

JNTUH UNIVERSITY COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY
HYDERABAD
B.Tech. in CIVIL ENGG.
COURSE STRUCTURE & SYLLABUS (R25 Regulations)
Applicable from AY 2025-26 Batch

I Year I Semester (25 Hours)

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Matrices and Calculus	3	1	0	4
2	BSC	Engineering Physics	3	0	0	3
3	CSC	C Programming and Data Structures	3	0	0	3
4	MEC	Computer Aided Engineering Graphics	2	0	2	3
5	MEC	Engineering Workshop	0	0	2	1
6	HSC	English for Skill Enhancement	3	0	0	3
7	BSC	Engineering Physics Laboratory	0	0	2	1
8	CSC	C Programming and Data Structures Laboratory	0	0	2	1
9	HSC	English Language and Communication Skills Laboratory	0	0	2	1
10	MC	Induction Program				
		Total Credits	14	01	10	20

I Year II Semester (27 Hours)

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2	BSC	Applied Chemistry	3	0	0	3
3	ESC	Basic Electrical and Electronics Engineering	3	0	0	3
4	DC	Engineering Geology and Building Materials	3	0	0	3
5	DC	Geology and Building Materials Testing Laboratory	0	0	2	1
6	DC	Engineering Mechanics	3	1	0	4
7	BSC	Chemistry Laboratory for Engineers	0	0	2	1
8	CSC	Python Programming Laboratory	0	1	2	2
9	ESC	Basic Electrical Engineering Laboratory	0	0	2	1
10	MC	NSS	0	0	2	0
		Total Credits	15	2	10	21

II YEAR I SEMESTER(25 Hours)

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Probability and Statistics	3	0	0	3
2	DC	Building Planning and Construction	3	0	0	3
3	DC	Strength of Materials	3	0	0	3
4	DC	Surveying and Geomatics	3	0	0	3
5	DC	Fluid Mechanics	3	0	0	3
6	BSC	Computational Mathematics Laboratory	0	0	2	1
7	DC	Computer Aided Building Drafting Laboratory	0	0	2	1
8	DC	Strength of Materials Laboratory	0	0	2	1
9	DC	Surveying and <u>Geomatics</u> Laboratory	0	0	2	1
10	SDC	Design Thinking Laboratory	0	0	2	1
		Total Credits	15	0	10	20

II YEAR II SEMESTER(27 Hours)

S. No.	Course Code	Course Title	L	T	P	Credit s
1	DC	Concrete Technology	3	0	0	3
2	DC	Advanced Strength of Materials	3	0	0	3
3	DC	Environmental Engineering	3	0	0	3
4	DC	Hydraulics and Hydraulic Machinery	3	0	0	3
5	DC	Basic Structural Analysis	2	0	0	2
6	DC	Innovation and Entrepreneurship	2	0	0	2
7	DC	Environmental Engineering Laboratory	0	0	2	1
8	DC	Concrete Technology Laboratory	0	0	2	1
9	DC	Hydraulics and Hydraulic Machinery Laboratory	0	0	2	1
10	SDC	Digital Surveying and GIS Laboratory	0	0	2	1
11	MC	Environmental Science	1	0	0	0
12	DC	Real Time / Field Based Project	0	0	2	1
		Total Credits	17	0	10	21

III YEAR I SEMESTER(26 Hours)

S. No.	Course Code	Course Title	L	T	P	Credit s
1	DC	Reinforced Concrete Design	3	0	0	3
2	DC	Soil Mechanics	3	0	0	3
3	DC	Estimation , Quantity Surveying & Valuation	2	0	0	2
4	PE	Professional Elective-I	3	0	0	3
5	OE	Open Elective-I	2	0	0	2
6	DC	Water Resources Engineering	3	0	0	3
7	DC	Geotechnical Engineering Laboratory	0	0	2	1
8	DC	Advanced English Communication Skills Laboratory	0	0	2	1
9	SDC	Project Management Software Laboratory	0	0	2	1
10	MC	Gender Sensitization Lab*/ Human Values and Professional Ethics*	1	0	0	0
11	MC	Yoga	0	0	2	0
		Total Credits	18	0	08	20

***Note: For the courses Gender Sensitization Lab and Human Values and Professional Ethics-** one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Constitution of India will be conducted in the following week.

III YEAR II SEMESTER(25 Hours)

S. No	Course Code	Course Title	L	T	P	Credits
1	DC	Foundation Engineering	3	0	0	3
2	DC	Design of Steel Structures	3	1	0	4
3	MS	Business Economics and Financial Analysis	3	0	0	3
4	PE	Professional Elective-II	3	0	0	3
5	OE	Open Elective – II	2	0	0	2
6	DC	Transportation Engineering	3	0	0	3
7	DC	Computer Aided Design Laboratory	0	0	2	1
8	DC	Transportation Engineering Laboratory	0	0	2	1
9	SDC	Building Information Modelling Laboratory	0	0	2	1
10	MC	Indian Knowledge System	1	0	0	0
		Total Credits	18	1	06	21

IV YEAR I SEMESTER (25 Hours)

S. No.	Course Code	Course Title	L	T	P	Credits
1	DC	Railways, Waterways and Airport Engineering	3	0	0	3
2	DC	Prestressed Concrete	3	0	0	3
3	MS	Fundamentals of Management	3	0	0	3
4	PE	Professional Elective-III	3	0	0	3
5	PE	Professional Elective – IV	3	0	0	3
6	OE	Open Elective – III	2	0	0	2
7	DC	Civil Engineering Software Laboratory	0	0	2	1
8	DC	Computational Laboratory	0	0	2	1
9	DCP	Industry Oriented Mini Project/ Summer Internship	0	0	4	2
		Total Credits	17	0	08	21

IV YEAR II SEMESTER(34 Hours)

S. No.	Course Code	Course Title	L	T	P	Credits
1	PE	Professional Elective – V	3	0	0	3
2	PE	Professional Elective – VI	3	0	0	3
3	DCP	Project Work	0	0	28	14
		Total Credits	6	0	28	20

***Note:** Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information.

Professional Elective - I

1	Indeterminate Structural Analysis
2	Air Pollution and Control Measures
3	Green Building Technologies
4	Advanced Construction Technologies
5.	Advanced Concrete Technology

Professional Elective – II

1	AI and ML Applications in Civil Engineering
2	Remote Sensing and GIS
3	Construction Planning and Management
4	Industrial Waste Water Treatment
5	EIA and Life Cycle Assessment

Professional Elective- III

1	Smart Cities and Urban Innovation
2	Big Data Analytics in Civil Engineering
3	Ground Improvement Techniques
4	Ground Water Hydrology
5	Pre-Engineered Buildings

Professional Elective- IV

1	Solid and Hazardous Waste Management
2	IoT Applications in Civil Engineering
3	Intelligent Transportation Systems
4	Elements of Earthquake Engineering
5	Hydraulic Structures

Professional Elective- V

1	Pavement Engineering
2	Digital Image Processing in Civil Engineering
3	Urban Hydrology
4	Earth Retaining Structures
5.	Finite Element Analysis

Professional Elective- VI

1	Repair and Rehabilitation of Structures
2	Highway Construction and Practices
3	Sustainable Engineering Technologies
4	Climate Change Adaptation and Mitigation
5	Rock Mechanics

OPEN ELECTIVES**Open Elective- I**

1	Disaster Management
2	Low Carbon Materials and Green Buildings

Open Elective- II

1	Building Science and Technology
2	Environmental Impact Assessment

Open Elective- III

1	Road Safety Engineering
2	Building Services Engineering

Pre-requisites: Mathematical Knowledge at pre-university level	
Objectives:	
To learn	
<ul style="list-style-type: none"> • Applying basic operations on matrices and their properties. • Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations. • Concept of eigenvalues and eigenvectors and to reduce the quadratic form to canonical form • Geometrical approach to the mean value theorems and their application to the mathematical problems • Evaluation of surface areas and volumes of revolutions of curves. • Evaluation of improper integrals using Beta and Gamma functions. • Partial differentiation, concept of total derivative • Finding maxima and minima of function of two and three variables. • Evaluation of multiple integrals and their applications 	
UNIT-I: Matrices	10 L
Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, Gauss Seidel Iteration Method.	
UNIT-II: Eigen values and Eigen vectors	10 L
Linear Transformation and Orthogonal Transformation: Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.	
UNIT-III: Calculus	10 L
Limits and Continuous function and its properties, Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (All the theorems without proof).	
UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)	10 L
Definitions of Limit and continuity, Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.	
UNIT-V: Multivariable Calculus (Integration)	8 L
Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Change of variables for double integrals (Cartesian to polar), Evaluation of Triple Integrals, Change of variables for triple integrals (Cartesian to Spherical and Cylindrical polar coordinates). Applications: Areas by double integrals and volumes by triple integrals.	
Course outcomes:	
After learning the contents of this paper, the student must be able to	
<ul style="list-style-type: none"> • Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations • Find the Eigenvalues and Eigen vectors 	

- Reduce the quadratic form to canonical form using orthogonal transformations.
- Solve the applications on the mean value theorems.
- Evaluate the improper integrals using Beta and Gamma functions
- Find the extreme values of functions of two variables with/ without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, volumes,

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ENGINEERING PHYSICS **(Common To All Non-circuit Branches)**

B.Tech. II Year I Sem.

L T P C

3 0 0 3

Pre-requisites: 10+2 Physics

COURSE OBJECTIVES:

- To understand the wave nature of light and related phenomena such as interference, diffraction and polarization.

- To explore the acoustic properties of buildings and the generation, detection and applications of ultrasonic waves.
- To provide a foundation in quantum mechanics and introduce basic principles of quantum computing.
- To study the classification, properties, and technological applications of magnetic, dielectric and superconducting materials.
- To understand the principles, types, and applications of lasers and optical fiber communication systems.

UNIT - I:WAVE OPTICS

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Farunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power. Introduction to polarization, double refraction, Nicol's Prism, quarter and half wave plates.

UNIT - II:ACOUSTICS OF BUILDINGS & ULTRASONICS

Introduction to Acoustics of Buildings, Reverberation, Time of Reverberation, Sabine's Formulae, Basic Requirements of Acoustically good hall, Factors affecting the Architectural Acoustics and their Remedies. Introduction to Ultrasonics, Production of Ultrasonics by Piezoelectric and Magnetostriction Methods, Detection of Ultrasonics by Kund's Tube and Quartz Crystal Methods, Applications of Ultrasonics.

UNIT - III:QUANTUM MECHANICS AND QUANTUM COMPUTING

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, Eigen values and Eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box. Introduction to Quantum Computing, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits.

UNIT - IV: MAGNETIC AND DIELECTRIC MATERIALS

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, introduction to superconductivity; properties, Type -I and Type -II superconductors. Applications of superconductors. Introduction to dielectric materials, types of polarization, electronic and ionic polarizabilities. Ferroelectric, piezoelectric, pyroelectric materials and their applications.

UNIT - V: LASER AND FIBRE OPTICS

Introduction to laser, characteristics of laser, population inversion, pumping, lasing action, Einstein coefficients and their relations, Ruby laser, He-Ne laser, CO₂ laser, semiconductor diode laser, applications of laser. Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, optical fibre for communication system, applications.

COURSE OUTCOMES:

- Students will be able to explain and analyze optical phenomena such as interference, diffraction, and polarization using wave theory.(*SDG 9*)
- Students will demonstrate understanding of architectural acoustics and the generation and detection techniques of ultrasonic waves.(*SDG 4*)
- Students will apply quantum mechanical concepts like wave functions and Schrödinger's equation and explain the structure of a quantum computer.(*SDG 9*)
- Students will classify magnetic and dielectric materials and describe their behavior, including superconductivity and various polarization effects.(*SDG 9*)
- Students will describe laser operation principles and fiber optics fundamentals and apply them in communication and instrumentation systems.(*SDG 9, SDG 7*)

TEXT BOOKS:

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc.
3. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

REFERENCE BOOKS:

1. Jozef Gruska, *Quantum Computing*, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

C PROGRAMMING AND DATA STRUCTURES

B.Tech. I Year I Sem.

L T P C

3 0 0 3

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

Course Outcomes:

1. Understand the various steps in Program development.
2. Explore the basic concepts in C Programming Language.
3. Develop modular and readable C Programs
4. Understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures.
5. Apply data structures such as stacks, queues in problem solving
6. To understand and analyze various searching and sorting algorithms.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development

Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output

Structure of a C Program – Operators, Bit-wise operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements.

UNIT - II

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion.

Designing Structured Programs – Functions, basics, user defined functions, inter function communication, standard functions.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays.

UNIT - III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility,

Pointer Applications – Passing an array to a function, Memory allocation functions, array of pointers

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

UNIT - IV

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.

Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.

UNIT – V

Sorting- selection sort, bubble sort, insertion sort,

Searching-linear and binary search methods.

Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCE BOOKS:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

COMPUTER AIDED ENGINEERING GRAPHICS

B.Tech. I Year I Sem.

L T P C

2 0 2 3

Course Objectives:

1. To develop the ability of visualization of different objects through technical drawings
2. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products

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

1. Apply computer aided drafting tools to create 2D and 3D objects
2. sketch conics and different types of solids
3. Appreciate the need of Sectional views of solids and Development of surfaces of solids
4. Read and interpret engineering drawings
5. Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting

UNIT – I: Introduction to Engineering Graphics

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid.

Introduction to Computer aided drafting – views, commands and conics

UNIT- II: Orthographic Projections (Conventional and Computer Aided)

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes.

Computer aided orthographic projections – points, lines and planes.

UNIT – III: (Conventional and Computer Aided)

Projections of Regular Solids - Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views,

Computer aided projections of solids – sectional views

UNIT – IV: Development of Surfaces of Right regular solids

Prism, Cylinder, Pyramid and Cone.

Development of surfaces using computer aided drafting

UNIT – V: Isometric Projections (Conventional and Computer Aided)

Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non-isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions.

Conversion of orthographic projection into isometric view using computer aided drafting.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas: S. Chand and company Ltd., 3rd Edition, 2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C M Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley & Sons Inc, 3rd Edition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer Aided Engineering Drawing, K Balaveera Reddy, CBS Publishers, 2nd Edition, 2015.

Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.

ENGINEERING WORKSHOP

B.Tech. I Year I Sem.

L T P C

0 0 2 1

Pre-requisites: Practical skill

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

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

- CO 1: Study and practice on machine tools and their operations
- CO 2: Practice on manufacturing of components using workshop trades including plumbing, fitting, carpentry, foundry, house wiring and welding.
- CO 3: Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- CO 4: Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

- I. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
- II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
- III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
- IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
- V. Welding Practice – (Arc Welding & Gas Welding)
- VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
- VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

Text Books:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K.Venugopal / Anuradha.

Reference Books:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

ENGLISH FOR SKILL ENHANCEMENT

B.Tech. I Year I Sem.

L T P C

3 0 0 3

INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational eco system. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material.

LEARNING OBJECTIVES

This course will enable the students to:

- a. Improve their vocabulary.
- b. Use appropriate sentence structures in their oral and written communication.

- c. Develop their reading and study skills.
- d. Equip students to write paragraphs, essays, précis and draft letters.
- e. Acquire skills for Technical report writing.

COURSE OUTCOMES

Students will be able to:

- CO1** Choose appropriate vocabulary in their oral and written communication. (**SDG 4, 8**)
- CO2** Demonstrate their understanding of the rules of functional grammar and sentence structures. (**SDG 4**)
- CO3** Develop comprehension skills from known and unknown passages. (**SDG 4, 8**)
- CO4** Write paragraphs, essays, précis and draft letters. (**SDG 4**)
- CO5** Write abstracts and reports in various contexts. (**SDG 4, 8**)

SYLLABUS

The course content / study material is divided into **Five Units**.

Unit -I

Theme: **Perspectives**

Lesson on ‘The Generation Gap’ by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

Unit -II

Theme: **Digital Transformation**

Lesson on ‘Emerging Technologies’ from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice

Writing: Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

Unit –III

Theme: **Attitude and Gratitude**

Poems on ‘Leisure’ by William Henry Davies and ‘Be Thankful’ - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

Unit –IV

Theme: **Entrepreneurship**

Lesson on ‘Why a Start-Up Needs to Find its Customers First’ by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.

Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.

Reading: Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice

Writing: Writing Practices- Note Making-Précis Writing.

Unit –V

Theme: **Integrity and Professionalism**

Lesson on ‘Professional Ethics’ from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Technical Vocabulary and their Usage– One Word Substitutes – Collocations.

Grammar: Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice

Writing: **Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) - Types of Reports - Writing a Technical Report.**

Note: Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

➤ (Note: As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is **Open-ended**, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

Prescribed Textbook

1. **Board of Editors. 2025. English for the Young in the Digital World. Orient BlackSwan Pvt. Ltd.**

References:

1. Swan, Michael. (2016). *Practical English Usage*. Oxford University Press. New Edition.
2. Karal, Rajeevan. 2023. *English Grammar Just for You*. Oxford University Press. New Delhi
3. 2024. *Empowering with Language: Communicative English for Undergraduates*. Cengage Learning India Pvt. Ltd. New Delhi
4. Sanjay Kumar & Pushp Lata. 2022. *Communication Skills – A Workbook*. Oxford University Press. New Delhi
5. Wood,F.T. (2007). *Remedial English Grammar*. Macmillan.
6. Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students*. Mc Graw-Hill Education India Pvt. Ltd.

ENGINEERING PHYSICS LABORATORY

(Common To All Non-circuit Branches)

B.Tech. II Year I Sem.

L T P C

0 0 2 1

COURSE OBJECTIVES:

- To explore the electromagnetic and dielectric behavior of materials through experiments such as B-H curve and dielectric constant determination.
- To understand fundamental quantum phenomena by experimentally determining physical constants like Planck's constant and work function.
- To investigate optical phenomena using diffraction, interference (Newton's Rings), and study of optical fiber properties.
- To characterize the performance of semiconductor and optoelectronic devices like laser diodes, solar cells, and Hall effect sensors.
- To develop analytical and data fitting skills through experimental modeling and application of the least squares method.

1. Study of B-H curve of a ferromagnetic material.
2. Determination of dielectric constant of a given material.
3. Determination of work function and Planck's constant using photoelectric effect.
4. Determination of wavelength of source using diffraction grating.
5. Study of V-I & L-I characteristics of a given laser diode.
6. Determination of acceptance angle and numerical aperture of a given optical fibre.
7. Newton Rings: to determine the radius of curvature of Plano-convex lens.
8. Determination of energy gap of a semiconductor.
9. Determination of Hall coefficient and carrier concentration of a given semiconductor.
10. Understanding the method of least squares – Torsional pendulum as an example.
11. To study and analyze the characteristics of a solar cell by plotting the V-I (voltage-current) and P-V (power-voltage) curves
12. To determine the frequency of the A.C. mains supply using a sonometer by finding the resonant length of the vibrating wire that matches the frequency of the alternating current.

Note: Any 8 experiments are to be performed.

COURSE OUTCOMES:

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

- Analyse magnetic and dielectric properties of materials using B-H curve and dielectric constant experiments. **(SDG 9)**
- Determine key quantum mechanical constants and validate the photoelectric effect. **(SDG 4, 9)**
- Measure optical parameters using diffraction gratings and Newton's Rings, and study fiber optic properties. **(SDG 7, 9)**
- Evaluate characteristics of semiconductor and optoelectronic devices, including energy gap, Hall Effect, laser diodes, LEDs, and solar cells. **(SDG 7, 13)**
- Apply curve fitting techniques such as the least squares method to analyze experimental data and estimate physical quantities. **(SDG 4, 9)**

C PROGRAMMING AND DATA STRUCTURES LABORATORY

B.Tech. I Year I Sem.

L T P C

0 0 2 1

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

Course Outcomes:

1. Develop modular and readable C Programs
2. Solve problems using strings, functions
3. Handle data in files
4. Implement stacks, queues using arrays, linked lists.
5. To understand and analyze various searching and sorting algorithms.

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
 - i) Addition of Two Matrices
 - ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations:
 - i) To insert a sub-string in to a given main string from a given position.
 - ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.

16. Write a C program to construct a pyramid of numbers.
17. Write a C program that uses functions to perform the following operations:
 - i) Reading a complex number
 - ii) Writing a complex number
 - iii) Addition of two complex numbers
 - iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)
18.
 - i. Write a C program which copies one file to another.
 - ii. Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)
19.
 - i. Write a C program to display the contents of a file.
 - ii. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)
20. Write a C program that uses functions to perform the following operations on singly linked list.:
 - i) Creation
 - ii) Insertion
 - iii) Deletion
 - iv) Traversal
21. Write C programs that implement stack (its operations) using
 - i) Arrays
 - ii) Pointers
22. Write C programs that implement Queue (its operations) using
 - i) Arrays
 - ii) Pointers
23. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
 - i) Bubble sort
 - ii) Selection sort
 - iii) Insertion sort
24. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
 - i) Linear search
 - ii) Binary search

TEXT BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Let us C, YeswanthKanitkar
3. C Programming, Balaguruswamy.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

(Common to all Branches of Engineering)

B.Tech. I Year I Sem.

L T P C

0 0 2 1

The **English Language and Communication Skills (ELCS) Lab** focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Listening Skills:

Objectives

1. To enable students develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:

3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately
5. To practise speaking in social and professional contexts

Learning Outcomes

Students will be able to:

- CO1** Listen actively and identify important information in spoken texts (**SDG 4**)
- CO2** Interpret the speech and infer the intention of the speaker (**SDG 4**)
- CO3** Improve their accent for intelligibility (**SDG 4, 8, 10**)
- CO4** Speak fluently with clarity and confidence (**SDG 4, 8, 10**)
- CO5** Use the language in real life situations (**SDG 4, 8**)

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

- a. Computer Assisted Language Learning (CALL) Lab which focusses on listening skills**
- b. Interactive Communication Skills (ICS) Lab which focusses on speaking skills**

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I

CALL Lab:

Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening

Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - *Testing Exercises*

ICS Lab:

❖ Diagnostic Test – Activity titled ‘Express Your View’

Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others

Practice: Any Ice-Breaking Activity

Exercise – II

CALL Lab:

Instruction: *Listening vs. Hearing - Barriers to Listening*

Practice: Listening for General Information - - Multiple Choice Questions - *Listening Comprehension Exercises* (*It is essential to identify a suitable passage with exercises for practice.*)

ICS Lab:

Instruction: Features of Good Conversation – Strategies for Effective Communication

Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III

CALL Lab:

Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)

Practice: Differences between British and American Pronunciation –*Listening Comprehension Exercises*

ICS Lab:

Instruction: Describing Objects, Situations, Places, People and Events

Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events (*A wide range of Materials / Handouts are to be made available in the lab.*)

Exercise – IV

CALL Lab:

Instruction: Techniques for *Effective Listening*

Practice: *Listening for Specific Details* - Listening - Gap Fill Exercises - *Listening Comprehension Exercises*

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity

Practice: Activity on Telling and Retelling Stories - Collage

Exercise – V

CALL Lab:

Instruction: Identifying the literal and implied meaning

Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: Understanding Non-Verbal Communication

Practice: Silent Speech - Dumb Charades Activity

❖ Post-Assessment Test on ‘Express Your View’

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

- i) Computers with Suitable Configuration
- ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

 **Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.**

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

References:

1. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook*. Cambridge University Press
2. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities*. Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach*. Cambridge University Press
4. (2022). *English Language Communication Skills – Lab Manual cum Workbook*. Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. *Five Minute Activities – A Resource Book for Language Teachers*. Cambridge University Press.

*** *** ***

INDUCTION PROGRAM

B.Tech. I Year I Sem.

L T P C

3 0 0 3

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

B.Tech. I Year II Sem.

L T P C

3 0 0 3

Pre-requisites: Mathematical Knowledge at pre-university level
Objectives:
To learn
<ul style="list-style-type: none">• Methods of solving the differential equations of first and higher order.• Concept, properties of Laplace transforms• Solving ordinary differential equations using Laplace transforms techniques.• The physical quantities involved in engineering field related to vector valued functions• The basic properties of vector valued functions and their applications to line, surface and volume integrals
UNIT-I: First Order ODE 8 L
Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.
UNIT-II: Ordinary Differential Equations of Higher Order 10 L
Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax}V(x)$ and $xV(x)$, method of variation of parameters.
UNIT-III: Laplace transforms 10 L
Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.
UNIT-IV: Vector Differentiation 10 L
Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration	8 L
Line, Surface and Volume Integrals, Theorems of Green, Gauss and Stokes (without proofs) and their applications	
Course outcomes: After learning the contents of this paper, the student must be able to <ul style="list-style-type: none">• Identify whether the given differential equation of first order is exact or not• Solve higher differential equation and apply the concept of differential equation to real world problems.• Use the Laplace transforms techniques for solving ODE's.• Evaluate the line, surface and volume integrals and converting them from one to another	

Text Books

3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Editon, 2016.

References

5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
6. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition,Pearson, Reprint, 2002.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.
8. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

APPLIED CHEMISTRY

CE/ME/ ME(IDP)/CHEMICAL/METT/BIOTECH/GEO INFO

B.Tech. I Year II Sem

L T P C

3 0 0 3

Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes (CO's):

1. Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes. (SDG 4, 6)
2. Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods. (SDG 4)
3. Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs. (SDG 4, 7, 9)
4. Students will learn the basic concepts and properties of polymers and other engineering materials. (SDG 4, 9)
5. Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications. (SDG 4, 9, 13)

UNIT-I: Water and its treatment: [8]

Introduction, types of hardness and units – Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water – Disinfection of potable water by chlorination and break-point chlorination. Defluoridation- Nalgonda technique.

Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion- exchange processes. Desalination of brackish water - Reverse osmosis.

Unit-II: Electrochemistry and Corrosion: [8]

Introduction- Electrode potential, standard electrode potential, types of electrodes, Nernst equation (no derivation), Galvanic cell, cell representation, EMF of cell- Numerical problems. Reference electrodes - Primary reference electrode – Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Determination of pH of an unknown solution using SHE and Calomel electrode.

Corrosion: Introduction - Definition, causes and effects of corrosion - Theories of corrosion, chemical and electrochemical corrosion - Mechanism of electrochemical corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT-III: Energy Sources: [8]

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, construction and applications of Direct Methanol Fuel Cell (DMFC).

Fuels: Introduction and characteristics, Calorific value of fuel - HCV, LCV- Dulong's formula - Numerical problems.

Fossil fuels: Introduction, classification, Petroleum- Refining of Crude oil, Cracking - Moving bed catalytic cracking. LPG and CNG - composition and uses.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers: [8]

Definition, classification of polymers: Based on origin and tacticity with examples - Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization.

Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6). Thermoplastics and thermo setting plastics, Fiber reinforced plastics (FRP).

Conducting polymers: Definition and classification with examples - Mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Polylactic acid(PLA) and its applications.

UNIT-V - Applications of Materials: [8]

Cement: Portland cement, its composition, setting and hardening.

Phase rule: Definition – Phase, component, degrees of freedom. Phase rule equation. Phase diagrams - One component system - water. Two component system - Lead silver system.

Lubricants: Definition and characteristics of a good lubricant – thin film mechanism of lubrication, properties of lubricants - viscosity, cloud and pour point, flash and fire point.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection).

SUGGESTED TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE TEXT BOOKS:

3. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
4. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
5. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
6. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
7. Challenges and Opportunities in Green Hydrogen by Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
8. Raman Spectroscopy in Human Health and Biomedicine,
<https://www.worldscientific.com/doi/epdf/10.1142/13094>
9. E-Content- <https://doi.org/10.1142/13094> | October 2023

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

B.Tech. I Year II Sem.

L T P C

3 0 0 3

COURSE OBJECTIVES: The course should enable the students to:

- Provide foundational understanding of DC and AC circuit concepts, analysis techniques, and three-phase system fundamentals.
- Familiarize students with electrical installation components, safety devices, energy calculations, and battery backup systems.
- Develop knowledge of construction, principles, equations, and performance characteristics of electrical machines and transformers.
- Impart understanding of semiconductor diodes, rectifiers, and filter circuits for basic electronic power conversion.
- Introduce transistor devices (BJT, FET), their configurations, comparisons, and biasing methods for amplification applications.

COURSE OUTCOMES: After completion of course, the student should be able to:

1. Analyze DC and AC circuits, apply KVL/KCL, and determine electrical quantities in single-phase and three-phase balanced systems.
2. Identify and select appropriate LT switchgear, wiring, and battery systems; perform basic calculations for energy consumption and power factor improvement.
3. Explain the construction, working principles, and fundamental equations (EMF, torque) of transformers, DC machines, induction motors, and synchronous generators.
4. Explain the construction, working principles, and fundamental equations (EMF, torque) of transformers, DC machines, induction motors, and synchronous generators.
5. Compare the operation and configurations of BJT and FET devices, and explain their suitability for amplification applications.

UNIT-I: D.C. CIRCUITS AND A.C. CIRCUITS

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL and KCL, analysis of simple circuits with dc excitation.

A.C. 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, Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-II: ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT-III: ELECTRICAL MACHINES

Construction and Working principle of Single-phase transformer, EMF equation, Three phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equation, Construction and working principle of Three phase Induction motor, Construction and working principle of synchronous generators.

UNIT-IV: P-N JUNCTION & ZENER DIODE AND RECTIFIERS & FILTERS

P-N Junction and Zener Diode: Principle of Operation P-N junction Diode, Volt - Ampere characteristics, Temperature dependence, Ideal versus practical, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Filters – Inductor Filters, Capacitor Filters.

UNIT-V: BIPOLAR JUNCTION TRANSISTOR (BJT) AND FIELD EFFECT TRANSISTOR (FET)

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET.

TEXTBOOKS:

1. Basic Electrical and electronics Engineering, M.S. Sukija and T.K. Nagasarkar, Oxford University press, 1st Edition, 2012.
2. Basic Electrical and electronics Engineering, D.P. Kothari and I.J. Nagarath, McGraw Hill Education, 2nd Edition, 2020.

REFERENCE BOOKS:

1. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
2. Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
4. Linear circuit analysis, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press 2nd Edition, 2004.
5. Network Theory, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th Edition 2003.
8. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
9. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/108105112>
2. <https://nptel.ac.in/courses/108102185>

ENGINEERING GEOLOGY AND BUILDING MATERIALS

B.Tech. I Year II Sem.

L T P C

3 0 0 3

Course Objectives: The objective of this Course is to

- Give the basics knowledge of Geology that is required for constructing various Civil Engineering Structures, basic Geology, Geological Hazardous and Environmental Geology.
- Focus on the core activities of engineering geologists—site characterization and geologic hazard identification and mitigation. Planning and construction of major Civil Engineering projects.
- To introduce the classification, properties, and applications of traditional and modern building materials
- To impart knowledge on the types and properties of cement, aggregates, water, and admixtures, including their standards and testing procedures

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

- Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice.
- The fundamentals of the engineering properties of Earth materials.
- Explain how stones, bricks, tiles, and timber are classified, made, and used in building construction.
- Describe different types of paints, varnishes, glass, plastics, and modern materials, and explain their uses in buildings.

UNIT-I

Introduction: Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological drawbacks. Importance of Physical geology, Petrology and Structural geology.

Weathering of Rocks: Its effect over the properties of rocks importance of weathering with reference to dams, reservoirs and tunnels weathering of common rock like “Granite”

UNIT- II

Mineralogy: **Definition** of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldspar, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Chlorite, Kyanite, Garnet, Talc, Calcite. Study of other common economics minerals such as Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Magnesite, and Bauxite.

Petrology: Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Dykes and sills, common structures and textures of igneous, Sedimentary and metamorphic rocks. Their distinguishing features, Megascopic and microscopic and

microscopic study of Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sandstone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

UNIT- III

Structural Geology: Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults unconformities, and joints-their important types and case studies.

Stones and Bricks: Classification and properties of building stones, Quarrying, dressing, and testing of stones, Manufacturing, classification, and properties of bricks, Tests on bricks,.

UNIT-IV

Tiles : Types and properties of clay tiles – manufacturing process, Uses of tiles in buildings , Tests on tiles.

Timber and Wood Products: Classification and structure of timber, Defects in timber, seasoning, and preservation, Types of engineered wood – plywood, particle board.

UNIT-V

Paints, Varnishes, and Miscellaneous Materials: Types of paints, constituents, and applications, Varnishes, distempers – composition and uses, Glass – types and uses, Plastics, asphalt, bitumen, adhesives, and sealants – properties and applications, Modern building materials: GFRP, geosynthetics, AAC blocks.

Cement: Types as per IS codes (OPC, PPC, PSC), Composition and hydration of cement compounds, Tests on cement (consistency, setting time, strength).

TEXT BOOKS:

1. Engineering Geology by N. Chennakesavulu, McMillan, India Ltd.2005
2. P.C.Varghese, "Building Materials", PHI Learning Pvt. Ltd.

REFERENCE BOOKS:

1. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.
2. Principles of Engineering Geology (2023) by K.V.G.K. Gokhale– B.S. Publications.
3. Reference handbook on Building Materials , Bureau of Indian Standards.

GEOLOGY AND BUILDING MATERIALS TESTING LABORATORY

B.Tech. I Year II Sem.

L T P C

0 0 2 1

Course Objectives: The objective of this Course is to

- Develop practical skills in identifying minerals and rocks based on physical and chemical properties.
- Classify minerals and rocks into appropriate geological groups.
- Understand crystallography and crystal systems through visual identification.
- Apply techniques for identification of igneous, sedimentary, and metamorphic rocks.
- Interpret geological maps and recognize topographical and structural features.
- Solve basic structural geology problems related to folds, faults, and unconformities.

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

- Accurately identify minerals from various mineral groups using hand specimens.
- Classify and identify igneous rocks based on texture, structure, and mineral content.
- Classify and identify sedimentary rocks and interpret their depositional environments.
- Identify and distinguish metamorphic rocks and their textures and structures.)
- Interpret topographic features and geological structures from maps and identify conventional geological symbols.
- Analyze and solve basic structural geology problems involving folds, faults, and unconformities

Experiments:

1. Study of physical properties of minerals.
2. Study of Crystal and Crystal system.
3. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
4. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
5. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.
6. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
7. Tests on Tiles
8. Fineness of cement by sieving and specific gravity of cement
9. Initial and final setting times of cement
10. Compressive strength of cement

ENGINEERING MECHANICS

B.Tech. I Year II Sem.

L T P C

3 1 0 4

Course Objectives: This course is expected to enable the student to:

- Provide Knowledge of force systems and free body diagram to analyze rigid body equilibrium
- Comprehend the principles of Friction and solve engineering mechanics problems associated with frictional force
- Compute the centroid, first moment and second moment of an area
- Impart the concept of motion of particles and rigid bodies.
- Familiarize the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations

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

- Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.
- Solve problem of bodies subjected to friction.
- Find the location of centroid and calculate moment of inertia of a given section.
- Understand the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.
- Interpret and implement work-energy principle and its applications.

UNIT - I

Introduction to Engineering Mechanics– Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant-Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

UNIT - II

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, Ladder friction

Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. –Theorem of Pappus.

UNIT - III

Area moment of inertia - Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem.

Mass Moment of Inertia: Moment of Inertia of Masses-Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies.

UNIT - IV

Kinematics of Particles: Kinematics of particles – Rectilinear motion – Curvilinear motion – Projectiles. Kinetics of Particles: Kinetics of particles– Newton’s Second Law– Differential equations of rectilinear and curvilinear motion–Dynamic equilibrium–Inertia force–D. Alembert’s Principle applied for rectilinear and curvilinear motion.

UNIT - V

Work-Energy Principle: Equation of translation, principle of conservation of energy, work-energy principle applied to particle motion and connected systems, fixed axis rotation. Impulse– Momentum Principle: Introduction, linear impulse momentum, principle of conservation of linear momentum, elastic impact and types of impact, loss of kinetic energy, coefficient of restitution.

TEXTBOOKS:

1. G. Lakshmi Narasaiah (2023) Engineering Mechanics, B.S. Publications
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2024), Singer’s Engineering Mechanics– Statics & Dynamics, B.S. Publications
3. Shames and Rao (2006), Engineering Mechanics, Pearson Education
4. S.S. Bhavikatti (2021) Engineering Mechanics, New age International Publishers.

REFERENCE BOOKS:

1. Timoshenko S. P and Young D.H, “Engineering Mechanics”, McGraw-Hill International Edition, 2017.
2. Andrew Pytel, JaanKiusalaas, “Engineering Mechanics”, Cengage Learning, 2014.
3. Bee r F. P & Johnston E. R Jr. Vector, “Mechanics for Engineers”, TMH, 2004.
4. Hibbeler R.C & Ashok Gupta, “Engineering Mechanics”, Pearson Education, 2010.
5. Tayal D.H.,” Engineering Mechanics–Statics & Dynamics”, Umesh Publications, 2011.
6. Basudeb Bhattacharyya, “Engineering Mechanics”, Oxford University Press, 2008.
7. Meriam.J.L., “Engineering Mechanics”, Volume-II Dynamics, John Wiley & Sons, 2008.
8. P.C Dumiretal. “Engineering Mechanics”, University press

CHEMISTRY LABORATORY FOR ENGINEERS

B.Tech. I Year II Sem.

L T P C

0 0 2 1

Course Objectives:

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.

Course Outcomes(CO's):

1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering. (SDG 4, 9)
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions. (SDG 6, 12)
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions. (SDG 4, 9)
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6. (SDG 9, 12)
5. Students will understand the working principle of Colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law). (SDG 3, 13)

List of Experiments:

- I. Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method.
- II. Conductometry:**
 1. Estimation of the concentration of strong acid by Conductometry.
 2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.
- III. Potentiometry:**
 1. Estimation of concentration of Fe^{+2} ion by Potentiometry using KMnO_4 .
 2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone
- IV. pH Metry:** Determination of an acid concentration using pH meter.
- V. Preparations:**
 1. Preparation of Bakelite.
 2. Preparation Nylon – 6, 6.
- VI. Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
- VII. Lubricants:**
 1. Estimation of acid value of given lubricant oil.
 2. Estimation of viscosity of lubricant oil using Ostwald's Viscometer.

VIII. Virtual lab experiments

1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

PYTHON PROGRAMMING LABORATORY

B.Tech. I Year II Sem.

L T P C

0 1 2 2

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

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

- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

Note: The lab experiments will be like the following experiment examples.

List of Experiments:

1.
 - I. Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
 - II. Start the Python interpreter and type `help()` to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3. Write a program to calculate compound interest when principal, rate and number of periods are given.
4. Read the name, address, email and phone number of a person through the keyboard and print the details.
4. Print the below triangle using for loop.

```
5
4 4
3 3 3
2 2 2 2
1 1 1 1 1
```
5. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character(use 'if-else-if' ladder)
6. Python program to print all prime numbers in a given interval (use break)
7. Write a program to convert a list and tuple into arrays.
8. Write a program to find common values between two arrays.
9. Write a function called `palindrome` that takes a string argument and returnsTrue if it is a palindrome and False otherwise. Remember that you can use the built-in function `len` to check the length of a string.

10. Write a function called `is_sorted` that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
11. Write a function called `has_duplicates` that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
12. Write a function called `remove_duplicates` that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
13. The wordlist I provided, `words.txt`, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
14. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
15. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
16. Remove the given word in all the places in a string?
17. Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
18. Writes a recursive function that generates all binary strings of n-bit length
19. Write a python program that defines a matrix and prints
20. Write a python program to perform multiplication of two square matrices
21. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
22. Use the structure of exception handling all general-purpose exceptions.
23. Write a function called `draw_rectangle` that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
24. Add an attribute named `color` to your Rectangle objects and modify `draw_rectangle` so that it uses the `color` attribute as the fill color.
25. Write a function called `draw_point` that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
26. Define a new class called `Circle` with appropriate attributes and instantiate a few `Circle` objects.
Write a function called `draw_circle` that draws circles on the canvas.
27. Write a python code to read a phone number and email-id from the user and validate it for correctness.
28. Write a Python code to merge two given file contents into a third file.
29. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
30. Write a Python code to Read text from a text file, find the word with most number of occurrences
31. Write a function that reads a file `file1` and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.
32. Import numpy, Plotpy and Scipy and explore their functionalities.
33. Install NumPypackage with pip and explore it.
34. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
35. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Introduction to Python Programming, Gowrishakar S, Veena A, CRC Press
4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
5. Python for Data Science, Dr. Mohd Abdul Hameed, Wiley publications
6. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech press
7. Introduction to Python, Gowrishankar S, Veena A., CRC Press

BASIC ELECTRICAL ENGINEERING LABORATORY

B.Tech. I Year II Sem.

L T P C

0 0 2 1

Prerequisites: Basic Electrical and Electronics Engineering

COURSE OBJECTIVES: The course should enable the students to:

- Demonstrate the constructional details of electrical machines and LT switchgear components through cut-out sections and models.
- Apply and verify fundamental circuit laws, theorems, and power measurement techniques in DC, single-phase, and three-phase systems.
- Conduct experiments on transformers, DC motors, induction motors, and alternators to evaluate their performance characteristics.
- Perform experiments on diodes, rectifiers, transistors, and FETs to study their behavior and applications.
- Acquire hands-on skills in using measuring instruments such as CRO, multimeters, function generators, and regulated power supplies in laboratory experiments.

COURSE OUTCOMES: After completion of course, the student should be able to:

1. Demonstrate and explain the constructional features of electrical machines and LT switchgear components.
2. Verify experimentally KVL, KCL, network theorems, transformer voltage/current relationships, and AC power measurement.
3. Determine experimentally the performance characteristics of DC shunt motors, three-phase induction motors, and alternators.
4. Analyze the characteristics and applications of PN junction diode, Zener diode, rectifiers, transistor, and FET through experiments.
5. Operate and use effectively CRO, multimeters, function generators, and regulated power supplies for measurement and testing in laboratory experiments.

List of Experiments:

PART A: ELECTRICAL

1. Verification of KVL and KCL.
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a SinglePhase Transformer (ii) Verification of Relationship between Voltages and Currents (StarDelta, DeltaDelta, Delta Star, StarStar) in a Three Phase Transformer.
3. Measurement of Active and Reactive Power in a balanced Threephase circuit.
4. Performance Characteristics of a Separately Excited DC Shunt Motor.
5. Performance Characteristics of a Threephase Induction Motor.
6. NoLoad Characteristics of a Threephase Alternator.

PART B: ELECTRONICS

1. Study and operation of (i) Multimeters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.

2. P-N Junction diode characteristics.
3. Zener diode characteristics and Zener as voltage Regulator.
4. Input and Output characteristics of Transistor in CB, CE configuration.
5. Full Wave Rectifier with and without filters.
6. Input and Output characteristics of FET in CS configuration.

TEXTBOOKS:

3. Basic Electrical and electronics Engineering, M.S. Sukija and T.K. Nagasarkar, Oxford University press, 1st Edition, 2012.
4. Basic Electrical and electronics Engineering, D.P. Kothari and I.J. Nagarath, McGraw Hill Education, 2nd Edition, 2020.

REFERENCE BOOKS:

10. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
11. Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
12. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
13. Linear circuit analysis, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press 2nd Edition, 2004.
14. Network Theory, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
15. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
16. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th Edition 2003.
17. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
18. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

ONLINE RESOURCES:

3. <https://nptel.ac.in/courses/108105112>
4. <https://nptel.ac.in/courses/108102185>

NSS

B.Tech. I Year II Sem.

L T P C

0 0 2 0

PROBABILITY AND STATISTICS

B.Tech. II Year I Sem.

L T P C

3 0 0 3

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn

- The theory of Random Variable, and probability distributions of single random variables.
- The sampling theory and testing of hypothesis and making statistical inferences.
- The curve fitting, correlation and regression for the given data.

Course outcomes: After learning the contents of this paper, the student must be able to

- Apply the concepts of Random variable and distributions to some case studies.
- Correlate the concepts of one unit to the concepts in other units.
- Understood sampling theory and apply hypothesis testing in real-world scenarios
- Fit the curve, correlation and regression for the given data.

UNIT-I: Random Variables and Probability Distributions

8 L

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable

Discrete Probability Distributions: Binomial Distribution – Poisson distribution

UNIT-II: Continuous Distributions and Sampling

10 L

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions.

Fundamental Sampling Distributions: Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-III: Estimation

10 L

Introduction – Statistical Inference – Classical Methods of Estimation – Single Sample: Estimating the mean – Standard error of a point Estimate. Two samples: Estimating the difference between two means – Single sample: Estimating a proportion – Two samples: Estimating the difference between two proportions – Two samples: Estimating the ratio of two variances.

UNIT-IV: Tests of Hypotheses (Large and Small Samples)

10 L

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two- sample tests concerning variances: F-distribution

UNIT-V: Applied Statistics

10 L

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves. Correlation and Regression – Rank correlation.

TEXT BOOKS:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

REFERENCE BOOKS

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
Sheldon M Ross, Probability and Statistics for Engineers and Scientists, academic press

BUILDING PLANNING AND CONSTRUCTION

B.Tech. II Year I Sem.

L T P C

3 0 0 3

Course Objectives:

This course is expected to enable the student to:

- **Provide fundamental knowledge** about buildings and the influence of climate, orientation, and landscaping on building planning and design.
- **Impart understanding of planning principles**
- **Familiarize students with the National Building Code (NBC)**, its structure and guidelines for residential buildings,
- **Develop knowledge of key building components**
- **Introduce various finishing works** and temporary structures

Course Outcomes:

Upon completion of this course, student should be able to

- Understand the classification of buildings, criteria for site selection, the impact of climate on building design, and the role of orientation and landscaping in planning.
- Apply the principles of planning and interpret building bye-laws to design functionally efficient, economical, and regulation-compliant buildings.
- Interpret and implement provisions of the National Building Code (NBC) related to residential buildings and understand basic construction techniques including foundations and masonry.
- Identify and analyze various types of floors, roofs, staircases, doors, windows, and lintels used in building construction and their suitability for different design conditions.
- Demonstrate knowledge of finishing works such as plastering, pointing, and floor finishes, and explain the types, design, and safety aspects of scaffolding, formwork, and centering.

UNIT-I Fundamentals of Buildings: Building, Classification of buildings, Site selection for Residential buildings, Climate and its influence on building planning; Elements of Climate, Climatic Zone of India, Climate and comfort, Earth and its motion, Directions and their characteristics, Landscaping.

Orientation of buildings; orientation, Factors affecting orientation, Sun, Wind, Rain, CBRT suggestions orientation criteria for Indian conditions.

UNIT-II Principles of planning and Bye Laws of buildings: Aspects, prospect, Privacy, Furniture Requirements, Roominess, Grouping, Circulation, Elegance, Economy, Practical consideration.

Buildings bye Laws; Introduction, Objective, Principles, Applicability of building bye Laws. Introduction to National building code, Objectives, Scope, Structure of NBC. General Building Requirements, Guidelines for Residential Buildings. Building Heights, Setbacks, FAR/FSI. Open Spaces, room sizes, Lighting and Ventilation, Means of Access and service ducts. Classification of buildings for fire safety.

UNIT-III

Introduction to building construction and site preparation; components of Building, **Foundations: Functions & Requirements, Types of Shallow Foundations:** isolated footings, combined footings, strap footings, wall footings, raft foundations, **Types of Deep Foundations:** driven piles (timber, precast concrete, steel), bored cast-in-situ piles. Brick masonry – types – bonds; Stone masonry – types

UNIT-IV

Floors, Roofs, Stairs, Doors, Windows:

Types of floors – Ground and upper floors – Brick flooring, Cement concrete flooring, Stone flooring, Tiled flooring, Types of roofs – Flat, Pitched, Sloped, Curved roofs Components and classification of staircases – Straight flight, Dog-legged, Open well, Spiral staircases –Types of doors – Panelled, Flush, Glass, PVC, Aluminium, Steel, Sliding, Revolving, Collapsible, and Rolling shutter doors – Door frame materials and fittings. Types of windows

UNIT-V

Finishing Works:

Plastering – Purpose, types , tools and techniques – Defects in plastering. Pointing – Types and application areas – Differences between plastering and pointing.

Scaffolding, Formwork, and Centering:

Scaffolding – Definition, purpose, components – Types: Single, Double, Cantilever, Suspended, Trestle, Steel and patented scaffolds – Safety considerations. Formwork – Functions, materials (timber, steel, aluminum, plastic), formwork for slabs, beams, columns, and walls – Centering: Definition and role in arches and domes.

Text Books:

1. Kumara Swamy N. and Kaneswaran Rao A., *Building Planning and Drawing*, Charotar Publishing House, Revised Edition, 2020.
2. B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, *Building Construction*, Laxmi Publications, 11th Edition, 2022.
3. S.S. Bhavikatti, *Building Materials and Construction*, Vikas Publishing House, 4th Edition, 2020.

Reference Books:

1. Sushil Kumar, *Building Construction*, Standard Publishers Distributors, 21st Edition, 2022.
2. Bindu Balan and R. Sathish Kumar, *Climatology and Building Design*, McGraw Hill Education, 1st Edition, 2020.
3. Gurcharan Singh, *Building Planning, Designing and Scheduling*, Standard Book House, 6th Edition, 2019.
4. Rangwala S.C., *Building Construction*, Charotar Publishing House, 33rd Edition, 2021.
5. M. Chakraborti, *Building Planning and Drawing*, Chakraborti Publications, 9th Edition, 2021.
6. Bureau of Indian Standards, *National Building Code of India (NBC) – 2016*, SP 7, Part 1 & 2, Reprint 2021.

STRENGTH OF MATERIALS

B.Tech. II Year I Sem.

L T P C

3 0 0 3

Pre-Requisites: Engineering Mechanics

Course Objectives: The objective of this Course is to

- Understand the nature of stresses developed in simple geometries such as bars, cantilevers and beams for various types of simple loads.
- Calculate the elastic deformation occurring in simple members for different types of loading.
- Show the plane stress transformation with a particular coordinate system for different orientation of the plane.
- Know different failure theories adopted in designing of structural members.

Course Outcome: On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, related to the strength of structured and mechanical components.
- Recognize various types loads applied on structural components of simple framing geometries and understand the nature of internal stresses that will develop within the components.
- To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Analyze various situations involving structural members subjected to plane stresses by application of Mohr's circle of stress.

UNIT - I

Simple Stresses and Strains: Concept of stress and strain- St. Venant's Principle-Stress and Strain Diagram-Elasticity and plasticity –Types of stresses and Strains-Hooke's law–stress–strain diagram for mild steel–Working stress–Factor of safety–Lateral strain, Poisson's ratio and volumetric strain –Pure shear and Complementary Shear-Elastic moduli, Elastic constants and the relationship between them–Bars of varying section–composite bars–Temperature stresses.

Strain Energy–Resilience–Gradual, sudden, and impact loadings–simple applications.

UNIT - II

Shear Force and Bending Moment: Types of beams–Concept of shear force and bending moment –S. F and B.M diagrams for cantilever, simply supported including overhanging beams subjected to point loads, uniformly distributed load, uniformly varying load, couple and combination of these loads – Point of contra flexure–Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT - III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation-Section Modulus Determination of flexural/bending stresses of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections–Design of simple beam sections.

Shear Stresses: Derivation of formula for shear stress distribution – Shear stress distribution across various beam sections like rectangular, circular,triangular,I, T angle and channel sections.

UNIT - IV

Deflection of Beams: Slope, deflection and radius of curvature–Differential equation for the elastic line of a beam–Double integration and Macaulay’s methods–Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load and Couple-Mohr’s theorems –Moment area method –Application to simple cases.

UNIT - V

Thin Cylinders: Thin seamless cylindrical shells–Derivation of formula for longitudinal and circumferential stresses–hoop, longitudinal and Volumetric strains–changes in diameter, and volume of thin cylinders – Thin spherical shells.

Thick Cylinders: Introduction-Lame’s theory for thick cylinders–Derivation of Lame’s formulae– distribution of hoop and radial stresses across thickness–design of thick cylinders–compound cylinders–Necessary difference of radii for shrinkage.

TEXT BOOKS:

1. Strength of Materials by B. Raghu Kumar, BS Publications.
2. Strength of Materials by B.S. Basavarajaiah and P. Mahadevappa, 3rd Edition, Universities Press
3. Strength of Materials by R. K Rajput, S. Chand & Company Ltd.
4. Strength of Materials by R. Subramanian, Oxford University Press

REFERENCE BOOKS:

1. Mechanics of Materials by R.C. Hibbeler, Prentice Hall publications
2. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall publications
3. Strength of Materials by T.D. Gunneswara Rao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt.Ltd.

SURVEYING AND GEOMATICS

B.Tech. II Year I Sem.

L T P C

3 0 0 3

Course Objectives: The objective of this Course is to

- Understand the fundamentals of surveying including its objectives, classifications, principles, and accessories used.
- Apply techniques for measurement of distances, directions, and angles using various conventional and modern instruments.
- Perform levelling and contouring to determine elevations and prepare topographical maps.
- Compute areas and volumes using different methods applicable in engineering projects like earthworks.
- Handle theodolite and tachometric surveys and perform traversing and curve setting.
- Use modern surveying instruments such as Total Station and GPS for accurate data collection and analysis.

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

- Classify and describe different types and phases of surveying, and explain conventional symbols and scales.
- Measure linear distances and directions using chains, tapes, compasses, and EDM methods, and apply corrections accurately.
- Perform differential levelling and contouring using various instruments and compute heights using HI and Rise & Fall methods.
- Calculate areas and volumes using MDM, DMD methods and Planimeter; compute earthwork quantities and reservoir capacities.
- Use theodolite for angle measurements, trigonometric levelling, and traverse computations including adjustments.
- Apply principles of tachometry and set out horizontal curves in the field.
- Utilize Total Station and GPS for advanced survey work and differentiate between modern and traditional surveying methods.

UNIT-I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions

Linear distances – Approximate methods, Direct Methods- Chains-Tapes, ranging, Tape corrections, indirect methods- optical methods- E.D.M. method.

Prismatic Compass- Bearings ,included angles, Local Attraction, Magnetic Declination and dip.

UNIT- II

Levelling and Contouring **Leveling**- Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method- Rise and Fall method, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, Direct& Indirect methods of contour surveying, interpolation and sketching of Contours.

Computation of Areas and Volumes

Areas -Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

Volumes - Computation of areas for level section and two-level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

UNIT- III

Theodolite Surveying: Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

UNIT-IV

Tachometric Surveying: Principles of Tachometry, stadia and tangential methods of Tachometry.

Curves: Types of curves and their necessity, elements of simple curve, setting out of simple Curves,

UNIT-V

Modern Surveying Methods: Total Station and Global Positioning System: Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory – electromagnetic distance measuring system-principle of working and EDM instruments, Components of GPS–space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

TEXT BOOKS:

1. Surveying with Geomatics and R First Edition (2022) by Marcelo de Carvalho Alves, Luciana Sanches.
2. Surveying and leveling by R. Subramanian, Oxford university press, New Delhi.
3. Chandra A M, "Higher Surveying", Newage International Pvt.Ltd. Publishers, New Delhi,2002.
4. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer -Verlag Publishers, 2001.

REFERENCE BOOKS:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw-Hill–2000.
2. Arora K R “Surveying Vol 1,2&3, Standard Book House, Delhi,2004.
3. Surveying (Vol–1,2&3), by B.C. Punmia, AshokKumar Jain and ArunKumar Jain-Laxmi Publications (P) ltd., New Delhi.
4. Chandra A M,“Plane Surveying”, New Age International Pvt.Ltd., NewDelhi,2002.
5. Surveying by Bhavikatti; Vikas publishing house ltd.
6. Duggal S K,“Surveying (Vol–1&2), Tata McGrawHill Publishing Co. Ltd. New Delhi,2004.
7. Surveying and leveling by R. Agor Khanna Publishers 2015.

FLUID MECHANICS

B.Tech. II Year I Sem.

L T P C

3 0 0 3

Course Objectives: The objectives of the course are to

- Introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- Provide a first level exposure to the students to fluid statics, kinematics and dynamics.
- Learn about the application of mass, energy and momentum conservation laws for fluid flows.
- Train and analyses engineering problems involving fluids with a mechanistic perspective is essential for the civil engineering students
- To obtain the velocity and pressure variations in various types of simple flows.
- To prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology.

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

- Understand the broad principles of fluid statics, kinematics and dynamics.
- Understand definitions of the basic terms used in fluid mechanics and characteristics of fluids and its flow.
- Understand classifications of fluid flow.
- Be able to apply the continuity, momentum and energy principles.

UNIT-I

Properties of Fluid

Distinction between a fluid and a solid; Properties of fluids – Viscosity, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility. **Fluid Statics**

Fluid Pressure: Pressure at a point, Pascal's law, Hydrostatic law, Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces.

UNIT- II

Fluid Kinematics

Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; One, two- and three-dimensional flows; Streamline, path line, streak line and stream tube; stream function, velocity potential function, flow net, One, two- and three-dimensional

Continuity equations in Cartesian coordinates applications.

Fluid Dynamics

Surface and Body forces -Euler's and Bernoulli's equation; Momentum equation. Correction factors. Bernoulli's equation to real fluid flows.

UNIT- III

Flow Measurement in Pipes

Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube, applications of Momentum equations; Forces exerted by fluid flow on pipe bend, sudden enlargement in pipes.

Flow Over Notches & Weirs

Flow through rectangular; triangular and trapezoidal notches and weirs; End contractions; Velocity of approach. Broad crested weir.

UNIT-IV

Flow through Pipes

Reynolds experiment, Reynolds number, Loss of head through pipes, Darcy- Wiesbatch equation, minor losses, total energy line, hydraulic grade line, Pipes in series, equivalent pipes, pipes in parallel, siphon, branching of pipes, three reservoir problem, power transmission through pipes. Analysis of pipe networks: Hardy Cross method and EPANET, water hammer in pipes and control measures.

UNIT-V

Laminar & Turbulent Flow

Laminar flow through circular pipes, and fixed parallel plates.

Boundary Layer Concepts

Prandtl contribution, Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness concepts of laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. Drag and Lift and types of drag, magnus effect.

TEXT BOOKS:

1. Theory and Applications of Fluid Mechanics, K. Subramanian, TataMcGrawHill
2. Fluid Mechanics by Modi and Seth, Standard Book House.
3. Fluid Mechanics by Streeter
4. Fluid Mechanics by R.C.Hibbeler, Pearson India Education Services Pvt.Ltd.

REFERENCE BOOKS:

1. Fluid Mechanics—Frank M. White—8th Edition—McGraw-Hill Education.
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman

Chakraborty, Mc Graw Hill Education (India) Private Limited

3. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
4. Fluid Mechanics & Hydraulic Machines, Domkundwar& Domkundwar Dhanpat Rai & Co
5. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publication Pvt. Ltd.

COMPUTATIONAL MATHEMATICS LABORATORY

B.Tech. II Year I Sem.

L T P C

0 0 2 1

Pre-requisites: Matrices, Iterative methods and ordinary differential equations

Course Objectives: To learn

1. Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
2. Solution of Algebraic and Transcendental Equations using Python/MATLAB
3. Solve problems of Linear system of equations
4. Solve problems of **First-Order ODEs Higher order linear differential equations with constant coefficients**

Course outcomes: After learning the contents of this paper, the student must be able to

1. Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
3. Write the code to solve problems of **First-Order ODEs Higher order linear differential equations with constant coefficients**

*** Visualize all solutions Graphically through programmes**

UNIT - I: Eigen values and Eigenvectors:

6P

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations

6P

Bisection method, Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations:

6P

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidal method

UNIT-IV: First-Order ODEs

8P

Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.

Programs:

- Solving exact and non-exact equations

- Solving exponential growth/decay and Newton's law of cooling problems

UNIT-V: Higher order linear differential equations with constant coefficients**6P****Programs:**

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, O'Reilly publishing.
4. Introduction to Python Programming, William Mitchell, PavelSolin, Martin Novak et al., NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

COMPUTER AIDED BUILDING DRAFTING LABORATORY

B.Tech. II Year I Sem.

L T P C

0 0 2 1

Course Objectives: The objective of this Course is to

- Plan buildings as per NBC.
- Understand various types of conventional signs and brick bonds.
- Draw the plan section and elevation for doors, trusses and staircases.
- Use AutoCAD tools to draw building plans, sections and elevations from a given line diagram and specifications.
- Develop working drawings of residential buildings.

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

- Plan buildings as per NBC.
- Use different Commands of selected drafting software to draw Conventional signs and brick bonds, Plan, Section and Elevation of buildings.
- Draw section and elevation of paneled doors and trusses.
- Draw and detail the different components of Staircases.
- Develop and draw single/ two storey residential building and public building as per the building by-laws.
- Draw Electrical layout, Plumbing layout for residential buildings.

List of Experiments:

1. Planning Aspects of Building systems as per National Building Code(NBC).
2. Brick bonds: English bond & Flemish bond– Odd and Even courses.
3. Developing plan and section of dog-legged staircase.
4. Developing plan of single storied residential building.
5. Developing section and elevation of single storied residential building.
6. Developing plan of single/ two storied Residential building as per Building by-laws.
7. Developing plan of public building as per building by-laws.
8. Developing section and elevation of public building.
9. Development of working drawing of building–Electrical Layout.
10. Development of working drawing of building–Plumbing Layout.

TEXT BOOKS:

1. Computer Aided Design Laboratory by M.N. Sesha Prakash & Dr.G.S. Servesh–Laxmi Publications.
2. Engineering Graphics by P.J. Sha– S. Chand & Co.
3. Civil Engineering Drawing-I by N. Sreenivasulu, S. Rama Rao– Radiant Publishing House.

REFERECE BOOKS:

1. Civil Engineering Drawing-I by S. Mahaboob Basha—Falcon Publishers
2. Building drawing by M.G.Shah-Tata McGraw-Hill Education
3. Structural Engineering Drawing by S. Mahaboob Basha—Falcon Publishers

STRENGTH OF MATERIALS LABORATORY

B.Tech. II Year I Sem.

C

L T P

0 0 2 1

Course Objectives: The objectives of the course are to

- Conduct the Tension test, Compression test on various materials
- Conduct the Shear test, Bending test on determinate beams
- Conduct the Compression test on spring and Hardness test using various machines
- Conduct the Torsion test, Impact test on various materials

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

- Determine the yield stress, ultimate tensile stress, percentage elongation of steel, compressive strength of brick and concrete
- Determine the ultimate shear stress, modulus of elasticity of steel
- Determine the stiffness of the close-coiled helical spring and hardness number of mild steel, brass, copper and aluminum.
- Determine the modulus of rigidity and impact strength of steel.

List of Experiments:

1. Tension test
2. Bending test on(Steel/Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on concrete.
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges.
12. Continuous beam-deflection test.

SURVEYING AND GEOMATICS LABORATORY

B.Tech. II Year I Sem.

L T P C

0 0 2 1

Course Objectives: The objectives of the course are to

- Learn and understand the various basic concept and principles used in surveying like Chain Surveying, Compass Surveying, Plane Table Surveying, and Levelling Surveying.
- Learn and understand about theodolite and total station in surveying.
- Learn and understand how to calculate Area of plot and Ground.
- Learn and understand about Horizontal Angle, Vertical Angle, Horizontal distance and Vertical distance to study the ground profile using total station.

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

- Prepare Map and Plan for required site with suitable scale.
- Prepare contour Map and Estimate the Quantity of earthwork required for formation level for Road and Railway Alignment.
- Judge which type of instrument to be used for carrying out survey for a Particular Area and estimate the area.
- Judge the profile of ground by observing the available existing contour map.

CYCLE-I

Theodolite surveying:

1. Measurement of horizontal angles and vertical angles.
2. Distance between two inaccessible points.
3. Measurement of area by theodolite traversing(Gales traversetable).
4. Determination of tachometer constants.
5. Distance between two inaccessible points using the principles of tachometer surveying.
6. Distance between two inaccessible points using the principles of trigonometric surveying

CYCLE-II

Total Station:

7. Area Measurement
8. Stake Out
9. Remote Elevation Measurement
10. Missing Line Measurement
11. Longitudinal & Cross Section Profile
12. Contouring
13. Providing a Simple Circular Curve
14. Demonstration using DGPS

DESIGN THINKING LABORATORY

B.Tech. II Year I Sem.

L T P C

0 0 2 1

Course Objectives: The objectives of the course are to

- Introduce students to the principles and stages of design thinking, creativity, and user-centered innovation.
- Develop students' ability to frame problems and create solutions using iterative and collaborative methods.
- Enhance empathy-driven approaches to design and engineering challenges.
- Cultivate skills in rapid prototyping, brainstorming, ideation, and effective team collaboration.
- Build communication and presentation skills through real-world pitch and innovation exercises.
- Promote critical reflection and systems thinking in addressing complex design problems

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

- Apply design thinking methodology (Empathize, Define, Ideate, Prototype, Test) to solve real-world problems.
- Use empathy-based research techniques to understand user needs and perspectives.
- Generate innovative ideas using ideation tools like "Yes, and", "Five/Nine Whys", and "Six Thinking Hats".
- Demonstrate the ability to collaborate in multidisciplinary teams and engage in constructive feedback.
- Rapidly prototype and test design concepts within constrained timeframes (e.g., 48-hour challenges).
- Present and pitch design solutions effectively to a target audience or jury.
- Analyze systems and complex problems using systems thinking tools to propose sustainable solutions.
- Reflect critically on team-based design experiences and iterate solutions based on feedback and testing.

STUDENTS' RESPONSIBILITIES:

1. Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
2. Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
3. Identifying general societal and social problems that may be effectively addressed using design thinking principles
4. Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

ACTIVITIES:

1. Introduction and briefing (15 minutes)
2. Ice-breaker activity (20 minutes)

3. Introduction to Design Thinking (20 minutes)
4. Building empathy for the user (1 hour)
5. Define a problem statement (1 hour)
6. Ideation part 1: Generate ideas and potential solutions (1 hour) Presentation (5 minutes): What is ideation? Activity—worst possible idea (10 minutes) Activity—coming up with solutions (10 minutes) Activity—sharing ideas and getting feedback (10 minutes) Activity—refining your solution (10 minutes) Reflection and discussion (5 minutes)
7. Ideation part 2: User journey mapping (1 hour) Presentation (10 minutes): What is a user journey map? Activity—define the activities and steps in the customer’s experience (15 minutes) Activity—group the steps into phases (10 minutes) Activity—adding goals and pain-points (15 minutes) Sharing user journey maps, reflection and discussion (10 minutes)
8. Prototype and test ideas (1 hour) Presentation (5 minutes): Activity—create mobile screens (15 minutes) Activity—add functionality to mobile screens (15 minutes) Activity—user testing (15 minutes) Activity—decide on a winning approach (10 minutes):
9. Debrief and outline next steps (15 minutes)

Exercises:

1. The Pin-Up Exercise
2. The Systems Thinking Exercise
3. The 48-Hour Crash Course Exercise
4. The Design with Empathy Exercise
5. The Tinker Toy Exercise
6. The Wallet Exercise
7. The Pitch Competition Exercise
8. “Yes, but” vs. “Yes, and” exercise
9. “Five whys” or “Nine Whys” exercise
10. The “Six Thinking Hats” exercise

TEXT BOOKS:

1. Kumantri Ranga Chari (2024) Applied Design Thinking for Problem Solving - A Tool Kit for Business Practitioners and Managers, BS Publications
2. Tim Brown, “Change by Design”, Harper Business, 2012 (ISBN: 978-0062337382)
3. Donald A. Norman, “The Design of Everyday Things”, MIT Press, 2013 (ISBN: 978-0262525671)
4. Daniel Ling, “Complete Design Thinking Guide for Successful Professionals”, Create Space Independent Publishing, 2015 (ISBN: 978-1514202739)
5. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, Routledge Taylor and Francis group, 2019, 1st edition.
6. Engineering Design, George E. Dieter, Linda C. Schmidt, McGraw-Hill Education, 2019, 5th edition.
7. Product design and development, Ulrich, K., Eppinger, S. and Yang, M., 2020, 7th edition.

REFERENCE BOOKS:

1. Bruno Munari, “Design as Art”, Penguin UK, 2009 (ISBN: 978-0141035819)

2. Tom Kelly, Jonathan Littman, “The Art of Innovation”, HarperCollins Business, 2002 (ISBN: 978- 0007102938)
3. Thomas Lockwood, “Design Thinking: Integrating Innovation, Customer Experience, and Brand Value”, Allworth Press, 2009 (ISBN: 978-1581156683)
4. Joost Groot Kromelink, “Responsible Innovation: Ethics, Safety and Technology”, 2nd ed., TU Delft, Faculty of Technology, Policy and Management, 2019 (e-Book ISBN: 978-9463662024)
5. Jimmy Jain, “Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners”, Notion Press, 2018 (ISBN: 978-1642495034)

Other Suggested Readings:

1. <https://www.arvindguptatoys.com>
2. <https://honeybee.org>
3. <https://dschool.stanford.edu/resources/getting-started-with-design-thinking>
4. <https://designthinking.ideo.com>

CONCRETE TECHNOLOGY

B.Tech. II Year II Sem.

L T P C

3 0 0 3

Pre-Requisites: Building Materials

Course Objectives: The objectives of the course are to

- **Know** different types of cement as per their properties for different field applications.
- **Understand Design** economic concrete mix proportion for different exposure conditions and intended purposes.
- **Know** field and laboratory **tests** on concrete in plastic and hardened stage.

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

- **Determine** the properties of concrete ingredients i.e., cement, sand, coarse aggregate by conducting different tests. Recognize the effects of the rheology and early age properties of concrete on its long-term behavior.
- **Apply** the use of various chemical admixtures and mineral additives to design cement-based materials with tailor-made properties.
- **Use** advanced laboratory techniques to characterize cement-based materials.
- **Perform** mix design and engineering properties of special concretes such as high-performance concrete, self-compacting concrete, and fiber reinforced concrete.

UNIT I

Aggregate: Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine, Manufactured sand and coarse Aggregates – Gap graded aggregate – Maximum aggregate size- Properties Recycled aggregate.

UNIT - II

Fresh Concrete: Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing, vibration and revibration of concrete – Steps in manufacture of concrete – Quality of mixing water.

UNIT – III

Hardened Concrete: Water / Cement ratio – Abram's Law – Gel/space ratio – Gain of

strength of concrete – Maturity concept – Strength in tension and compression – Factors affecting strength – Relation between compression and tensile strength - Curing.

Testing of Hardened Concrete: Compression tests – Tension tests – Factors affecting strength – Flexure tests – Splitting tests – Pull-out test, Non-destructive testing methods – codal provisions for NDT.

UNIT - IV

Elasticity, Creep & Shrinkage – Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – types of shrinkage.

UNIT – V

Admixtures: Types of admixtures – mineral and chemical admixtures.

Mix Design: Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

Special Concretes: Introduction to Light weight concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Polymer concrete – High performance concrete – Self compacting concrete, Nano silica and Nano Alumina concrete.

TEXT BOOKS:

1. Concrete Technology by M.S. Shetty. – S. Chand & Co.; 2004
2. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford university Press, New Delhi
3. Concrete Technology by M. L. Gambhir. – Tata Mc. Graw Hill Publishers, 5THEdition, New Delhi

REFERENCE BOOKS:

1. Properties of Concrete by A. M. Neville – Low priced Edition – 4th edition
2. Concrete: Micro structure, Properties and Materials – P.K. Mehta and J.M. Monteiro, Mc-Graw Hill Publishers

IS Codes:

IS 383 : 2016

IS 516 : 2018 (Part -1 - 4)

IS 10262 - 2019

ADVANCED STRENGTH OF MATERIALS

B.Tech. II Year II Sem.

L T P C

3 0 0 3

Pre-Requisites: Strength of Materials - I

Course Objectives: The objective of this Course is

- To understand the nature of stresses developed in simple geometries shafts, springs, columns & cylindrical and spherical shells for various types of simple loads.
- To calculate the stability and elastic deformation occurring in various simple geometries for different types of loading.
- To understand the unsymmetrical bending and shear center importance for equilibrium conditions in a structural member of having different axis of symmetry.

UNIT – I

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equation – Assumptions made in the theory of pure torsion – Polar section modulus – Power transmitted by shafts – Combined bending and torsion – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

UNIT – II

Columns and Struts: Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns – assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Long columns subjected to eccentric loading – Secant formula – Empirical formulae — Rankine – Gordon formula- Straight line formula – Prof. Perry's formula.

BEAM COLUMNS: Laterally loaded struts – subjected to uniformly distributed and concentrated loads.

UNIT - III

Direct and Bending Stresses: Stresses under the combined action of direct loading and bending moment, core of a section – determination of stresses in the case of retaining walls, chimneys and dams – conditions for stability-Overturning and sliding – stresses due to direct loading and bending moment about both axis.

UNIT – IV

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter, and volume of thin cylinders – Thin spherical shells.

Thick Cylinders: Introduction - Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage.

UNIT – V

Unsymmetrical Bending:

Introduction – Centroidal principal axes of section – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis.

Shear Centre: Introduction - Shear center for symmetrical and unsymmetrical (channel, I, T and L) sections.

Course Outcome: On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity, and perform calculations, relative to the strength of structures and mechanical components in particular to torsion and direct compression.
- To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Analyze strength and stability of structural members subjected to Direct, and Direct and Bending stresses.
- Understand and evaluate the shear center and unsymmetrical bending.

TEXT BOOKS:

1. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.
2. Mechanics of Materials by Dr. B. C Punmia, Dr. Ashok Kumar Jain and Dr. Arun Kumar Jain
3. Strength of Materials by R. Subramanian, Oxford University Press.

REFERENCE BOOKS:

1. Mechanics of Materials by R.C. Hibbeler, Pearson Education
2. Engineering Mechanics of Solids by Popov E.P. Prentice-Hall Ltd
3. Strength of Materials by T.D.Gunneswara Rao and M.Andal, Cambridge Publishers
4. Strength of Materials by R. K. Bansal, Lakshmi Publications House Pvt. Ltd.
5. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd

ENVIRONMENTAL ENGINEERING

B.Tech. II Year II Sem.

L T P C

3 0 0 3

Course Objectives: This subject provides the knowledge of water sources, water treatment, design of distribution system wastewater treatment, and safe disposal methods. The topics of characteristics of wastewater, sludge digestion are also included , basics of Air Pollution & Control.

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

- Assess characteristics of water and wastewater.
- Estimate quantities of water and wastewater and plan conveyance components.
- Design components of water and wastewater treatment plants.
- Be conversant with issues of air pollution and control.

UNIT – I

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

UNIT – II

Layout and general outline of water treatment units: Sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices–Design of distribution systems–pipe appurtenances.

UNIT - III

Characteristics of sewage :Waste water collection–Estimation of waste water and storm water – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances, manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – plumbing requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming –self-purification of rivers.

UNIT – IV

Waste water treatment plant : Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – ASP– Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

UNIT – V

Air pollution : Classification of air pollution– Effects air pollution–Global effects–Meteorological parameters affecting air pollution–Atmospheric stability–Plume behavior –Control of particulates – Gravity settlers, cyclone filters, ESPs–Control of gaseous pollutants–automobile pollution and control.

TEXT BOOKS:

1. Environmental Engineering by H. S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.ASincero, Pearson 2015.
3. Environmental Engineering, I and II by BC Punmia, Std. Publications.
4. Environmental Engineering, I and II by SK Garg, Khanna Publications.
5. Environmental Pollution and Control Engineering CS Rao,Wiley Publications

REFERENCE BOOKS:

1. Water and Waste Water Technology by Steel, Wiley
2. Wastewater engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley, 2007.
5. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
6. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
7. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication

HYDRAULICS AND HYDRAULIC MACHINERY

B.Tech. II Year II Sem.

L T P C

3 0 0 3

Course Objectives : The objective of the course is to

- Define the fundamental principles of water conveyance in open channels.
- Discuss and analyze the open channels in uniform and Non-uniform flow conditions.
- Study the characteristics of hydroelectric power plant and its components.
- Analyze and design of hydraulic machinery and its modeling.

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

- Apply their knowledge of fluid mechanics in addressing problems in open channels and hydraulic machinery.
- Understand and solve problems in uniform, gradually and rapidly varied flows in open channel in steady state conditions.
- Apply dimensional analysis and to differentiate the model, proto type and similitude conditions for practical problems.
- Get the knowledge on different hydraulic machinery devices and its principles that will be utilized in hydropower development and for other practical usages.

UNIT-I

Open Channel Flow-I: Introduction to Open channel flow - Comparison between open channel flow and pipe flow, Classification of open channel flows, Velocity distribution. Uniform flow–Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae for uniform flow – Factors affecting Manning's Roughness Coefficient. Most economical sections.Computation of Uniform flow, Normal depth.

Critical Flow: Specific energy – critical depth - computation of critical depth – critical, sub critical and super critical Flows-Channel transitions (Theory only).

UNIT- II

Open Channel Flow-II: Non-uniform flow–Gradually Varied Flow-Dynamic equation for G.V.F; Classification of channel bottom slopes–Classification and characteristics of Surface profiles– Computation of water surface profiles by Numerical and Analytical approaches. Direct step method.

Rapidly varied flow: Elements and characteristics (Length and Height) of Hydraulic jump in rectangular channel– Types, applications and location of hydraulic jump, Energy dissipation and other uses.

UNIT- III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity – Rayleigh's method and Buckingham's π methods–Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency.

UNIT-IV

Hydraulic Turbines – I: Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines–Pelton wheel–Francis turbine–Kaplan turbine–working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency.

Hydraulic Turbines–II: Governing of turbines–Surge tanks–Unit and specific turbines–Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation. Selection of turbines.

UNIT-V

Centrifugal Pumps: Pump installation details–classification–work done–Manometric head–minimum starting speed–losses and efficiencies–specific speed. Multistage pumps –pumps in series, parallel – performance of pumps – characteristic curves – NPSH – Cavitation.

TEXT BOOKS:

1. Fluid Mechanics by Modi and Seth, Standard Book House.
2. Fluid Mechanics and Hydraulic machines by Manish Kumar Goyal, PHI learning Private Limited, 2015
3. Fluid Mechanic & Fluid Power Engineering by D. S. Kumar (Kataria & Sons Publications Pvt. Ltd.).

REFERENCE BOOKS:

1. Fluid Mechanics by R.C. Hibbeler, Pearson India Education Services Pvt.Ltd
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborty, Mc Graw Hill Education (India) Private Limited
3. Hydraulic Machines by Banga & Sharma (Khanna Publishers).
4. Open channel flow by V.T.Chow (McGraw Hill Book Company).

BASIC STRUCTURAL ANALYSIS

B.Tech. II Year II Sem.

L T P C

2 0 0 2

Pre-Requisites: Strength of Materials – I

Course Objectives: The objective of the course is to

- Differentiate the statically determinate and indeterminate structures.
- To understand the nature of stresses developed in perfect frames and three hinged arches for various types of simple loads
- Analyse the statically indeterminate members such as fixed bars, continuous beams and for various types of loading.
- Understand the energy methods used to derive the equations to solve engineering problems
- Evaluate the Influence on a beam for different static & moving loading positions

UNIT – I

Analysis of Perfect Frames: Types of frames- Perfect, Imperfect and Redundant pin jointed plane frames - Analysis of determinate pin jointed plane frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

UNIT – II

Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's theorem-Unit Load Method - Deflections of simple beams and pin- jointed plane frames - Deflections of statically determinate bent frames.

Three Hinged Arches – Introduction – Types of Arches – Comparison between Three hinged and Two hinged Arches - Linear Arch - Eddy's theorem - Analysis of Three hinged arches - Normal Thrust and radial shear and bending moment - Geometrical properties of parabolic and circular arches - Three hinged parabolic circular arches having supports at different levels.

UNIT - III

Propped Cantilever and Fixed Beams: Determination of static and kinematic indeterminacies for beams- Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia - subjected to uniformly distributed load - point loads - uniformly varying load, couple and combination of loads - Shear force, Bending moment diagrams and elastic curve for Propped Cantilever and Fixed Beams-Deflection of Propped cantilever and fixed beams - effect of sinking of support, effect of rotation of a support.

UNIT – IV

Continuous Beams: Introduction-Continuous beams - Clapeyron's theorem of three moments- Analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed-continuous beams with overhang - effect of sinking of supports.

Slope Deflection Method: Derivation of slope-deflection equation, application to continuous beams with and without sinking of supports -Determination of static and kinematic indeterminacies for frames

- Analysis of Single Bay, Single storey Portal Frames by Slope Deflection Method including Side Sway
- Shear force and bending moment diagrams and Elastic curve.

UNIT – V

Moving Loads and Influence Lines: Introduction maximum SF and BM at a given section and absolute maximum shear force and bending moment due to single concentrated load ,uniformly distributed load longer than the span, uniformly distributed load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length - Definition of influence line for shear force and bending moment - load position for maximum shear force and maximum bending Moment at a section - Point loads, uniformly distributed load longer than the span, uniformly distributed load shorter than the span.

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

- An ability to apply knowledge of mathematics, science, and engineering.
- Analyse the statically indeterminate bars and continuous beams.
- Draw strength behaviour of members for static and dynamic loading.
- Calculate the stiffness parameters in beams and pin jointed trusses.
- Understand the indeterminacy aspects to consider for a total structural system.
- Identify, formulate, and solve engineering problems with real time loading.

TEXT BOOKS:

1. Structural Analysis Vol I & II by G. S. Pandit and S.P. Gupta, Tata McGraw Hill Education Pvt.Ltd.
2. Basic Structural Analysis by K.U. Muthu *et al.*, I.K. International Publishing House Pvt. Ltd

REFERENCE BOOKS:

1. Structural Analysis by R. C. Hibbeler, Pearson Education
2. Structural Analysis Vol –I & II by V.N. Vazirani and M.M. Ratwani, Khanna Publishers.
3. Mechanics of Structures Vol – I and II by H.J. Shah and S.B. Junnarkar, Charotar PublishingHouse Pvt. Ltd.
4. Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill Education Pvt. Ltd.
5. Fundamentals of Structural Analysis by M.L. Gamhir, PHI Learning Pvt. Ltd.

INNOVATION AND ENTREPRENEURSHIP

B.Tech. II Year II Sem.

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Course Objectives : The objective of this Course is to

- develop entrepreneurial mindset among civil engineering students
- encourage innovative thinking for solving real-world infrastructure problems
- equip students with the basics of business planning, startup creation, and IP rights
- bridge the gap between engineering solutions and market needs

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

- Understand the fundamentals of innovation, creativity, and entrepreneurs
- Identify opportunities and develop innovative solutions in civil engineering
- Prepare business models and feasibility studies for civil-related startups
- Apply principles of intellectual property, prototyping, and product development
- Demonstrate leadership and teamwork in entrepreneurial projects

UNIT 1:

Introduction to Innovation & Entrepreneurship Innovation vs. Invention vs. Creativity Entrepreneurial traits and motivation Types of Entrepreneurs (Tech, Social, Green, Civil-focused) Successful startup case studies in infrastructure and civil engineering

UNIT 2:

Design Thinking & Ideation Empathy and user-centered design Problem identification in civil/environmental infrastructure Brainstorming and idea validation Rapid prototyping for construction materials, smart structures, etc.

UNIT 3:

Business Model & Start-Up Ecosystem Elements of a business model (Canvas model) Market analysis and feasibility Minimum Viable Product (MVP) Government schemes for startups (Startup India, Atal Innovation Mission) Incubators, accelerators, and funding options

UNIT 4:

Legal and Financial Aspects Basics of intellectual property rights (patents, copyrights, trademarks) Financial planning, budgeting, and cost estimation Funding options: Bootstrapping, Angel investors, VCs Civil engineering-specific legal compliance (construction, land use, etc.)

UNIT 5:

Innovation in Civil Engineering Smart city innovations Green building materials and sustainable design Entrepreneurship opportunities in construction tech, project management, surveying tech Automation in civil engineering – BIM, drones, 3D printing, etc.

TEXT BOOKS:

1. “Innovation and Entrepreneurship” by Peter F. Drucker
2. “Entrepreneurship Development” by S.S. Khanka
3. “Design Thinking” by Tim Brown

REFERENCE BOOKS:

1. AICTE Innovation Cell & Startup India Toolkit
2. Case studies on civil engineering startups (e.g., Katerra, Brick&Bolt, etc.)

ENVIRONMENTAL ENGINEERING LABORATORY

B.Tech. II Year II Sem.

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Course Objectives: The objectives of the course is to

- **Perform** the experiments to determine water and waste water quality.
- **Understand** the water & wastewater sampling, their quality standards.
- **Estimate** quality of water, wastewater, Industrial water.

Practical Work: List of Experiments

1. Determination of pH
2. Determination of Electrical Conductivity
3. Determination of Total Solids (Organic and inorganic)
4. Determination of Acidity
5. Determination of Alkalinity
6. Determination of Hardness (Total, Calcium and Magnesium Hardness)
7. Determination of Chlorides
8. Determination of optimum coagulant Dosage
9. Determination of Dissolved Oxygen (Winkler Method)
10. Determination of COD
11. Determination of BOD
12. Determination of Residual Chlorine
13. Total count
14. Noise level measurement

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

- Understand about the equipment used to conduct the test procedures.
- Perform the experiments in the lab.
- Examine and Estimate water, waste water, air and soil Quality.
- Compare the water, air quality standards with prescribed standards set by the local governments.
- Develop a report on the quality aspects of the environment.

TEXT/REFERENCE BOOKS:

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
2. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan, Thompson / Brooks/ Cole; Second Edition 2008.
3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.
4. Met Calf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.
5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
6. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
7. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development

CONCRETE TECHNOLOGY LABORATORY

B.Tech. II Year II Sem.

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Course Objectives:

- To know the various procedures to determine the characteristics of cement.
- To understand the test procedures to evaluate the characteristics of aggregates.
- To know the test procedures to find the properties of fresh concrete.
- To understand the test procedures to find mechanical properties of hardened concrete.

LIST OF EXERCISES:

1. Tests on Cement:

- a) Soundness.
- f) Compressive strength.

2. Tests on Aggregates:

- a) Specific gravity of fine aggregate.
- b) Specific gravity of coarse aggregate.
- c) Bulking of fine aggregate.
- d) Grading of fine aggregate

3. IS method of mix design of normal concrete as per IS : 10262

4. Tests on Fresh Concrete:

- a) Slump cone test.
- b) Compacting factor test.
- c) Vee-Bee consistometer test.

5. Tests on Hardened Concrete:

- a) Compressive & Tensile strength tests.
- b) Modulus of elasticity of concrete.
- c) Non-destructive testing of concrete.

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

- Perform various tests required to assess the characteristics of cement.

- Test and evaluate the properties of fine and coarse aggregates and determine its suitability for construction.
- Evaluate the fresh and hardened properties of concrete.
- Design the concrete mix for required strength and test its performance characteristics.

HYDRAULICS AND HYDRAULIC MACHINERY LABORATORY

B.Tech. II Year II Sem.

L T P C

0 0 2 1

Course Objectives: The objective of this Course is to

- **Identify** the behavior of analytical models introduced in lecture to the actual behavior of real fluid flows.
- **Explain** the standard measurement techniques of fluid mechanics and their applications.
- **Illustrate** the students with the components and working principles of the Hydraulic machines-different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
- **Analyze** the laboratory measurements and to document the results in an appropriate format.

Course Outcomes: Students who successfully complete this course will have demonstrated ability to:

- **Describe** the basic measurement techniques of fluid mechanics and its appropriate application.
- **Interpret** the results obtained in the laboratory for various experiments.
- **Discover** the practical working of Hydraulic machines-different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
- **Compare** the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions.
- Write a technical laboratory report

List of Experiments

1. Verification of Bernoulli's equation
2. Determination of Coefficient of discharge for a small orifice by a constant head method
3. Calibration of Venturimeter/ Orifice Meter
4. Calibration of Triangular/Rectangular/ Trapezoidal Notch
5. Determination of Minor losses in pipe flow
6. Determination of Friction factor of a pipeline
7. Determination of Energy loss in Hydraulic jump
8. Determination of Manning's and Chezy's constants for Open channel flow.
9. Impact of jet on vanes
10. Performance Characteristics of Pelton wheel turbine
11. Performance Characteristics of Francis turbine
12. Performance characteristics of Kaplan Turbine
13. Performance Characteristics of a single stage/multistage Centrifugal Pump

DIGITAL SURVEYING AND GIS LABORATORY

B.Tech. II Year II Sem.

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Course Objectives: The objective of this Course is to

- Familiarize students with advanced survey instruments such as Total Station, Digital Level, GIS and GPS.
- Provide hands-on training in digital data collection and interpretation.
- Enhance the capability of students in applying modern survey and GIS techniques in civil engineering practices.

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

- Handle and operate Total Station, GPS, and Digital Level effectively.
- Perform field surveys, including traversing, levelling, and contouring using digital instruments.
- Transfer and process survey data using basic GIS tools.
- Develop topographical maps and reports based on digital survey data.

List of Experiments:

1. Introduction to GPS surveying – types and working principles.
2. Static and dynamic GPS survey using handheld devices.
3. Route tracking and waypoint marking with GPS.
4. Digital levelling – procedure and applications.
5. Contouring using Total Station and digital level.
6. To understand the features in the Survey of India toposheet.
7. To georeference the scanned Survey of India toposheet using GIS.
8. To delineate the boundary for the catchment area using GIS.
9. To prepare the basemap for the delineated catchment area using GIS.
10. To prepare the contour map for the delineated area using GIS.

SOFTWARE/TOOLS TO BE USED:

- Total Station
- Digital Level
- GPS instrument
- Surveying Software: AutoCAD / Civil 3D
- Open source software for GIS

RECOMMENDED BOOKS AND MANUALS:

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying Vol. 1 & 2, 18th Edition, 2020, Laxmi Publications Pvt. Ltd., ISBN: 9789380856596.
2. Satheesh Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, 2nd Edition, 2017,

Pearson Education India, ISBN: 9789332587697.

- 3. R. Subramanian, Surveying and Levelling, 2nd Edition, 2014, Oxford University Press, ISBN: 9780199456154.
- 4. N.N. Basak, Surveying and Levelling, 3rd Edition, 2017, McGraw Hill Education (India), ISBN: 9789353161598.
- 5. Satheesh Gopi, GPS Surveying: Theory and Applications, 1st Edition, 2015, Pearson Education India, ISBN: 9789332541088.
- 6. Total Station and GPS Surveying – User Manuals, Manufacturer Guides (Leica Geosystems, Sokkia, Topcon, etc.).

ENVIRONMENTAL SCIENCE

B.Tech. II Year II Sem.

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Course Objectives:

- Understand the components, structure, and functions of ecosystems and their relevance to human society.
- Comprehend classification, sustainable management, and challenges of natural resources including water, minerals, land, forests, and energy.
- Grasp the significance, value, and conservation approaches for biodiversity, including threats and legislative frameworks.
- Analyze types, sources, and impacts of environmental pollution, and learn technological and policy measures for pollution prevention and control.
- Develop awareness about global environmental challenges, international agreements, and the role of policy, law, and Environmental Impact Assessment (EIA) in sustainable development.

Course Outcomes:

- Understand the structure, function, and significance of ecosystems, including energy flow, biogeochemical cycles, and biodiversity conservation through field experiences.
- Analyze the classification, utilization, and sustainable management of natural resources, along with alternative energy options.
- Evaluate biodiversity at genetic, species, and ecosystem levels, its values, threats, and conservation methods under national and international frameworks.
- Identify types, sources, and impacts of environmental pollution, and apply suitable control technologies while assessing global environmental challenges and protocols.
- Interpret environmental policies, legislation, and the EIA process to propose management plans addressing contemporary environmental and sustainability issues.

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

UNIT- II

Natural Resources: Classification of Resources: Living and Non-Living resources,

water resources: use and overutilization of surface and groundwater, floods and

droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation,

environmental effects of extracting and using mineral resources, **Land resources:**

Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT- III

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: **Environmental Pollution:** Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts :** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, WaterAct, ForestAct, Wildlife Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. **EIA:** EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan(EMP).Contemporary Environmental Issues Climate change; Sustainable development goals (SDGs); Global environmental challenges; Environmental policies and international agreements.

TEXTBOOKS:

- 1 Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.
- 2 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 3 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

- 1 Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
- 2 Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
- 3 Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
- 4 Environmental Studies by Anubha Kaushik, 4th Edition, Newage international publishers.
- 5 Text book of Environmental Science and Technology-Dr. M. Anji Reddy 2007, B S Publications.