme, Poster preparation and presentation.
5. **Public Speaking –** Speaking with confidence and clarity in different contexts on various issues.

Text Books:

1. T Balasubramanian, "A Textbook of English Phonetics for Indian Students", Macmillan, 2nd Edition, 2017.
2. J Sethi et al., "A Practical Course in English Pronunciation (with CD)", Prentice Hall India, 2005.
3. Priyadarshi Patnaik, "Group Discussions and Interview Skills", Cambridge University Press Pvt. Ltd., 2nd Edition, 2023.
4. Aruna Koneru, "Professional Speaking Skills", Oxford University Press, 2018.

Suggested Reading:

1. "English Language Communication Skills – Lab Manual cum Workbook", Cengage Learning India Pvt. Ltd., 2022.
2. KN Shoba& J. Lourdes Javani Rayen."Communicative English – A workbook", Cambridge University Press, 2019.
3. Sanjay Kumar& Pushp. Lata. "Communication Skills: A Workbook. Oxford University Press", 2019.
4. Veerendra Mishra et al. "English Language Skills: A Practical Approach", Cambridge University Press, 2020.

Suggested Software:

1. K-VAN Multi-Media Language Lab
2. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
3. Digital All
4. Orell Digital Language Lab (Licensed Version).

OPEN ELECTIVES

(Offered by Civil Engg. Department to other Departments)

Sl. No.	Code	Subject Name	Semester
1	26CE O01	Infrastructure for Smart Cities	Even semester
2	26CE O02	Disaster Risk Reduction and Management	Odd semester
3	26CE O03	Green Buildings for Sustainable Infrastructure	Odd semester
4	26CE O04	Project Planning and Management	Even semester
5	26CE O05	Intelligent Transportation Systems	Odd semester
6	26CE O06	Environmental Pollution Management	Even semester

26CEO01

INFRASTRUCTURE FOR SMART CITIES

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To enable the students to

1. Comprehend the Necessity of Infrastructural Development for Smart Cities.
2. Illustrate the Components and Planning Aspects of a Smart City.
3. Outline Smart Transportation Systems for Smart Cities.
4. Summarize the Significance of Disaster Resilient Infrastructure in Smart Cities.
5. Review Policies and Implementation of Smart Cities at National and Global Perspectives.

Course Outcomes: At the end of the course, Student will be able to

1. Understand the necessity of infrastructural development for smart cities.
2. Illustrate the components and planning aspects of a smart city.
3. Outline smart transportation systems for smart cities.
4. Summarize the significance of disaster resilient infrastructure in smart cities.
5. Review policies and implementation of smart cities at national and global perspective.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	-	-	-	-	-	2	-	3
CO2	2	-	-	-	-	1	-	-	-	-	-	2	-	3
CO3	2	-	-	-	3	1	-	-	-	-	-	2	-	3
CO4	2	3	-	-	3	1	-	-	-	-	-	2	-	3
CO5	2	-	-	-	-	1	-	-	-	-	3	2	-	3

UNIT I

Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment

UNIT II

Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security.

UNIT III

Intelligent transport systems: Connected vehicles, autonomous vehicles, GPS, Navigation system, traffic safety management, mobility services, E-ticketing.

UNIT IV

Disaster resilient Infrastructure: Electricity, sanitation and water supply systems, fire hazard management, earthquake resilient structures, ICT tools.

UNIT V

Infrastructure Management: System and Policy for Smart city, integrated infrastructure management systems,

worldwide policies for smart city, Government of India - policy for smart city, Smart cities in India, Case studies of smart cities.

Text Books:

1. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany (ISBN: 0-87395-678-8)
2. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science

References:

1. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science.
2. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines (1).pdf
3. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988 5. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ar12/preview
2. http://acl.digimat.in/nptel/courses/video/105105160/L01.html

26CE O02

DISASTER RISK REDUCTION AND MANAGEMENT

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To enable the students to

1. To learn about the types, causes, impacts and management concept of disaster.
2. To learn about the disaster management cycle and early warning systems
3. To make the students become aware of stress and trauma management during a disastér.
4. To identify the role of technology and institutional framework behind disaster management in India.
5. To identify the structural and non-structural measures of disaster mitigation and learn about the provisions of Disaster management Act.

Course Outcomes: Upon completion of this course, the student will be able to,

1. Explain the fundamental concepts of disaster management.
2. Demonstrate the principles and practices of disaster risk reduction management.
3. Identify stress and its management during disaster.
4. Outline institutional frame work at different levels of administration.
5. Evaluate disaster management study including data search, analysis and presentation as a case study.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO2	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO3	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO4	2	-	-	-	2	3	-	-	-	-	-	1	-	-
CO5	2	-	-	-	-	3	-	-	-	-	-	1	-	-

UNIT I

Fundamental concepts in disaster management: Hazard and disaster-concepts, vulnerability and risk, Hazard and disaster type – Natural, Water- related, pandemic and Human induced hazards disasters. Causes and Impacts of disasters – Impacts on natural eco systems: physical, psychological and social impact. Disaster and financial resilience. Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance)

UNIT II

Disaster Management Cycle: Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness. Disaster risk reduction (DRR). Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards and Early warning systems

UNIT III

Disaster Impacts Management: Trauma and stress management, First aid and emergency procedures Awareness generation strategies for the community on safe practices in disaster (as per regional significance)

UNIT IV

Institutional framework of disaster management in India: NDMA-SDMA, NDRF, civic volunteers, and NIDM. Phases of disaster/risk management and post-disaster responses. Compensation and insurance Applications of remote sensing & GIS in disaster management. Components of disaster management. Preparedness of rescue and relief, mitigation, rehabilitation & reconstruction. Institutional frame work of disaster management in India

UNIT V

Capacity building for disaster/damage mitigation: Structural and Nonstructural measures forcapacity building for disaster/damage mitigation. Disaster risk reduction strategies and national disaster management guidelines. Disaster management Act -2005. Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

Text Books:

1. Singh, R. (2017), "Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami". Horizon Press publications.
2. Taimpo (2016), "Disaster management and preparedness". CRC Press Publications

Suggested Reading:

1. Nidhi, G.D. (2014), "Disaster management preparedness" .CBS Publications Pvt. Ltd.
2. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S. (2013), "Flood Disaster Risk Management-CBS Publications Pvt Ltd.
3. Singh, R. (2016), "Disaster management Guidelines for Natural Disasters" Oxford University PressPvt. Ltd

E Resources:

1. https://nptel.ac.in/courses/124107010
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

26CE O03

GREEN BUILDINGS FOR SUSTAINABILE INFRASTRUCTURE

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To enable the students

1. To understand the concepts of green buildings.
2. To remember the quality and uses of green building materials.
3. To acquire the concepts of design and construction of green buildings.
4. To remember and understand the policies and rating systems of green building.

Course Outcomes: After the completion of the course, the student will be able to:

1. Identify green building and green building materials.
2. Make use of different rating agencies to classify the type of building.
3. Analyze sustainability and its implications for the practice of engineering.
4. Evaluate the potential of the alternative construction materials for sustainability.
5. Examine the green building rating systems and its contribution to sustainability.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	1	1	3	-	-	-	-	2	-	3
CO2	2	-	-	-	-	1	3	-	-	-	-	2	-	3
CO3	2	-	-	-	1	1	3	-	-	-	-	2	-	3
CO4	2	-	-	-	-	1	3	-	-	-	-	2	-	3
CO5	2	-	-	-	1	1	3	-	-	-	-	2	-	3

UNIT-I

Course Syllabus Green Building: Concept of Green building, Principles of green buildings, Eco-friendly materials, Certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED).

UNIT-II

Green Building Materials: Green Building Materials and Equipment in India, what are key requisites for Constructing a Green Building, Important Sustainable features for Green Building.

UNIT-III

Building Services: Fire protection – classes of fire and causes, development of fire, fire resisting materials, means of escape, Standing Fire Advisory Council norms. Water supply -Water distribution and plumbing fixtures.

Applications in the Built Environment: Concepts of green buildings, climate responsive building - Reduction of energy consumption, direct and indirect methods - Reduction of water consumption, direct and indirect methods - Carbon footprint and eco footprints of buildings - New concepts and trends in green buildings,

national and international.

UNIT-IV

Sustainability: The Concept of Sustainability; Definition of Sustainability, Dimension of Sustainability. Three Pillars of Sustainability, Principles of Sustainability - 5R, Construction Materials Resource Efficiency, Operational Reuses of the Construction Materials, Sustainability Goals for construction Industry.

UNIT-V

Sustainability in Built Environment: Environmentally sensitive design, low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings.

Books and Materials Text Books:

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5th edition, 1994.
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7th edition, 2013.

Reference Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Bradley A. Striebig, Adebayo A. Ogundipe and Maria Papadakis, Engineering Applications in Sustainable Design and Development, 1st edition, 2016.
3. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.

E Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102195/
2. https://archive.nptel.ac.in/courses/124/107/124107011/

26CE O04

PROJECT PLANNING AND MANAGEMENT

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To enable the students to

1. The discipline of project and programme management, within an overall appreciation of the nature and purpose of projects.
2. The principles and practice of project planning, design, preparation, and appraisal techniques for projects in a development context.
3. The theory and practice of management skills for project and programme management, focusing particularly on 'hard' and 'soft' skills for successful project implementation.

Course Outcomes: After the completion of the course, the student will be able to:

1. After the completion of the course, the student will be able to:
2. Identify project characteristics and various phases of a project.
3. Illustrate project organization, staffing and feasibility of projects.
4. Apply the techniques of Project planning, scheduling and Execution Control.
5. Evaluate Resources, Budget, Claims and Disputes.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	-		-	2	-	3	-	2	-	3
CO2	2	3	-	-	-		-	-	-	3	-	2	-	3
CO3	2	3	-	-	-		-	-	-	3	-	2	-	3
CO4	2	2	-	-	-	3	-	-	-	3	2	2	-	3
CO5	2	2	-	-	-	3	-	2	-	3	2	2	-	3

UNIT-I

Project Management: Overview of Project Management, Concepts and Definitions. Project manager and his responsibilities. Types of projects, various stages of projects, Organizational structures used in project management. Management Functions and staffing.

UNIT-II

Project Planning: Time planning, Contents of Project plan, planning process, Work breakdown structure, process mapping. Project Budgeting: Financial Projections, time value of money, cost of capital, capital investment decisions.

UNIT-III

Scheduling Techniques: Bar Charts, CPM & PERT: Time estimate- Optimistic time estimate, Most likely time estimate, Pessimistic time estimate & Expected time. Project Scheduling, Network Analysis, Cost- Time Analysis in Network Planning, Float - Total float, free float.

UNIT-IV

Monitoring and Controlling: Plan monitor control cycle, data collection and reporting, Project control. Working with stakeholders.

UNIT-V

Conflict Management: claims and Disputes- Source of claim, Claim Management, Dispute resolution, Arbitration and its advantages, Project closure.

Text Books:

1. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015.

2. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Reference Books:

1. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
2. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006.
3. Angerame, Mike. Engineering & construction project management. Denver, Colo: Hampton Group, 2002.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104161/
2. https://archive.nptel.ac.in/courses/110/104/110104073/

26CE O05

INTELLIGENT TRANSPORTATION SYSTEMS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To enable the students to

1. To understand the fundamentals of ITS.
2. To understand the role and application of data collection techniques in modern transportation systems.
3. To Understand the processes involved in information management and the operation of Traffic Management Centres (TMC).
4. Gain detailed knowledge of various functional areas within ITS.
5. Evaluate the implementation and impact of ITS programs in both developed and developing countries, recognizing global trends and challenges.

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

1. Outline the fundamental components of ITS.
2. Demonstrate the ability to identify various data collection techniques used in ITS.
3. Understand the telecommunications and information management in ITS.
4. Gain in-depth knowledge of the functional areas within ITS.
5. Evaluate the different user needs and services provided by ITS.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	1	3	-	-	-	-	2	-	3
CO2	2	2	-	-	-	1	3	-	-	-	-	2	-	3
CO3	2	2	-	-	-	1	3	-	-	-	-	2	-	3
CO4	2	2	-	-	-	1	3	-	-	-	-	2	-	3
CO5	2	-	-	-	-	1	3	-	-	-	-	2	-	3

UNIT I

Introduction to ITS: Definition of ITS and identification of ITS objectives, objectives and goals of ITS, historical background, evolution and development of ITS, benefits of ITS, economic, environmental, and social benefits.

UNIT II

ITS Data Collection Techniques: Detectors, types of detectors and their applications; Automatic Vehicle Location (AVL), technology and usage; Automatic Vehicle Identification (AVI), systems and implementation; Geographic Information Systems (GIS), role in ITS; video data collection, techniques and importance.

UNIT III

Telecommunications in ITS: Importance of telecommunications in the ITS system, role and necessity of telecommunications, information management, data collection, storage, and dissemination; Traffic Management Centres (TMC), functions and operations; vehicle – roadside communication, methods and technologies; vehicle positioning system, GPS and other positioning technologies.

UNIT IV

ITS Functional Areas: Advanced Traffic Management Systems (ATMS) concepts and components; Advanced Traveler Information Systems (ATIS), features and benefits; Commercial Vehicle Operations (CVO) systems and management; Advanced Vehicle Control Systems (AVCS), safety and control mechanisms; Advanced Public Transportation Systems (APTS), enhancing public transport efficiency; Advanced Rural Transportation Systems (ARTS), ITS applications in rural areas.

UNIT V

ITS Applications and Global Perspective: ITS user needs and services, travel and traffic management, public

transportation management, electronic payment systems, commercial vehicle operations, emergency management, advanced vehicle safety systems, information management, automated highway systems, concepts of vehicles in platoons, integration of automated highway systems, ITS programs in the world, overview of ITS implementations in developed countries, ITS in developing countries.

Textbooks:

1. Ghosh, S., Lee, T.S. Intelligent Transportation Systems: New Principles and Architectures, CRC Press, 2000.
2. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.

Reference Books:

1. Karl B. Schnelle, Jr. and Charles A. Brown, Air Pollution Control Technology Handbook, CRC Press, 1st Edition, 2001.
2. Air Pollution by Jeremy Colls, SPON Press, 2nd Edition, 2003.
3. Seinfeld, J.H., Pandis, S.N., Atmospheric Chemistry and Physics, John Wiley, 2006.

E Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ce14/preview
2. https://www.nptelvideos.com/video.php?id=1944&c=11

26CE O06

ENVIRONMENTAL POLLUTION MANAGEMENT

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: To enable students to

1. Knowledge of natural systems which make life possible on Earth.
2. An awareness of the need to manage natural system.
3. An understanding of sustainable development to meet the needs of the present, without compromising the ability of future generations to meet their own need.
4. A sense of responsibility and concern for the welfare of the environment and all organism.
5. A sound basis for further study, personal development and participation in local and global environmental concerns.

Course Outcomes: After the completion of the course, the student will be able to:

1. Identify water pollution sources, types and treatment methods.
2. Apply knowledge on Prevention and control of air pollution.
3. Inspect sources, effects and mitigation methods of noise pollution.
4. Examine soil pollution sources, effects and control measures.
5. Develop Environmental management plan to minimize environmental pollution.

CO-PO Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	1	3	-	-	-	-	2	-	3
CO2	2	2	1	-	-	1	3	-	-	-	-	2	-	3
CO3	2	2	1	-	-	1	3	-	-	-	-	2	-	3
CO4	2	2	-	-	-	1	3	-	-	-	-	2	-	3
CO5	2	-	-	-	-	1	3	-	-	-	-	2	-	3

UNIT-I:

Water pollution: Introduction - Sources and types of water pollutants; Physical, Chemical and Biological properties; Ground water - Surface water – seawater, Estuaries. Impacts of water pollution on environment; Water Quality standards (Drinking and Industrial): IS code, CPCB, EPA and WHO - water treatment - physical, chemical and biological. Water Pollution Prevention and Control Act, 1974.

UNIT-II

Air pollution: Structure and composition of atmosphere – classification, sources and effects of air pollution; Environmental issues: Acid rain, global warming and ozone depletion, Air Quality Standards: CPCB, EPA and WHO, Air Quality Index (AQI), Prevention and control of air pollution particulate control – settling chamber, scrubber, bag filter, cyclones electrostatic precipitators. Gaseous emission control methods. Air pollution prevention and control Act 1981.

UNIT-III

Noise Pollution: Noise Pollution Basics of acoustics- propagation of indoor and outdoor sound- noise profiling effects of noise – measurement, index and mitigation methods- health effects of noise. Noise Standards: CPCB and WHO. Noise barrier design.

UNIT-IV

Soil Pollution: Sources, soil mineralogy, organic and inorganic pollutants - types and effects of pollutants on plants, soil pollution control measures - soil microbes and function, bioremediation.

UNIT-V

Environmental management: Environmental impact assessment and statement; Government strategies in pollution control: subsides, polluter pays principle and regulations; Sources of environmental information and regulations; Sustainable development and environmental protection.

Text Books:

1. C. S. Rao, Environmental Pollution Control Engineering, 3rd Edition, New Age International Pvt Ltd, 2018.
2. Rao, M. N and H.V.N. Rao, Air Pollution, Tata McGraw – Hill Publishing Company Limited. New Delhi, 2017.

Reference Books:

1. H.S Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, Indian Edition, McGraw Hill Education (India) Pvt Ltd, 2014.
2. De Nevers, N., Air Pollution Control Engineering, 3rd edition, Waveland Press Inc 2017.
3. Sagar Pal Singal, Noise Pollution and Control Strategy, 2nd Edition, Alpha Science International Ltd, 2005.

E Resources:

1. https://archive.nptel.ac.in/courses/123/105/123105001/
2. https://archive.nptel.ac.in/courses/103/107/103107215/