METHODIST COLLEGE OF ENGINEERING & TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Accredited by NBA & NAAC with A+ Grade

Approved by AICTE, New-Dehli. Affiliated to Osmania University, Hyderabad.
Abids, HYDERABAD-500001, Telangana.

M21 - SCHEME OF INSTRUCTIONS and SYLLABI of III - VIII Semesters for B.E. Four Year Degree Programme in Civil Engineering

(With Effect from the Academic Year 2022-23)
(As approved in Academic Council Meeting)

Empower Youth - Architects of Future World

B.E. (Civil Engineering) - III SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2BS303HS	Numerical Methods and Partial Differential Equations	3	1	-	4	40	60	4
2	2HS302HS	Managerial Economics & Financial Accountancy	3	-	-	3	40	60	3
3	2ES301CS	Programming for Problem Solving (C)	3	-	-	3	40	60	3
4	2PC301CE	Building Materials and Concrete Technology	3	-	-	3	40	60	3
5	2PC302CE	Solid Mechanics	3	-	-	3	40	60	3
6	2PC303CE	Surveying	3	-	-	3	40	60	3
7	2MC302HS	Essence of Indian Traditional Knowledge	2	-	-	2	40	60	-
Practical Courses									
8	2ES351CS	Programming for Problem Solving Laboratory (C)	-	-	2	2	40	60	1
9	2PC351CE	Surveying Laboratory	-	-	2	2	40	60	1
10	2PC352CE	Concrete Technology Laboratory	-	-	2	2	40	60	1
Total			**20**	**1**	**6**	**27**			**22**

B.E. (Civil Engineering) - IV SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2HS403HS	Human Values and Professional Ethics	2	-	-	2	40	60	2
2	2ES403CS	Python Programming	2	-	-	2	40	60	3
3	2PC404CE	Mechanics of Materials and Structures	3	-	-	3	40	60	3
4	2PC405CE	Design of Reinforced Concrete Structures	3	-	-	3	40	60	3
5	2PC406CE	Fluid Mechanics	3	-	-	3	40	60	3
6	2PC407CE	Hydrology	2	-	-	2	40	60	2
7	2MC403HS	Indian Constitution	2	-	-	2	40	60	-
Laboratory Courses									
8	2PC453CE	Mechanics of Materials Laboratory	-	-	2	2	40	60	1
9	2PC454CE	Building Drawing & Drafting Laboratory	-	-	2x3h	6	40	60	3
10	2ES453CS	Python Programming Lab	-	-	2	2	40	60	1
	PW	Practise School-1 (Short Internship) #							
Total			**17**	**0**	**10**	**27**			**21**

To be conducted after the IV Semester in the Summer Vacation and to be evaluated in V Semester.

B.E. (Civil Engineering) - V SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2ES506CE	Disaster Preparedness and Planning	2	-	-	2	40	60	2
2	2PC508CE	Structural Analysis	3	-	-	3	40	60	3
3	2PC509CE	Soil Mechanics	3	-	-	3	40	60	3
4	2PC510CE	Hydraulics Engineering	3	-	-	3	40	60	3
5	2PC511CE	Water Resources Engineering	3	-	-	3	40	60	3
6	2PC512CE	Design of Steel Structures	3	-	-	3	40	60	3
7	OE	Open Elective – I	3	-	-	3	40	60	3
Practical Courses									
8	2PC555CE	Soil MechanicsLaboratory	-	-	2	2	40	60	1
9	2PC556CE	Fluid Mechanics & Hydraulic Engineering Laboratory	-	-	2	2	40	60	1
10	PW501CE	Practise School-1/ Internship Evaluation	-	-	2	2	50		2
Total			**20**	**0**	**6**	**26**			**24**

Open Elective -I

1	OE501CE	Disaster Mitigation *

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

B.E. (Civil Engineering) - VI SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2PC613CE	Construction Engineering & Management	2	-	-	2	40	60	2
2	2PC614CE	Transportation Engineering	3	-	-	3	40	60	3
3	2PC615CE	Environmental Engineering	3	-	-	3	40	60	3
4	2PC616CE	Foundation Engineering	3	-	-	3	40	60	3
5	PE	Professional Elective - I	3	-	-	3	40	60	3
6	PE	Professional Elective - II	3	-	-	3	40	60	3
7	OE	Open Elective -II	3	-	-	3	40	60	3
Practical Courses									
8	2HS653HS	Soft Skills Laboratory	-	-	2	2	40	60	1
9	2PC657CE	Transportation Engineering Laboratory	-	-	2	2	40	60	1
10	2PC658CE	Environmental Engineering Laboratory	-	-	2	2	40	60	1
	PW	Practise School-2/ Mini Project #							
Total			**20**	**0**	**6**	**26**			**23**

\# To be conducted after the VI Semester in the Summer Vacation and to be evaluated in VII Semester

Professional Elective – I

S. No.	PE Stream	Course Title
1	2PE601CE	Prestressed Structures
2	2PE602CE	Ground Water Engineering

Professional Elective – II

S. No.	PE Stream	Course Title
1	2PE603CE	Structural Engineering Design and Detailing-1 (RCC)
2	2PE604CE	Advanced Surveying

Open Elective – II

S.No.	Course Code	Course Title
1	OE602CE	Green Building Technologies*

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

B.E. (Civil Engineering) - VII SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2PC717CE	Estimation and Specification	2	-	-	2	40	60	2
2	2PC718CE	Highway Engineering and Pavement Design	3	-	-	3	40	60	3
3	PE	Professional Elective - III	3	-	-	3	40	60	3
4	PE	Professional Elective - IV	3	-	-	3	40	60	3
5	PE	Professional Elective - V	3	-	-	3	40	60	3
6	PE	Professional Elective - VI	3	-	-	3	40	60	3
7	OE	Open Elective - III	3	-	-	3	40	60	3
Practical Courses									
8	PW702CE	Guided Self-Study Software Certification courses	-	-	2	2	50		2
9	PW703CE	Technical Report and Seminar/Mini Project (Case Study Based)	-	-	2	2	50		2
Total			**20**	**0**	**4**	**24**			**24**

Professional Elective – III

Sl.No.	PE Stream	Course Title
1	2PE705CE	Structural Engineering Design and Detailing-2 (Steel)
2	2PE706CE	Sustainable Civil Engineering Materials

Professional Elective – IV

Sl.No.	PE Stream	Course Title
1.	2PE707CE	Repair, Retrofitting and Maintenance of Structures
2.	2PE708CE	Data Analytics in Civil Engineering

Professional Elective – V

Sl.No.	PE Stream	Course Title
1.	2PE709CE	Principles of Green building practices
2.	2PE710CE	Construction Project Management

Professional Elective – VI

Sl.No.	PE Stream	Course Title
1.	2PE711CE	Principles of Climate change
2.	2PE712CE	Infrastructure Engineering

Open Elective – III

Sl.No.	Course Code	Course Title
1.	OE703CE	Essentials of Road Safety Engineering*

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

B.E. (Civil Engineering) - VIII SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	PW804CE	Major Project (OR) Professional Practice School-II	-	-	20	20	100	100	10
		Total							**10**

Open Elective – IV

S. No.	Course Code	Course Title
1.	OE804CE	Remote Sensing and GIS*

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

B.E. (Civil Engineering) - III SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2BS303HS	Numerical Methods and Partial Differential Equations	3	1	-	4	40	60	4
2	2HS302HS	Managerial Economics & Financial Accountancy	3	-	-	3	40	60	3
3	2ES301CS	Programming for Problem Solving (C)	3	-	-	3	40	60	3
4	2PC301CE	Building Materials and Concrete Technology	3	-	-	3	40	60	3
5	2PC302CE	Solid Mechanics	3	-	-	3	40	60	3
6	2PC303CE	Surveying	3	-	-	3	40	60	3
7	2MC302HS	Essence of Indian Traditional Knowledge	2	-	-	2	40	60	-
Practical Courses									
8	2ES351CS	Programming for Problem Solving Laboratory (C)	-	-	2	2	40	60	1
9	2PC351CE	Surveying Laboratory	-	-	2	2	40	60	1
10	2PC352CE	Concrete Technology Laboratory	-	-	2	2	40	60	1
Total			**20**	**1**	**6**	**27**			**22**

Course Code	Course Title						Core/Elective
2BS303HS	NUMERICAL METHODS & PARTIAL DIFFERENTIAL EQUATIONS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic Differentiation, Integration and Trigonometric results.	3	1	-	-	40	60	4

COURSE OBJECTIVES:

It is intended to make the students to learn:

- To learn an alternative methods and analytical methods in mathematical concepts.
- To apply numerical techniques in solving ordinary differential equations.
- To study Interpolation and numerical methods to fit a curve
- To formulate and solve partial differential equations.
- To study physical applications of partial differential equations.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO1: Find the solution of algebraic and transcendental equations using numerical methods.

CO2: Apply numerical techniques to solve ordinary differential equations and definite integrals.

CO3: Apply numericalmethods to interpolate values and fit different curves from given data.

CO4: Find solutions of first order linear and non linear partial differential equations.

CO5: Apply the solution of partial differential equations to physical problems.

UNIT 1:

Numerical Solutions of Algebraic and Transcendental Equations: Introduction, Bisection Method, Regula-False method, Iteration method and Newton Raphson method. Solving linear system of equations by Gauss-Jacobi and Gauss-Seidel method.

UNIT 2:

Numerical integration: Trapezoidal Rule, Simpson?s 1/3rd and 3/8th Rule.

Numerical solutions of Ordinary Differential Equations: Solution of ordinary differential equations by Taylor's Series, Picard?s method of Successive approximations, Euler's and Modified Euler?s methods, Fourth Order Runge-Kutta Method.

UNIT 3:

Interpolation: Newton's Forward and Backward difference interpolations,

Lagrange's interpolation, Newton's divided difference interpolation.

Curve Fitting: Fitting a linear, second degree, exponential curve by method of least squares for the discrete data.

UNIT 4:

Partial Differential Equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients

UNIT 5:

Applications to Partial Differential Equations: Classification of linear second order partial differential equations, Separation of variables method , solution of one dimensional heat and wave equations, Two dimensional Laplace's equation.

TEXT BOOKS:

1. Dr.B.S.Grewal, Higher.EngineeringMathematics,KhannaPublicatins,43rd Edition,2014.
2. S.S.Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd.
3. B.V.Ramana, Higher Engineering Mathematics,3rd Edition 2015.

REFERENCES/SUGGESTEDREADING:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th Edition, 2012.
2. M.K.Jain, S.R.K.Iyengar and R.K. Jain, Numerical Methods for Science and Engineering Computation, 6th Edition, New Age International Publishers. 2020-2021.
3. Peter. V. O' Neil, Advance Engineering Mathematics, 7th Edition, 2012

Course Code	Course Title						Core/Elective
2HS302HS	MANAGERIAL ECONOMICS & FINANCIAL ACCOUNTANCY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to learn:

- To understand responsibilities of a manager of a business undertaking.
- To analyse various determinants influencing demand and price.
- To understand the principles of accounting and prepare Journal, Ledger, Trial Balance & Final accounts.
- To understand financial statement Analysis.
- To evaluate & analyse the long-term investments.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Determine the responsibilities & decision making in the Organization

CO 2. Understand the various factors influencing demand & market structure

CO 3. Understand the principles of accounting & solve the problems

CO 4. Analyse the Financial performance

CO 5. Understand the capital structure & to take decision on selection of projects

Unit-I

Introduction to Managerial Economics, its Scope, Importance and relation to other sciences, its usefulness to Engineers-Basic concepts of Managerial Economics.

Unit-II

Demand Analysis: Introduction to demand, determinants, law of demand, its assumptions, Elasticity of demand-price, income and cross elasticity, demand forecasting, Market competitive structure price & output determination under perfect competition and Monopoly.

Unit-III

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle-Journal - Ledger - Cash book - Trial Balance.

Unit-IV

Financial statement Analysis: Preparation of Final accounts with simple adjustments (including Problems). Ratio Analysis – Importance – Liquidity and profitability ratios

Unit-V

Capital management: Significance determinates and estimation of fixed and working capital requirements, sources of capital. Introduction to capital budgeting, Time Value of money - Methods: Non-Discounted cash flow methods (pay back, ARR), Discounted (NPV, PI, IRR) with problems.

TEXT BOOKS:

1. Mehta P.L., Managerial Economics, Sultan Chand & Sons Publishers.
2. Managerial Economics - A Problem-Solving Approach, by Luke M Froeb.
3. I.M.Panday Financial Management, Vikas Publishing House.
4. Maheswari S.N. Introduction to Accountancy. Vikas Publishing House.

REFERENCE BOOKS:

1. R.L.Varshney, K.L.Maheshwari, Managerial Economics, Sultan Publishers.
2. D.M.Mithani, Managerial Economics, Himalaya Publishing House.
3. Mukherjee, Hanif, Financial Accounting, Tata McGraw Hill.
4. Ramachandran, Kakani, Financial Accounting for Management, Tata McGraw Hill.

Course Code	Course Title						Core/Elective
2ES301CS	PROGRAMMING FOR PROBLEM SOLVING (C)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Mathematical Knowledge, Logical and Analytical Thinking	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

- To introduce the basic concepts of Computing environment, algorithms and flowcharts
- To acquire knowledge about the basic concept of writing a program
- To understand modular and structured programming constructs in C
- To learn the usage of structured data types, data handling and memory management using pointers

COURSE OUTCOMES:

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

CO1. Formulate algorithms and learn fundamental program methodologies of C programming.

CO2. Understand control statements and interpret derived data types with mathematical and engineering problems.

CO3. Develop modular programming techniques to solve searching, sorting and file system problems

CO4. Implement pointers and structures concept

CO5. Recognize pre-processor directives and user defined usage.

UNIT-I

Introduction to Computers: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Algorithm, Flowchart / Pseudo code with examples

Introduction to C Language: History of C, Features, Structure of C program, Character set, Tokens, Variables, Data types, I/O statements, Type conversion Syntax and Logical Errors in compilation, object and executable code.

UNIT-II

Operators and Control Structures: Operators, Operator precedence, Arithmetic expressions, Conditional Branching and Loops, Writing and valuation of conditionals and consequent branching

Arrays: Arrays (1-D, 2-D), Strings and its library functions.

UNIT-III

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble and Selection).

Functions: Functions, storage classes, Parameter passing techniques Passing arrays to functions, Recursion Concept, Command line arguments.

UNIT-IV

Pointers: Idea of pointers, Defining pointers, array of pointers, pointer arithmetic, dynamic memory allocation,

Structure: Structures, Defining structures and Array of Structures, self – referential structures, Unions concept, Functions and structures, Enum, Bitfields.

Unit – V

Pre-processor Directives: File Inclusion, Macros Substitutions, Conditional Compilation.

File Handling: Introduction to File Handling, Types of files, File operations, File input/output statements.

TEXT BOOKS :

1. Computer Science A structured programming approach using C, Behrouz A. Forouzan and Richard F. Gilberg, Cengage Learning, 2007, Third Edition (Unit 1-5)
2. Schaum's Outline of Programming with C, Byron Gottfried, McGraw-Hill ,2019, Fourth Edition (Unit 1-5)
3. Data Structures and Program Design in C, Robert Kruse, Bruce Leung, Tondo, Pearson, II Edition

REFERENCES/SUGGESTED READING :

1. C Programming Language, Brian W Kenningham, Dennis M Ritchie, Pearson, II Edition
2. How to solve it by Computer, R G Dromey, Pearson Edition.

Course Code	Course Title						Core/Elective
2PC301CE	BUILDING MATERIALS AND CONCRETE TECHNOLOGY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Understand physical properties and uses of various building materials
- Distinguish different types of paints, varnish and distemper.
- To understand the behavior of fresh and hardened concrete.
- To understand the factor affecting the workability and strength of concrete
- To impart the methods of proportioning of concrete mixtures.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Differentiate between various building materials i.e., both conventional and smart building materials

CO 2. Explain the process of plastering, pointing and damp proofing.

CO 3. Describe the properties of fresh Concrete & Hardened Concrete

CO 4. Explain the procedure for testing of concrete materials and on fresh and hardened concrete as per IS code

CO 5. Design the concrete mix according to requirements of IS, BIS and ACI codes.

Unit-I:

Building Blocks: Conventional bricks, light weight bricks, hollow building blocks, Load bearing and non-load bearing blocks. Importance and Uses of Fly ash bricks. Provisions of IS 2572.

Timber: Uses and types of timber. Seasoning and its importance.

Paints, Varnish and Distemper: Characteristics of good paints, Bases, vehicles, thinners and coloring pigments.Painting of different types of surfaces; types of varnish, and application.Types of distemper and application.

Unit-II:

Cement: Portland cement- chemical composition- Hydration of cement and hydration products- Heat of Hydration and Rate of hydration -Test on physical properties- Different grades of cement- Types of cements.

Aggregates: Classification of aggregate- Particle shape & texture- Bond, Strength & other mechanical properties of aggregate- Specific gravity, Bulk density, Porosity, adsorption & moisture content of aggregate- Bulking of sand- Deleterious Substance of aggregate- Soundness of aggregate- Sieve analysis- Fineness modulus- Grading curves- Grading of fine & coarse Aggregates- Gap graded aggregate- Maximum aggregate size.

Admixtures: Types of admixtures-mineral and chemical admixtures, water reducing agents.

Reinforcing steel: Types of reinforcement, specifications, storage and handling.

Unit-III:

Mortar: Types of mortar, preparation, setting and curing.

Plastering and Pointing: Types of plastering, preparation of surfaces, and defects. Types of pointing, preparation of surfaces.

Damp Proofing: Causes of dampness, effects of dampness, methods of damp proofing.

Unit-IV:

Fresh Concrete: Workability- Factors affecting workability- workability tests- Setting times of concrete- Effect of time and temperature on workability- Segregation & bleeding- Mixing and vibration of concrete- Steps in manufacture of concrete, revibrating, types of curing.

Hardened Concrete: Water/Cement ratio- Abram's Law- Gel space ratio- effective water in the mix short term and long-term properties of hardened concrete and stress strain curves of concrete

Testing of Hardened Concrete: Compression tests- Tension tests- Flexure tests - non-destructive testing methods-Rebound hammer test-ultrasonic pulse velocity test.

Unit-V:

Elasticity Creep & Shrinkage: 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.

Mix Design: Factors in the choice of mix proportions- Proportioning of concrete mix - IS method of mix design – British and ACI method of mix design.

TEXT BOOKS:

1. S.P. Arora, S.P. Bindra, 'Text book on Building Construction', Dhanpat Rai Publishing Co Pvt Ltd, 2014.
2. M. S. Shetty, A. K. Jain, 'Concrete Technology: Theory and Practice', 8th Edition, S Chand Publishing, 2018.

REFERENCE BOOKS:

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, 'Building Construction', 11th Edition, Laxmi Publications, 2016
2. M.L. Gambir, 'Concrete Technology', 5th Edition, Tata Mc-Graw Hill Publishers, New Delhi, 2017.

Course Code	Course Title						Core/Elective
2PC302CE	SOLID MECHANICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Engineering	L	T	D	P			
Mechanics	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Mechanical properties of materials & the stresses and strains in axially loaded members
- Evaluating shear forces and bending moments in beams,
- Bending stresses and shearing stresses in beams, combined direct and bending stresses short columns
- Evaluating compound stresses, principal stresses and planes, evaluation of stresses & strains in thin-walled pressure vessels
- Pure torsion theory and application to different types of springs.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Apply the fundamental concepts of stress and strain in the analysis and design of axially loaded members

CO 2. Analyse determinate beams to construct shear force diagram and bending moment diagrams

CO 3. Determine the bending and shear stress distribution in beams and also the stresses in members subjected to combined axial and bending loads.

CO 4. Analyse the compound stresses at a point and evaluate principal stresses and apply in evaluating stresses in cylindrical pressure vessels

CO 5. Evaluate the stresses of circular members subjected to torsion and analyze different types of springs.

Unit-I:

Mechanical properties of materials: Elasticity, Plasticity, Brittleness, Ductility, Malleability, Strength, toughness, hardness etc.

Simple Stresses and Strains: Definitions of stresses and strains, Hooke's Law, Modulus of Elasticity, Stress- Strain curve for ductile materials, Elastic constants, compound bars and temperature stresses.

Unit-II:

Shear Force and Bending Moment: Different types of beams and loads, shear force and bending moment diagrams for cantilever, and simply supported beams with and without over hangs subjected to different kinds of loads viz., point loads, uniformly distributed loads, uniformly varying loads and couples.

Bending Stresses in Beams: Assumptions in theory of simple bending, Derivation of flexure equation, Moment of resistance, calculation of stresses in statically determinate beams for different loads and different types of structural sections.

Unit-III:

Shear Stress in Beams: Derivation of equation of shear stresses, distribution across rectangular, circular, T and I section.

Direct and Bending Stresses: Direct loading, Eccentric loading, limit of eccentricity, Core of sections, rectangular and circular, solid and hollow sections.

Unit-IV:

Compound Stresses: Stresses on oblique planes, principal stresses and planes. Mohr's circle of stress.

Application to pressure vessels: Thin cylinders subjected to internal fluid pressure, volumetric change. Thick Cylinders: Lame's equations, stresses under internal and external fluid pressures, Compound cylinders, Shrink fit pressure.

Unit-V:

Torsion: Theory of pure torsion in solid and hollow circular shafts, shear stress, angle of twist, strength and stiffness of shafts, Transmission of Power. Combined torsion and bending for determination of principal stresses and maximum shear stress. Equivalent bending moment and equivalent twisting moment.

Springs: Close and open coiled helical springs under axial load and axial twist, Carriage springs.

TEXT BOOKS:

1. R. C. Hibbler, “Mechanics of Materials (SI Edition),”9th Edition, Pearson, 2018.
2. R. K. Bansal, “A Textbook of Strength of Materials: Mechanics of Solids (S.I. Units), 6th Edition,Laxmi Publications Pvt. Ltd., 2018

REFERENCE BOOKS:

1. Ferdinand P Beer, E. Russell Johnston Jr., John T. DeWolf, David F. Mazurek and SanjeevSanghi, “Mechanics of Materials (SI Edition),” 8th Edition, McGraw-Hill, 2020.
2. R. Subramanian, “Strength of Materials”, 3rd Edition, Oxford University Press, New Delhi, 2016.

Course Code	Course Title						Core/Elective
2PC303CE	SURVEYING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Basic	L	T	D	P			
Mathematics	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Conventional to latest surveying technologies.
- Working principles of surveying equipment.
- Measurement of distances, Angles, Areas and Volumes using various instruments.
- Setting out methods of Horizontal and vertical curves.
- Basics of advanced surveying concepts like Photogrammetry, GIS, GPS and Remote Sensing.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Explain the terminologies and concepts involved in basic and modern surveying equipment & technologies.

CO 2. Demonstrate the working principles and applications of basic and modern surveying instruments

CO 3. Apply the knowledge of surveying & levelling in calculating lengths, bearings, reduced levels, elevation differences and plotting.

CO 4. Apply the knowledge of theodolite and trigonometry in finding horizontal and vertical angles, heights of inaccessible points

CO 5. Make use of knowledge of curves concept in surveying, in setting out both horizontal and vertical curves.

Unit-I

Classification and principles of surveying;

Linear Measurements: Accessories for linear measurements; Principle of Chain surveying; Scales; Offset; Cross staff.

Angular Measurements: Types of meridians; Bearing systems and conversions; magnetic declination; Fore & Back Bearings; definition of local attraction; Traversing - Open & Closed traverse.

Plane Table surveying: Accessories of Plane Table; Advantages & Disadvantages of Plane Tabling.

Unit-II

Levelling: Definitions; Dumpy and Auto level; Temporary Adjustment of level; Types of levelling operations; Curvature & refraction corrections; Sensitiveness of bubble tube; Reciprocal levelling; Calculation of reduced level - HI & Rise and fall methods.

Contouring: Characteristics and uses of contours

Computation of Areas - Using Simpson's and Trapezoidal rule;

Computation of Volumes - Using Simpson's and Trapezoidal rule for a Level Section.

Electronic Distance Measurement: Principle and Types of EDM instruments

Total station: Parts of a Total Station, Advantages and Applications; Field Procedure for total station survey.

Unit-III

Theodolite Survey: Introduction to Theodolite; Definitions; Fundamental lines of a Theodolite; Temporary Adjustments; Measurement of horizontal and vertical angle; Coordinates & their computations, Omitted measurements; Trigonometric levelling: Calculations of elevations and distances of accessible and inaccessible objects by single and double plane methods.

Unit-IV

Curves: Theory of simple curves, setting out of simple curves by linear and angular methods; Elements of simple, compound & Reverse curves; Elements of Transition curve: length of transition curve; Vertical Curves-Types of vertical curves - Length of vertical curve

Unit-V

Photogrammetric Surveying: Vertical, Tilted and oblique photographs; Flying height and Scale of a Vertical Photograph

Global Positioning Systems: Segments; GPS measurements; errors.

Remote Sensing: Introduction; Classification of remote sensing; Idealised Remote sensing system

Geographic Information System: Definition; Components of GIS; Recent trends and applications of GIS.

TEXT BOOKS:

1. Punmia, B. C.,Ashok. K. Jain, & Arun. K. Jain. "Surveying-Vol. 1", 17th Edition, Laxmi Publications Pvt Limited 2022
2. Punmia, B. C.,Ashok. K. Jain, & Arun. K. Jain. "Surveying-Vol. 2", 16th Edition, Laxmi Publications Pvt Limited 2019.

REFERENCE BOOKS:

1. Basak, N. N. "Surveying & Levelling", 2nd Edition, McGraw-Hill Education, 2021.
2. Anji Reddy, M., "Remote Sensing and Geographical Information System", 4th Edition, B.S. Publications, 2012.

Course Code	Course Title						Core/Elective
2MC302HS	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE						MC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	-

COURSE OBJECTIVES:

It is intended to make the students to:

- To reinforce the students understanding with the pan-Indian heritage in terms of culture, traditions and knowledge.
- To impart understanding of the importance of the roots of the traditional knowledge and types.
- To impart basic knowledge on the evolution of the multiple languages that highlight India's diversity.
- To know Indian Languages, Philosophies, Religion, Literature, Fine arts and Technology.
- To explore the Ancient Science & Scientists, in Medieval and Modern India; the education system.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Understand the concepts of Indian culture and Traditions and their importance.

CO 2. Distinguish the Indian languages and literature

CO 3. Learn the philosophy of Ancient, Medieval and Modern India.

CO 4. Acquire the information about the fine arts in India

CO 5. Know the contribution of scientists of different eras, interpret the concepts and theimportance to protect Intellectual property of the nation.

UNIT-I

Introduction to Culture: Civilization, Culture and Heritage.

General characteristics of culture, importance of culture in human literature.

Indian Culture, Ancient India, Medieval India, Modern India.

UNIT -II

Indian Languages, Culture and Literature.

Indian Languages and Literature-I: -the evolution and role of Sanskrit, Prakrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India (Tamil).

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT - III

Religion and Philosophy: Religion and Philosophy in Ancient India (Buddhism, Jainism and Shatdarshanas), Religion and Philosophy in Medieval India, Religious reform movements in Modern India (Brahma Samaj &AryaSamaj)

UNIT-IV

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts Music: Divisions of Indian classical music, modern Indian music Dance and Drama.

Indian Architecture- Ancient (Harrappa and Mohenjodaro, Buddhist sculpture, Ashokan rock cut pillars, Iron Pillar of Mehrauli); Medieval- Bruhadeshwara temple, Ramappa Temple, Vijayanagara, Hampi) and Modern Architecture Science and Technology in India:

Development of science in Ancient, Medieval and Modern India.Their relation in terms of modern scientific perspective. Science and Scientists of Ancient, Medieval and Modern India Protection of traditional knowledge, significance, value to economy: Role of government in protection of indigenous knowledge and technology; protection of traditional knowledge bill, 2016.

UNIT - V

Education System in India:

Education in Ancient, Medieval and Modern India

Aims of education- Universities in Ancient India, Women Education in Ancient, Medieval and Modern India, National Education Policy-2020.

TEXT BOOKS:

1. Indian Knowledge Systems (2 Vols-Set),KapilKapoor and Avadhesh Kumar Singh, ISBN 10: 8124603367

2. Basanta Kumar Mohanta and Vipin K. Singh, Traditional Knowledge System and Technology in India, Book Originally published: 2012 Publication. ISBN 10: 8177023101
3. NitinSinghania, Indian Art and Culture, 4th Edition, ISBN: 9354601804.
4. S. Narain, Education and Examination Systems in Ancient India, written/ authored/edited by S. Narain', published 2017, English-Hardcover, ISBN 9789351282518 publisher: Kalpaz Publications.

REFERENCES BOOKS:

1. Science in Samskrit, Samskrita Bharati, Published by SamskritaBharati, New Delhi, India, 2007; ISBN 10: 8187276339 / ISBN 13: 9788187276333.
2. Founders of Sciences in Ancient India, Satya Prakash, Vijay Kumar Publisher, New Delhi.
3. Essentials of Indian Philosophy, M. Hiriyanna, Motilal Banarsidass Publishers, New Delhi.
4. NCET Books from VI to XII standards
5. The social and economic conditions of Medieval India. Chopra, Puri & Das.

Course Code	Course Title						Core/Elective
2ES351CS	PROGRAMMING FOR PROBLEM SOLVING LAB (C)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

- Understand the fundamentals of programming in C Language.
- Write, compile and debug programs in C.
- Formulate solution to problems and implement in C.
- Effectively choose programming components to solve computing problems

COURSE OUTCOMES:

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

CO 1. Choose appropriate data type for implementing programs in C language

CO 2. Design and implement modular programs involving input output operations, decision making and looping constructs

CO 3. Apply derived data types and implement programs to store data in structures and files

CO 4. Develop confidence for self-education and ability towards lifelong learning need of computer languages.

List of Experiments:

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sin x and Cos x values using series expansion.
3. Generating Pascal triangle, pyramid of numbers.
4. Factorial, Fibonacci, GCD recursive and non-recursive procedures
5. Linear search and binary search using recursive and non-recursive procedures.
6. Bubble sort and selection sort.
7. Matrix addition and multiplication using arrays,
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Programs on structures, union, enum and string manipulations.
10. File handling programs (Reading, Writing, Copying files).
11. Program illustrating using Command Line Arguments.

Course Code	Course Title						Core/Elective
2PC351CE	SURVEYING LABORATORY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Basic	L	T	D	P			
Mathematics	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student :

- Handle the surveying instruments to takelinear measurements from them.
- Use the levelling instruments to findreduced levels of the ground
- Utilise the theodolite, Total station andGPS instruments for Ground Surveying
- Understand the procedure of takingreadings and of extracting the terraininformation
- Familiar and competent enough todevelop map in suitable scale by usingdifferent surveying instruments like totalstation, dumpy level, global positioningsystem (GPS) etc.

COURSE OUTCOMES:

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

CO 1. Demonstrate the working principles and handling procedures of basic surveying instruments like chain, cross staff in finding out linear measurements

CO 2. Demonstrate the levelling instruments and apply the knowledge of levelling in finding out the reduced levels of ground

CO 3. Demonstrate the working principles and handling procedures of theodolite, total station and Hand-held GPS

CO 4. Make use of surveying equipment in computing lengths, areas & bearings of given field work

CO 5. Apply the knowledge of trigonometrical levelling in finding out reduced levels of elevated objects which are both accessible and inaccessible points.

List of experiments:

1. Find out the area using chain and cross staff surveying.
2. Introduction to levelling: Differential levelling using dumpy/Auto level
3. Profile and cross-sectional levelling using Dumpy/Auto level
4. Measurement of horizontal angles by repetition / reiteration methods using Vernier Theodolite.
5. Measurement of vertical angle: Application to simple problems of height and distance by measuring angle of elevation and depression
6. Single plane method: Determination of R.L. of an elevated Object using two Instrument Stations which are placed in a same vertical plane- when the base of the Object is inaccessible.
7. Two plane method: Determination of R.L. of an elevated Object using two Instrument Stations which are not placed in the same vertical plane- when base of the Object inaccessible.
8. Introduction to Total station and applications: Application to simple problems of height and distance by measuring angle of elevation and depression and determination of R.L of the target object.
9. Total station and applications: Determination of area enclosed in a closed traverse having minimum 5 stations
10. Global Positioning System (GPS): Determination of Latitude and Longitude of any four stations and computation of the area.

Course Code	Course Title						Core/Elective
2PC352CE	CONCRETE TECHNOLOGY LABORATORY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

It is intended to make the students to:

- Conduct tests on cement.
- Conduct tests on Fine Aggregate and Coarse Aggregate.
- Conduct tests on concrete in fresh state.
- Conduct tests on hardened concrete in hardened state.
- Evaluate the strength and quality of concrete.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Determine the properties of given cement sample and assess its suitability for use in construction.

CO 2. Determine the properties of fine and coarse aggregate samples to assess their suitability for use in construction works.

CO 3. Measure the workability of concrete and recommend its suitability for structural works.

CO 4. Determine the compressive strength of concrete

CO 5. Conduct destructive and non-destructive tests to evaluate the quality and strength of concrete.

List of experiments:

1. Determination of the specific gravity of the given cement sample.
2. Determination of the standard consistency of the given cement sample.
3. Determination of the initial setting time and final setting time of the given cement sample.
4. Determination of the bulking of Fine Aggregate.
5. Determination of the bulk density, void ratio, porosity and specific gravity of given Fine.
6. Determination of the bulk density, void ratio, porosity and specific gravity of given coarse Aggregate.
7. Determination of the fineness modulus of Fine Aggregate.
8. Determination of the fineness modulus of Coarse Aggregate.
9. Determination of the slump & compaction factor of concrete mix (Workability)
10. Determination of the compressive strength of concrete cubes.
11. Demo on Non-destructive testing of concrete specimen.

B.E. (Civil Engineering) - IV SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2HS403HS	Human Values and Professional Ethics	2	-	-	2	40	60	2
2	2ES403CS	Python Programming	2	-	-	2	40	60	3
3	2PC404CE	Mechanics of Materials and Structures	3	-	-	3	40	60	3
4	2PC405CE	Design of Reinforced Concrete Structures	3	-	-	3	40	60	3
5	2PC406CE	Fluid Mechanics	3	-	-	3	40	60	3
6	2PC407CE	Hydrology	2	-	-	2	40	60	2
7	2MC403HS	Indian Constitution	2	-	-	2	40	60	-
Laboratory Courses									
8	2PC453CE	Mechanics of Materials Laboratory	-	-	2	2	40	60	1
9	2PC454CE	Building Drawing & Drafting Laboratory	-	-	2x3h	6	40	60	3
10	2ES453CS	Python Programming Lab	-	-	2	2	40	60	1
	PW	Practise School-1 (Short Internship) #							
Total			**17**	**0**	**10**	**27**			**21**

To be conducted after the IV Semester in the Summer Vacation and to be evaluated in V Semester.

Course Code	Course Title						Core/Elective
2HS403HS	HUMAN VALUES AND PROFESSIONAL ETHICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	0	0	0	40	60	2

COURSE OBJECTIVES:

The following are the Objectives of the Course:

- To create an awareness on Human Values and Engineering Ethics.
- To move from discrimination to commitment.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.
- To encourage students to discover what they consider valuable in life.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Understand the significance of value inputs in a classroom and start applying them in their life and profession

CO 2. Assess their own ethical values and the social context of problems

CO 3. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.

CO 4. Understand the role of a human being in ensuring harmony in society and nature.

CO 5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Unit-I : Introduction to Value Education

1. Value Education, Definition, Concept and Need for Value Education
2. The Content and Process of Value Education
3. Self-Exploration as a means of Value Education
4. Happiness -Sukh, Suvidha, Sanyam & Swasthya.

Unit-II: Harmony in the Human Being

1. Human Being is more than just the Body

2. Harmony of the Self ('I') with the Body
3. Understanding Myself as Co-existence of the Self and the Body
4. Understanding Needs of the Self and the Needs of the Body

Unit-III: Harmony in the Family and Society and Harmony in Nature

1. Family as a basic unit of Human Interaction and Values in Relationships
2. The Dynamics of Mutual respect in Today's World – Affection, Care, Guidance, Reverence, Gratitude and Love.
3. Comprehensive Human Goals: The Five dimensions of Human Endeavour – Justice, Trust, Competence, Right Attitude and Mutual Tolerance

Unit-IV: Social Ethics

1. The Basics for Ethical Human conduct
2. Challenges to ethical conduct in existence
3. Holistic perception of Harmony in existence
4. Social Hierarchy - Ethical Conduct and Mutual Co-existence

Unit-V: Professional Ethics

1. Sanctity of Human values
2. Definitiveness of Ethical Human Conduct
3. Basics for Humanistic Education

TEXT BOOKS :

1. A.N Tripathy, "Human Values", New Age International Publishers, 2003.
2. Bajpai. B. L., Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted, 2004
3. Bertrand Russell Human Society in Ethics & Politics, Taylor and Francis, 2007.

REFERENCE BOOKS :

1. Corliss Lamont, Philosophy of Humanism,Humanist Press, 1997
2. Gaur. R.R. , Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3. Gaur. R.R. , Sangal. R , Bagaria. G.P, Teachers Manual Excel Books, 2009.
4. Mortimer. J. Adler, – Whatman has made of man, Hardcover, 2007.

Course Code	Course Title						Core/Elective
2ES403CS	PYTHON PROGRAMMING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Experience with a high-level language (C/C++, Java, MATLAB)	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise

COURSE OUTCOMES:

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

CO 1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO 2. Demonstrate proficiency in handling Strings and File Systems.

CO 3. Create, run and manipulate Python Programs using core data structures like Lists, Tuples and Dictionaries.

CO 4. Interpret the concepts of Object-Oriented Programming as used in Python.

CO 5. Create and animate a variety of shapes and develop an application with graphical user interface (GUI).

UNIT-I

Introduction to Python: installing Python, basic syntax, interactive shell, editing, saving, and running a script. The concept of data types, variables, assignments, immutable variables, numerical types, arithmetic operators and expressions, comments in the program, understanding error messages. Conditions, Boolean logic, logical operators, ranges, Control statements.

UNIT-II

Strings and Files: Strings and text files, manipulating files and directories, os and sys modules, text files: reading/writing text and numbers from/to a file, creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string, strings and number system: converting strings to numbers and vice versa.

Lists, tuples, and dictionaries

basic list operators, replacing, inserting, removing an element, searching and sorting lists, dictionary literals, adding and removing keys, accessing and replacing values, traversing dictionaries

UNIT-III

Design with functions: Hiding redundancy, complexity, arguments and return values, formal vs actual arguments, named arguments. Program structure and design. Recursive functions.

Classes and OOP: Classes, objects, attributes and methods, defining classes, design with classes, data modeling, persistent storage of objects, inheritance, polymorphism, operator overloading (_eq_, _str_, etc), abstract classes, exception handling, try block.

UNIT-IV

Simple Algorithms and Data structures: Search Algorithms, Sorting Algorithms, Hash Tables

Simple Graphics and Image Processing: "turtle" module, simple 2d drawing - colors, shapes, digital images, image file formats, image processing Simple image manipulations with 'image' module (convert to bw, greyscale, blur, etc).

UNIT-V

Graphical user interfaces: Event-driven programming paradigm, tkinter, module, creating simple GUI, buttons, labels, entry fields, dialogs, widget attributes - sizes, fonts, colors layouts, nested frames

Multithreading, Networks, and Client/Server Programming: Introduction to HTML, interacting with remote HTML server, running html-based queries, downloading pages, CGI programming, programming a simple CGI form

TEXT BOOKS :

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2nd Edition, 2017, Cengage Learning
2. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

REFERENCE BOOKS :

1. Mark Summerfield. ?Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016
3. NPTEL Course, Programming, Data Structures and Algorithms using Python, Link: https://nptel.ac.in/courses/106106145
4. NPTEL Course, The Joy of Computing using Python,
   Link: https://nptel.ac.in/courses/106106182
5. FOSSEE, Python, Link: https://python.fossee.in/

Course Code	Course Title						Core/Elective
2PC404CE	MECHANICS OF MATERIALS AND STRUCTURES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Solid Mechanics	L	T	D	P	40	60	3
	3	-	-	-			

COURSE OBJECTIVES:

It is intended to make the students to:

- Methods of evaluation of deflections of beams due to transverse loads.
- Buckling of columns and various theories to evaluate the critical load for columns.
- Analysis of unsymmetrical bending and the concept of shear centre.
- Static and Kinematics Indeterminacy, Analysis of indeterminate beams by Force Method: Propped Cantilever, Fixed beam and Continuous Beams.
- Evaluating the displacements and redundant forces in beams, indeterminate trusses and frames, using energy methods.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Calculate the deflections of determinate beams due to transverse loads by various methods

CO 2. Evaluate the buckling/critical load of columns for various end conditions using different theories

CO 3. Analyze the beams subjected to unsymmetrical bending and compute the location of the shear centre for various sections

CO 4. Determine the static and kinematics indeterminacy of indeterminate structures and analyze propped cantilever, fixed beams and continuous beams using force method of analysis

CO 5. Apply the energy principles and various energy methods to analyze beams, indeterminate trusses and frames to find deflections and redundant forces

Unit-I

Deflections in Beams: Slope and deflection by double integration/Macaulay's method for cantilever, simply supported beams and overhanging beams carrying

one, two-point loads, uniformly distributed load and uniformly varying load over entire span. Moment area method and conjugate beam methods for beams with varying flexural rigidity.

Unit-II

Columns and Struts: Euler's theory for long columns, different end conditions, equivalent length, Rankine's theory, Secant & Perry formula for eccentric loading.

Unsymmetric bending: 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.

Unit- III

Shear Centre: Concept and importance of shear center, shear flow and determination of shear center of simple sections such as T sections and Channel sections with one axis of symmetry

Static and Kinematic indeterminacy: Determination of static and kinematic indeterminacy of beams, pin jointed frames (trusses) and rigid frames.

Unit-IV

Propped Cantilevers: Cantilever beams on elastic and rigid props for point loads and uniformly distributed load only. Calculation of reactions, Bending moment and Shear force diagrams, and deflections.

Fixed Beams: Determination of shear force, bending moment slope and deflection in fixed beams with and without sinking of supports for point loads uniformly distributed load.

Continuous Beams: Determination of moments in continuous beams with and without sinking of supports by theorem of three moments, bending moment and shear force diagrams.

Unit-V

Energy Methods: Elastic Strain energy for various types of loading, Determination of deflections in statically determinate beams and trusses using Work-energy principle, Castigliano's theorems, Unit load method. Maxwell's theorem of reciprocal deflections, Betti's Law.

Redundant Trusses and Frames: Analysis of plane trusses with one degree of redundancy (internal /external) and plane frames with one degree of redundancy, Lack of fit and temperature effect.

TEXT BOOKS:

1. R. K. Bansal, "A Textbook of Strength of Materials: Mechanics of Solids (S.I. Units), 6th Edition, Laxmi Publications Pvt. Ltd., 2018
2. R.C. Hibbler, "Structural Analysis," 9th Edition, Pearson Education, 2017

REFERENCE BOOKS:

1. Ferdinand P Beer, E. Russell Johnston Jr., John T. DeWolf, David F. Mazurek and SanjeevSanghi, "Mechanics of Materials (SI Edition)," 8th Edition, McGraw-Hill, 2020.
2. R. C. Hibbler, "Mechanics of Materials (SI Edition)," 9th Edition, Pearson, 2018.
3. R. Subramanian, "Strength of Materials", 3rd Edition, Oxford University Press, New Delhi, 2016.
4. S. S. Bhavikatti, "Structural Analysis – I," 5th Edition, Vikas Publishing House Pvt. Ltd., 2021
5. MagantiJanardhana K.U. Muthu, Azmi Ibrahim, M. Vijayanand, "Basic Structural Analysis," 3rd edition, Wiley Publishers, 2019

Course Code	Course Title						Core/Elective
2PC405CE	DESIGN OF REINFORCED CONCRETE STRUCTURES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- The properties of concrete and steel and with the behaviour of reinforced concrete as a structural material and IS codal provisions as applicable for the design.
- Design philosophies.
- Principles of structural design of Reinforced Concrete Members.
- Hands- on- experience and skill to design structural Reinforced Concrete elements.
- Safety measures that have to be incorporated in design of structural elements.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Define the characteristic strength of materials and partial safety factors for load and materials & explain the design philosophies of working stress method and Limit state method

CO 2. Apply the key concepts, theories and mathematical fundamentals to analyze and design the structural elements.

CO 3. Analyze the moment capacity of structural elements & design the structural elements for flexure, shear and torsion

CO 4. Examine the serviceability of structural elements

CO 5. Design simple structural members to be able to safely resist bending, shear, torsion, deflection and compression within the imposed factors of safety.

Unit-I

Introduction: Materials used in reinforced concrete (Cement, sand, coarse aggregate, water and reinforcing bars). Introduction to Relevant IS codes (IS 456-2000, IS 875 part I to IV). Dead load, imposed load, wind load and earthquake load.

Working stress method: Design of Singly Reinforced beam: Balanced, under-reinforced and over reinforced sections

Limit State Method of Design: Introduction to the design of Concrete Structures using Limit state method of design. Design philosophies. Partial safety factors for material strength and Loads. Limit State of Collapse and Limit State of Serviceability.

Unit-II

Limit state of Collapse – Flexure

Assumption made in Limit state. Stress blocks Parameters, Moment of Resistance a singly reinforced section. Analysis and design of a singly reinforced section for flexure:

Design of Doubly Reinforced Beams: Analysis and Design for flexure a doubly reinforced rectangular section.

Design of T- Beams: Analysis and Design of Singly Reinforced T Beams for flexure Limit states of serviceability: Check for deflection and cracking.

Unit- III

Limit State of Collapse – Shear & Torsion:

Design of beam for Shear: Types of Shear failure of an R.C.C beam, Shear carrying capacity of a reinforced concrete Beam. Analysis and Design of a reinforced section for Shear.

Design of Beam for Torsion: Analysis of R.C.C beams for Torsion. Equivalent Shear and Equivalent Bending Moment. Design and detailing of R.C.C beam subjected to Torsion

Design of Beam for Bond: Flexural Bond, Anchorage (Development) Bond, Check for Bond Failure.

Unit-IV

Design of Slabs: Types of Slabs: Design of one way and two-way slabs - Simply supported and continuous slabs subjected to uniformly distributed loads, Detailing of reinforcement, Check for serviceability of slabs.

Design of stair cases: Types of stairs: Design and detailing of dog-legged stair cases.

Unit-V

Design of columns: Assumptions, Design of axially loaded circular, square and rectangular columns, Design of columns with uni-axial and bi-axial bending, interaction diagrams.

Design of footings: Design of isolated square, rectangular and circular footings and Design & Detailing of combined Rectangular RCC footings.

TEXT BOOKS:

1. A.K Jain, "Reinforced Concrete- Limit State Design", 7th edition, Nem Chand and Brospublications, 2012. (Unit 1-5)
2. Neelam Sharma, "Reinforced Cement concrete Design" S.K. Kataria and Sons publications 2017 (Unit 1-5)

REFERENCE BOOKS:

1. V. L. Shah and S. R. Karve, "Limit State Theory and Design of Reinforced Concrete", Structures Publications, 7th Edition,2014.
2. N. Krishna Raju, "Design of Reinforced Concrete Structures", CBS Publishers and Distributors, New Delhi, 4th edition, 2016

Relevant IS Codes:

1. IS: 456-2000, "Code of Practice for Plain and Reinforced concrete", Bureau of Indian Standards, New Delhi, India.
2. SP 16, "Design Aids for Reinforced Concrete to IS 456:1978", Bureau of Indian Standards, New Delhi, India.
3. SP 24, "Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete to IS 456:1978", Bureau of Indian Standards, New Delhi, India.
4. SP 34, "Handbook on Concrete Reinforcement and Detailing (With Amendment 1)", Bureau of Indian Standards, New Delhi, India.
5. IS: 875-1987, "Code of Practice For Design Loads (Other Than Earthquake) For Buildings And Structures Parts (1, 2, 3, 4 & 5)", Bureau of Indian Standards, New Delhi, India.

Course Code	Course Title						Core/Elective
2PC406CE	FLUID MECHANICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Engineering	L	T	D	P			
Mechanics	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- The properties of fluid, Fluid pressure, pressure measurements and problems in fluid statics
- The concepts of fluid mechanics–statics, kinematics and dynamics
- The fluid kinematics, including types of flows, fluid path lines and continuity equations
- The principles of fluid dynamics
- The flow measurement devices and applications.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Elucidate the fluids and different properties of fluids.

CO 2. Relate types of flows with the corresponding mathematical equations

CO 3. Solve the problems on pressure calculations, hydrostatic forces on bodies and buoyancy

CO 4. Make use of Euler's, Bernoulli's and Momentum equation to solve fluid dynamic problems

CO 5. Apply principles of fluid dynamics to make flow measurement calculations

Unit-I

Fluid Properties: Basic Concepts and Definitions: Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, 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, Piezometer, Manometer, Differential Manometer, Micro manometers. Pressure gauges, transducers.

Unit-II

Fluid Kinematics: Classification of fluid flow-steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, rotational and irrational flow,

compressible and incompressible flow, ideal and real fluid flow, one, two-and three-dimensional flows. Streamline, pathline, streakline and stream tube.

Law of mass conservation: Continuity equation from control volume and system analysis. Definition and properties of Stream function, velocity potential function and uses of flow nets.

Unit-III

Fluid Dynamics: Convective and local acceleration. Surface and body forces. Euler's equations of motion.

Law of energy Conservation: Bernoulli's equation from Euler's equation. Application of Bernoulli's equation.

Vortex flow- definition, types-free vortex and forced vortex motion.

Unit-IV

Measurement of Velocity: Pitot Static Tube, hot wire anemometer.

Measurement of discharge in pressure conduits: Venturimeter, orifice meter, orifices, mouth pieces, nozzle meter, elbow meter and rotameter.

Measurement of discharge in free surface flows: Notches and weirs, spillways.

Measurement of discharge in tanks: orifices (free discharging and submerged), mouth pieces (external cylindrical and Borda's mouthpiece.

Unit-V

Dimensional Analysis and Hydraulic Similitude: Rayleigh method, Buckingham Pi theorem and Dimensionless groups. Hydraulic Similitude, Laws of similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems.

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House, 2017
2. Mechanics: A Concise Introduction by Bidya Sagar Pani, PHI Publications, 2016.

REFERENCE BOOKS:

1. Fluid Mechanics by Dr. A.K. Jain, 2018
2. K. Subramanya, „Theory and Applications of Fluid Mechanics?, Tata McGraw-Hill Publishing Company Ltd., New Delhi,1993
3. Vijay Gupta and Santosh K. Gupta, „Fluid Mechanics and its applications?, Wiley Eastern Ltd., New Delhi, 1984.

Course Code	Course Title						Core/Elective
2PC407CE	HYDROLOGY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	2

COURSE OBJECTIVES :

It is intended to make the students to :

- Importance of Hydrology and its applications
- Introduction to Hydrological processes and estimation of Design flood
- Assessment of soil-water-plant relationship

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Outline the interaction among various processes in the hydrologic cycle

CO 2. Net evaporation rate from waterbodies with free surface bodies

CO 3. Develop the Rainfall – Runoff relationship

CO 4. Evaluate drawdown and yield in aquifers

CO 5. Estimate the Design flood for Water Resources Structures

Unit-I

Introduction – Hydrologic cycle, Importance, and application of hydrology.

Precipitation – Forms of precipitation, types of rainfall, Characteristics of precipitation in India, measurement of rainfall, types of rain gauges, rain gauge network design, water shed, mean rainfall over an area, estimation of missing precipitation data, presentation of rainfall data, probable maximum precipitation (PMP).

Unit-II

Abstractions from Precipitation- Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction; Transpiration process; Evapotranspiration- measurement of evapotranspiration, evapotranspiration equations; Infiltration, infiltration capacity, measurement of infiltration, infiltration indices.

Unit -III

Runoff- Definition, runoff process, factors affecting runoff, determination of runoff volume by empirical formulae, rational method, SCS-CN method, UNIT hydrograph method (def, limitation, application, derivation of unit hydrograph from direct runoff hydrograph and vice versa).

Unit-IV

Ground Water-Forms of sub surface water, vertical distribution of sub surface water, geologic formations of aquifers, saturated formation, types of aquifers, aquifer properties, Darcy's law, types of wells, steady radial flow into wells in confined and unconfined aquifer, yield of open wells, safe yield, constant level pumping test and recuperation test.

Unit-V

Floods: Definition, causes and impact of floods, control measures of floods, estimation of floods, flood frequency studies- Weibul's and Gumble's method, Introduction to flood routing and its importance, methods of flood routing.

TEXT BOOKS:

1. T1. K. Subramanya, "Engineering Hydrology",4th Edition Tata McGraw Hill PublishingCo.Ltd. 2017.
2. H.M. Raghunath, "Hydrology – Principles, Analysis and Design", 3rd Edition New Age International Publishers, 2015.

REFERENCE BOOKS:

1. K.C.Patra, "Hydrology & Water Resources Engineering", 2nd Edition Alpha Science International Ltd., 2008.
2. C.S.P.Ojha, P. Bhunya, R. Berndtsson, "Engineering Hydrology" Oxford University Press, 2008.

Course Code	Course Title						Core/Elective
2MC403HS	INDIAN CONSTITUTION						MC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Elementary Civics- School level	L	T	D	P			
	2	-	-	-	40	60	-

COURSE OBJECTIVES:

It is intended to make the students to:

- To create awareness and relevance of the Indian Constitution, its directive principles.
- To impart understanding of the role, powers and functions of administration at the Central, State and local levels.
- To create awareness and understanding of Fundamental Rights, State Policy and Duties of Ideal citizen
- To expose students to the relations between Central/Federal, State and Provincial units, divisions of executive, legislative and judiciary in them.
- To impart knowledge about the statutory institutions and their role.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Have a general knowledge and back ground about the Constitution of India and its importance.

CO 2. Will distinguish and understand the working of the Central, state and provincial levels of administration.

CO 3. Will be conscious about the fundamental duties, responsibilities and rights as an ideal citizen of India

CO 4. Will be able to perceive and interpret the functioning and distribution of resources between centre and state.

CO 5. Have an awareness and relate to the existing hierarchy of the social structure, election process and Grievance redressal in a democracy

Unit-I

Introduction to Constitution- Meaning, reasons for having a constitution.

Evolution of the Indian Constitution: History, 1909 Act,1919 Act and 1935 Act and Premeable.

Constituent Assembly: Composition and Functions.

Unit-II

Government vs. Governance : Union Government: Political Executive-President, Prime Minister, Council of Ministers, Bureaucratic Executive.

State Government: Executive: Governor, Chief Minister, Council of Ministers

Local Government: Panchayat Raj Institutions, Rural and Urban local bodies-composition

Unit-III

Rights and Duties: Fundamental Rights, Directive principles of State Policy, Fundamental Duties of a good citizen

Public Interest Litigation.

Unit-IV

Relation between Federal and Provincial units : Union-State relations: Administrative, Legislative and Financial, Inter-State council, NITI Ayog, Finance Commission of India.

Unit-V

Constitutional and Statutory Bodies:

Election Commission and Electoral Reforms, National Human Rights Commission, National Commission for Women, National Commission for Minorities, National Commission for Protection of Child Rights.

TEXT BOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India", English-Hardcover –Lexis Nexis, New Delhi.
2. Dr. B.L. Fadia, Dr.KuldeepFadia , "Indian Government and Politics", SahithyaBhavan Publications, Agra.
3. M .Lakshmikanth, "Indian polity', Tata McGraw Hill.

REFERENCE BOOKS:

1. M.V. Pylee, " Indian Constitution".
2. Khattar, "Indian Political System".
3. Constitution of India, Telugu Academy

Course Code	Course Title						Core/Elective
2PC453CE	MECHANICS OF MATERIALS LABORATORY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Mechanics	L	T	D	P			
of Materials	-	-	-	2	40	60	1

COURSE OBJECTIVES:

It is intended to make the students to :

- To understand stress- strain behavior of ductile materials
- To identify hardness number of different metals used in civil engineering practices
- To study deflection for different types of beams for different materials
- To know the rigidity modulus by conducting spring and torsion test
- To evaluate impact properties and energy absorption of mild steel material

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Appraise the behaviour of a ductile material under direct tension test, in addition to gaining knowledge on elastic properties of the material.

CO 2. Identify the hardness of various metals like brass, copper, aluminium etc

CO 3. Assess and understand the flexural properties of beams (simply supported, cantilever and fixed) of different materials like wood, steel, copper, aluminium etc

CO 4. Interpret the application of tension and compression springs in practice to understand the properties like stiffness, capacity, shear modulus etc. of the springs

CO 5. Understand the impact properties of the materials and also energy absorption.

List of experiments:

1. Uni- axial tension test on a specimen of ductile material.
2. Stress – Strain characteristics of a ductile material.
3. Brinell`s hardness test.
4. Izod impact test
5. Compression test on open coiled helical spring.
6. Torsion test on a specimen of ductile material.
7. Bending test on simply supported beam of Timber
8. Bending test on Simply supported beam of Steel.
9. Bending test on Cantilever beam of Aluminium.
10. Bending test on Fixed beam of copper.

Additional Experiments:

11. Tension test on closed coiled helical spring
12. Charpy impact test.

Course Code	Course Title						Core/Elective
2PC454CE	BUILDING DRAWING & DRAFTING LABORATORY						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	6	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- The basic concepts of Building Drawing.
- Skill sets to prepare computer aided engineering drawings.
- Details of construction of different building elements.
- Visualizing the completed form of the building and the intricacies of construction based on the engineering drawings.
- To know the principles of planning of building

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Illustrate the basic principles of building planning and drawings as per codal provisions.

CO 2. Apply the tools of AUTOCAD software to prepare structural drawings of various building components.

CO 3. Draw plan, elevation and sectional drawings of residential buildings in AutoCAD software.

CO 4. Develop isometric views of Single storey.

CO 5. Develop isometric views of Double storey residential buildings.

List of experiments:

1. Conventional Representation of building elements and materials.
2. Brick Masonry Bonds: Detailed drawing (section and elevation) of English Bond and Flemish Bond in odd and even courses - One brick wall and one and half brick wall.
3. Doors & Windows: Detailed drawing (plan, section and elevation) of doors and windows – framed panelled and glazed

4. Staircase: Detailed drawing (plan, section and elevation) of different forms of staircases – open well and dog legged.
5. Footings: Detailed drawing (Plan and section) of different types of footings
6. Roofs and floors: Detailed drawing (section elevation) of different types of floors – cement concrete, terrazzo, mosaic, roofs- pitched, curved and flat
7. Trusses: Detailed drawing (sectional elevation) of different types of roof trusses – king post, queen post.
8. Planning of buildings: Classification of buildings, General requirements of site and building. Building codes, Acts and Bye-laws, Licensing of building works. Functional planning of building such as residential, institutional, public, commercial, industrial buildings, checking for circulation, ventilation, structural, preparing sketch plan, working drawing etc.
9. Comprehensive drawing of buildings (Site plan, floor plan, elevation and sections in accordance with functional requirements for the following): Electrical, Plumbing and Sanitary Drawing of a Building: Single storey residential building.
10. Comprehensive drawing of buildings (Site plan, floor plan, elevation and sections in accordance with functional requirements for the following): Electrical, Plumbing and Sanitary Drawing of a Building: Double storey residential building.

Course Code	Course Title						Core/Elective
2ES453CS	PYTHON PROGRAMMING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

- To learn how to design and program using lists, tuples, and dictionaries.
- To learn how to use indexing and slicing to access data in Python programs.
- To learn structure and components of a Python and to read and write files.
- To learn how to design object-oriented programs with Python classes and Exception handling techniques.
- To learn how to design and build the GUI applications using python

COURSE OUTCOMES:

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

CO 1. Develop solutions to simple computational problems using Python programs.
CO 2. Solve problems using conditionals and loops in Python.
CO 3. Develop Python programs by defining functions and calling them.
CO 4. Use Python lists, tuples and dictionaries for representing compound data.
CO 5. Develop Python programs for GUI applications.

List of Experiments:

1. Develop program to demonstrate different number datatypes in python.
2. Develop program to understand the control structures of python.
3. Develop program on String manipulation.
4. Develop program to perform various operations on files.
5. Develop programs to learn different types of structures (list, dictionary, tuples) in python.
6. Develop programs to learn concept of functions scoping, recursion and list mutability.
7. Develop program to demonstrate classes and OOP principles.
8. Develop programs for data structure algorithms using python – searching, sorting and hash tables.
9. Develop programs to understand working of exception handling and assertions.
10. Draw graphics using Turtle.
11. Develop event driven GUI programs.
12. Develop Program for demonstration client server communication.

B.E. (Civil Engineering) - V SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2ES506CE	Disaster Preparedness and Planning	2	-	-	2	40	60	2
2	2PC508CE	Structural Analysis	3	-	-	3	40	60	3
3	2PC509CE	Soil Mechanics	3	-	-	3	40	60	3
4	2PC510CE	Hydraulics Engineering	3	-	-	3	40	60	3
5	2PC511CE	Water Resources Engineering	3	-	-	3	40	60	3
6	2PC512CE	Design of Steel Structures	3	-	-	3	40	60	3
7	OE	Open Elective – I	3	-	-	3	40	60	3
Practical Courses									
8	2PC555CE	Soil MechanicsLaboratory	-	-	2	2	40	60	1
9	2PC556CE	Fluid Mechanics & Hydraulic Engineering Laboratory	-	-	2	2	40	60	1
10	PW501CE	Practise School-1/ Internship Evaluation	-	-	2	2	50		2
Total			**20**	**0**	**6**	**26**			**24**

Open Elective -I

1	OE501CE	Disaster Mitigation *

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

Course Code	Course Title						Core/Elective
2ES506CE	Disaster Preparedness & Planning						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Environmental	L	T	D	P			
Sciences	2	-	-	-	40	60	2

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Learn about the basic principles of disaster management and the types of disasters.
- To understand natural disasters and its trends.
- To know individual and community preparedness and response, Understand the disaster management cycle and framework.
- Know about the disaster management systems in India and the applications of the latest technologies in disaster management.
- To know the use of application of science and technology in Disaster Management.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Apply the concepts of disaster management to evaluate a disaster situation.

CO 2. Interpreting the causes of disaster and after effects of disasters.

CO 3. Select appropriate pre-disaster, during disaster and post-disaster measures and framework

CO 4. Identify the disaster management acts and frameworks specific to India relevant to a situation.

CO 5. Identify a suitable technological application to aid disaster management.

Unit-I:

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity – Disaster and Development, and disaster management.

Unit-II:

Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms,

avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

Unit-III:

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation.

Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR.

Unit-IV:

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, National Policy on Disaster Management 2009 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies.

Unit-V:

Applications of Science and Technology for Disaster Management: Geo-informatics in Disaster Management (RS, GIS, and GPS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India. Case Studies: Lessons and Experiences from Various Important Disasters in India.

TEXT BOOKS:

1. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2017.
2. Disaster Management by Mrinalini Pandey Wiley 2014.

REFERENCE BOOKS:

1. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi, 2011
2. National Disaster Management Plan, Ministry of Home affairs, Government of India(http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf, 2009)

Course Code	Course Title						Core/Elective
2PC508CE	Structural Analysis						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Analyzingstatically indeterminate beams and portal frames using basic methods of analysis.
- Understanding the difference between slope deflection, moment distribution and Kani's method of analysis.
- Drawing Shear force diagram and bending moment diagram for indeterminate beams and portal frames.
- Stiffness matrix method of analyzing continuous beams and portal frames.
- Analyzing both three hinged and two hinged arches.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. CO1: Solve statically indeterminate beams and portal frames using slope deflection, moment distribution and Kani's method.

CO 2. Analyze the difference between slope deflection, moment distribution and Kani's method of analysis.

CO 3. Analyze SFD and BMD of statically indeterminate beams and portal frames using slope deflection, moment distribution and Kani's method.

CO 4. Develop Stiffness matrix to analyze continuous beams and portal frames.

CO 5. Analyze both the two hinged and three hinged arches with different geometry and subjected to different loading conditions.

Unit-I: SLOPE DEFLECTION METHOD

Application of the method to continuous beams with and without sinking of supports, single bay - portal frames (Indeterminacy not exceeding three), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

Unit-II: MOMENT DISTRIBUTION METHOD

Application of the method to continuous beams with and without sinking of supports, portal frames (static indeterminacy not exceeding three), loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams

Unit-III: KANI'S METHOD

Application of the method to continuous beams with and without support sinking, portal frames (static indeterminacy not exceeding three), and loading on each span may be point load(s) or uniformly distributed load on whole span, shear force and bending moment diagrams.

Unit-IV: STIFFNESS MATRIX METHOD

Application of Stiffness Matrix Method to continuous beams, plane trusses and plane frames structures (Degree of freedom not exceeding three) subjected to Concentrated forces, Uniform forces and Concentrated Moments.

Unit-V: 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 – Analysis of Two hinged arches – parabolic and segmental – determination of horizontal thrust, bending moment, normal thrust and radial shear for static loading.

TEXT BOOKS :

1. Theory of structures by S. Ramamrutham and R. Narayan, Dhanpat Rai publishing company. (9th edition)
2. Analysis of Structures Vol – II by V.N. Vazirani and M.M. Ratwani, Khanna Publishers. (16th edition)

REFERENCE BOOKS:

1. Structural Analysis by R. C. Hibbeler, Pearson Education. (10th edition)
2. Structural Analysis by G.S.Pandit and S.P. Gupta, Tata McGraw Hill Education Pvt. Ltd.(2nd edition)

Course Code	Course Title						Core/Elective
2PC509CE	Soil Mechanics						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Introduction of Particulate Mechanics further to the solid and fluid mechanics.
- To impart the fundamental concepts of soil mechanics and study of various classification of soil.
- To know the importance of index properties like grain size, consistency limits, soil classification.
- Characterization and classification of soils based on laboratory and field experiments
- Understand Seepage, Strength and Compressibility characteristics of soils and learn the analysis of applications involving them.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Classify the soil and interpret their index properties.

CO 2. Explain capillarity and laboratory procedure to determine the permeability parameters. Calculate the capillarity and permeability parameters of soils.

CO 3. Explain Seepage, quick sand condition and soil stresses. Draw a flow net to compute the seepage quantity in soils.

CO 4. Illustrate the mechanisms of the process of compaction and consolidation of soils, and the laboratory procedures to determine their characteristics.

CO 5. Analyse the soils for their shear strength and predict the stability of slopes.

Unit-I:

Origin & Classification of Soils: Soil as a pseudo-elastic three phase particulate medium Physical Properties of soil: Weight ratios (Water content, Density, Unit weights, Specific Gravity); Volume ratios (void ratio, porosity, degree of saturation, relative density); Interrelationships, Laboratory tests for determination of Index

properties. Classification and Identification of soils for general and engineering purposes as per IS: 1498-1970.

Unit-II:

Capillarity in Soils: Surface tension and capillary rise in soil, Capillary tension, Capillary pressure. pF value. Permeability of Soils: Darcy's law for flow through soils - validity of Darcy's Law - Factors affecting permeability - Laboratory tests for determination of co-efficient of permeability (constant head, variable head permeability tests) - Field tests (Pumping in and pumping out tests) - Equivalent permeability of stratified soils.

Unit-III:

Stress in Soils: Total, effective and neutral stress distribution in different ground conditions.

Seepage in Soils: Seepage flow, seepage pressure - Flow nets - Locating phreatic line in a homogeneous earthen dam using Kozeny's parabola - Computation of seepage quantity.

Quick Sand phenomena: Critical Hydraulic gradient, Remedial measures.

Unit-IV:

Compaction Process: Compaction Mechanism; factors affecting compaction. Laboratory determination of compaction characteristics-standard and modified Proctor tests- IS Light and Heavy compaction tests; compaction equipment, procedure and quality control.

Consolidation Process: Spring analogy - Void ratio and effective stress (e Vs logP) relationship – Terzaghi's theory of one-dimensional consolidation– Computation of magnitude of settlement and time rate of settlement.

Unit-V:

Shear Strength: Significance of Shear strength in soils - Mohr - Coulomb equation - shear parameter - Laboratory tests for determination of shear strength - Direct shear test, Tri-axial compression test, Un-confined compression test, Vane shear test, Factors affecting shear strength of cohesion-less and cohesive soils, Case studies. Stability of slopes: Stability of infinite and finite slopes, Stability of slopes of earthen dams, Taylors Stability number.

TEXT BOOKS :

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain "Soil Mechanics and Foundations", Laxmi Publication, 17th Edition, 2017.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors, 7th Edition, 2020.

REFERENCE BOOKS :

1. Venkata Ramaiah, C., "Geotechnical Engineering", New Age Publishers,2006
2. Dilip Kumar Badiya, "NOC: Soil Mechanics/Geotechnical Engineering I", NPTEL Course (https://nptel.ac.in/courses/105105168).

Course Code	Course Title						Core/Elective
2PC510CE	Hydraulics Engineering						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- To introduce the students to various hydraulic engineering problems in and pipe flow.
- Ability to impart various hydraulic problems in open channel flow.
- Ability to understand energy loss principles.
- Ability to relate the theory and practical problems in hydraulic engineering.
- Principles of turbines and pumps.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Classify various types of flow in pipes.

CO 2. Demonstrate friction loss in laminar and turbulent flows.

CO 3. Solve various problems in open channels.

CO 4. Illustrate the hydraulic jumps and its uses.

CO 5. Apply their knowledge of fluid mechanics in addressing problems in hydraulic machinery.

Unit-I: FLOW THROUGH PIPES

Reynolds experiment and its significance, laminar and turbulent flow, characteristics of laminar and turbulent flow. Velocity and shear distribution in laminar flow through circular pipes-Hagen Poiseuille equation, head loss in laminar flow. Loss of head through pipes —Darcy Wiesbach equation, Darcy friction factor for laminar flow, velocity profile of turbulent flow, empirical equations for turbulent flows, hydro dynamically smooth and rough boundaries. Minor losses, hydraulic gradient line, Pipe flow systems-pipes in series, equivalent pipes, pipes in parallel.

Unit-II: INTRODUCTIONTO OPEN CHANNEL

Flow-Comparison between open channel flow and pipe flow, geometrical parameters

of a channel, classification of open channels, classification of open channel flow, Velocity and pressure distribution across channel section.

Steady UniformFlow: Characteristics and development of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n". Most economical section of channel. Computationof Uniform flow, Normal depth.

Unit-III: STEADY NON-UNIFORM FLOW

Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions.

SteadyRVF -Hydraulic Jump- Theoryof hydraulicjump, Elementsand characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses.

Unit-IV: TURBINES

Classification of turbines. Work done and efficiency in Pelton Wheel, Francis's turbine and Kaplan turbine. Unit quantities and specific speed. Performance characteristics of turbines.

Unit-V: CENTRIFUGAL PUMPS

Components and functioning of a centrifugal pump- manometric head andefficiency, work done by impeller, priming of pump and minimum starting speed, specific speedandperformanceofcentrifugalpumps.

TEXT BOOKS :

1. P.N. Modi 'Hydraulic and Fluid Mechanics Including Hydraulic Machines', Standard Book House, New Delhi,2019
2. Dr.R.K. BansaL, 'A Textbook of Fluid Mechanics and Hydraulic Machines', Laxmi Publication., 2019.

REFERENCE BOOKS:

1. K. Subramanya, 'Fluid Mechanics and Hydraulic Machines', Tata McGrawHill Publication, 2018.
2. K. Subramanya, 'Flow in Open channel',Tata McGraw Hill Publication, 2019.

Course Code	Course Title						Core/Elective
2PC511CE	Water Resources Engineering						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Imparting knowledge regarding the fixation of different levels of reservoirs.
- Description regarding planning and design aspects of different types of Dams.
- Description of design aspects of different types of weirs and regulatory systems.
- Imparting knowledge regarding the different types of cross drainage structures.
- Introduce students to basic concepts of water, plants, their interactions, as well as irrigation.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Find crop – water requirements

CO 2. Explain the design aspects of different types of weirs and regulatory systems.

CO 3. Design different types of storage works and fixation of different levels of reservoirs.

CO 4. Analyze and design gravity dams and earthen dams.

CO 5. Analyze the different types of cross drainage structures.

Unit-I: STORAGE WORKS

Purpose, selection of site, zones of storage, computation of storage capacity, fixation of different levels of reservoirs (LWL, FRL, MWL), evaporation reduction techniques.

Dam: Classification of dams, selection of site for a dam, physical factors governing the selection of type of dams.

Unit-II: GRAVITY DAMS

Forces acting on gravity dam, failures of gravity dam, stability and design of gravity dam, principal and shear stresses, elementary and practical profiles of gravity dam, economical height of dam, high and low gravity dams, descriptions details of functions and types of galleries in gravity dams.

Unit-III: EARTHEN DAMS

Types, methods of construction, failures of earth dam, criteria for safe design of an earth dam, computation of seepage from flow net phreatic line in an earth dam (for homogeneous section with and without filter cases), design of earth dam to suit available materials, embankment and foundation seepage control measures.

Unit-IV: WEIRS

Components of division head work, types of weirs.

Spill ways: Descriptions details of different types of spill ways, descriptions details of energy dissipation below spillways, different types of spillway crest gates.

Cross Drainage Work: Definition, classification, selection and descriptions details of cross drainage works.

Unit-V: CANALS

Alignments, classification of alluvium canals and their function, lining of canals, methods of lining and design of lined canals.

Irrigation: Definition, necessity of irrigation, types of irrigation systems and methods.

Crops Water Requirement : Crops and crop seasons in India, duty, delta and base period of crops, factors affecting duty, consumptive use of water and evapotranspiration, wilting points.

TEXT BOOKS:

1. S.K. Garg, "Irrigation Engineering and Hydraulic Structure", Khanna Publication,2023
2. Modi P.N., "Irrigation and Water Resources and Water Power Engineering", Standard Book House, New Delhi,2019

REFERENCE BOOKS:

1. Punmia, B.C., Pande B. B., "Irrigation and Water Power Engineering", Standard Book House, New Delhi,17th Edition, 2021.
2. S.K.Sharma - Irrigation Engineering & Hydraulic Structures S.Chand Publishers, New Delhi 2016.

Course Code	Course Title						Core/Elective
2PC512CE	Design of Steel Structures						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Understand the design criteria, design philosophy and behavior of structural steel.
- Identify the different failure modes of bolted and welded connections, and determine their design strengths.
- Identify the different failure modes of steel tension and compression members and beams, and compute their design strengths
- Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria.
- Assess the loads on roof truss and design of purlins

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Explain the composition of structural steel and IS codal provisions and load combinations implemented in the design codes for steel structures

CO 2. Analyze and design simple connections between structural members including riveted and welded connections.

CO 3. Analyze tension &compression members and column bases

CO 4. Design tension &compression members and column bases

CO 5. Evaluate the loading on roof trusses and design of purlins

Unit-I:

Introduction to steel design: Materials and Specifications:Chemical composition of steel, types of Structural Steel, Residual stresses, Stress Concentration. Design Philosophies, working Stress Method, Limit State Method, Codes and Specifications, Characteristic Loads, Dead Loads, Imposed Loads, Earthquake Loads,

Wind Loads and Load Combinations. Partial safety factors for materials and loads and loading combinations.

Design of Connections (Limit state method):

i) Bolted Connections: Bolted Connections, Behaviour of Bolted Joints, Design Strength ofOrdinary Black Bolts, Design Strength of High Strength Friction Grip Bolts, Pin Connections, Simple Connections and Eccentric Connections.

ii)Welded Connections: Advantages of Welding, Types of Welds and Joints, Simple Connections and Eccentric Connections

Unit-II:

Design of Tension Members (Limit State Method): Types of Tension Members, Design of Strands,

Slenderness Ratio, Modes of Failure, Factors Effecting Strength of Tension Members, Design of Tension Members (Angles, Other sections, and Rods), Lug Angles, Tension Member Splice

Unit-III:

Design of Compression Members (Limit State Method): Introduction, Possible Failure Modes, Behavior of Compression Members, Elastic Buckling of Slender Compression Members, Behavior of Real Compression Members, Sections of Compression Members, Effective Length, Design of Compression Members with Single Section and Built-up Sections (Symmetric in both directions), Lacing and Battening, Column Splices. Design of Column Bases (Limit state method): Design of Slab Base and Gusseted Base for Column

Unit-IV:

Design of Beams (Limit State Method): Types of Beams, Section Classification, Lateral Stability of Beams, Buckling of Real Beams, Behaviour of Beams in Bending, Design of Laterally Supported and Unsupported Beams, Design of Compound Beams, Shear Strength of Beams, Maximum Deflection, Web Buckling and Web Crippling.

Unit-V:

Design of Roof Trusses (Limit State Method): Types of Trusses, End Bearings, Spacing of Trusses and Purlins, Estimation of Loads with different Roof Coverings, Self-weight of Truss, Wind Effects, Design of Purlins for Dead Load, Imposed Load and Wind Loads. Detailed Design of Roof Trusses including Joints and Supports (only Angular Trusses.

TEXT BOOKS :

1. Subramanian. N, "Design of Steel Structures", Oxford University Press, 2018
2. Duggal S.K., "Design of Steel Structures", 3rd Edition, Tata McGraw Hill Publishing, 2017.

REFERENCE BOOKS:

1. Bhavikatti, S.S., "Design of Steel Structures", 5th Edition, I.K. International Publishing House Pvt. Ltd. 2017.
2. NPTEL COURSE: https://archive.nptel.ac.in/courses/105/105/105105162//

Course Code	Course Title						Core/Elective
2PC555CE	Soil Mechanics Lab						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Classifying different types of soils.
- Relating the concepts of soil mass, soil solids and soil structure.
- Describing the laboratory test procedures and appreciate the suitability of each test.
- Evaluating the soil properties.
- Relating theoretical concepts to practical concepts by doing lab test

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Determine Specific gravity of different soils by test results, interpret and validate the same.

CO 2. Analyze particle size distribution of soil by conducting sieve analysis test.

CO 3. Analyze the behavior of soils with water by conducting tests.

CO 4. Analyze shear strength of soils on application of stress in laboratory.

CO 5. Determine permeability and compaction characteristics of various soils.

List of Experiments:

DETERMINATIONOFINDEXPROPERTIES:

1. Determination of Specific Gravity of soil solids using Density bottle method.
2. Determination of Specific Gravity of Soil Solids using Pycnometer method.
3. Determination of water content using Pycnometer method.
4. Determination of Liquid limit using Casagrande ‘s standard Liquid Limit device.
5. Determination of Plastic limit.
6. Sieve Analysis for plotting Particle size distribution curve.

7. Determination of Field Density using Sand Replacement Method.
8. Determination of Field Density by core cutter method.

DETERMINATION OF ENGINEERING PROPERTIES:

9. Determination of Compaction Characteristics.
10. a) Determination of Co-efficient of Permeability by Constant Head Permeameter test.
    b) Determination of Co-efficient of Permeability by Variable Head Permeameter test.
11. Determination of shear strength, parameters by Direct Shear Test

DEMONSTRATION OF TEST PROCEDURE:

12. Unconfined Compression Test.
13. Vane Shear Test.

Course Code	Course Title						Core/Elective
2PC556CE	Fluid Mechanics & Hydraulic Engineering Laboratory						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Verify the principles studies in fluid mechanics.
- Calibrating various flow measuring device by determining coefficient of discharge.
- Provide understanding of practical application of open channels.
- Application of force concepts on jets and hydraulic machines.
- Determination of characteristics curve of turbine and pumps.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Compute discharge flowing through streams and canals.
CO 2. Determination the type of flow in pipe, and discharge through pipes and losses in pipes.
CO 3. Competence in understanding flow phenomenon in open channels.
CO 4. Analyze the force acting due to jets concept and its application in hydraulic machines.
CO 5. Demonstrate working principles of hydraulic pumps and turbines.

List of Experiments:

1. Determination of coefficient of discharge of a Rectangular Notch with end contractions.
2. Determination of coefficient of discharge of V- Notch.
3. Determination of coefficient of discharge of a Venturi meter.
4. Determination of coefficient of discharge of an Orifice meter.
5. Determination of coefficient of discharge of a Circular Orifice.
6. Determination of coefficient of discharge of a Mouth piece.
7. Classification of flow by Reynolds Experiment.
8. Determination of Darcy's friction factor.
9. Determination of roughness coefficient in an open channel.
10. Determination of a vane coefficient.
11. Determination of basic characteristics of a hydraulic jump.
12. Study of main characteristic curve of a centrifugal pump.
13. Study of universal characteristic curve of a Francis Turbine.

Course Code	Course Title						Core/Elective
PW501CE	PRACTICE SCHOOL-1 EVALUATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	50	-	2

COURSE OBJECTIVES:

It is intended to make the students to :

- Latest technological developments and needs of the industry
- Solving the real time field problems with the help of theoretical knowledge acquired at institution
- Summarizing and presenting the work before the Panel
- Acquiring skills in technical report writing
- Importance of working effectively in a team

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Explain techniques, processes and tools used in the industry

CO 2. Discuss the current needs of the industry in his/her area of interest

CO 3. Explain the practical knowledge acquired in the chosen area/work done.

CO 4. Summarize and prepare a technical report on practice school completed at industry

CO 5. Adapt to work in a team or as an individual effectively

Practice School Guidelines:

1. Each student should opt for practice school that would provide to gain ample field knowledge in the relevant field of engineering such that theoretical knowledge gained in the class can be applied to solve the practical/ field problem.
2. Students should take a challenging task, may be small portion, and apply the knowledge gained to solve it
3. Students should devote full 2 weeks for practice school. If any student undergoes practice school duration is less than 2 weeks, shall not be considered.

4. Students are permitted to undertake in-house (college campus) practice school with the prescribed guidelines. Head of the department should allocate faculty members as advisors for all IV students at the end of III semester for advising the students regarding the practice school.
5. Head of the department should depute faculty members for monitoring the student practice school by communicating to the company guide.
6. It is the responsibility of the concern faculty to monitor the day-to-day academic activities of their students. If any student found misbehaving, misconduct during practice school (particularly during academic hours) and upon receipt of the complaint, immediately the disciplinary action shall be initiated against the student and faculty concerned should submit a report.
7. Maximum number of students allowed per faculty shall be decided by the individual department in consultation with Academic section.
8. After completing 2 weeks of practice school, each individual student has to submit a certificate of completion from company and a technical report of their work. Evaluation will be done for 50 marks depend on their work, report and presentation skills.
9. HOD should constitute practice school evaluation committee consisting of senior department faculty members that may include one faculty from other dept. The evaluation committee should involve in the evaluation process. Committee can take decision to reject the student's practice school if it doesn't meet the requirements. Such students have to repeat the practice school.

Evaluation Criteria:

Practice School Evaluation: 50 marks	**Activity**	**Weightage**
Distribution of Marks	Type of problem/work handled	10
	Report	10
	Presentation	15
	Ability to answer questions	15

OPEN ELECTIVES

Course Code	Course Title						Core/Elective
1OE501AD	ARTIFICIAL INTELLIGENCE						Open Elective
Prerequisite	Contact Hours per Week						
	L	T	D	P	CIE	SEE	Credits
NIL	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
- To introduces different knowledge representation methods in AI Programs.
- To introduce different design techniques for Game Playing Programs.
- To introduce the AI Agents their design, planning and learning techniques.
- To introduce the natural language processing and expert systems.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Understand fundamental AI concepts and identify arrange of symbolic and non symbolic AI techniques.

CO 2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.

CO 3. Use different knowledge representation techniques used in AI Applications.

CO 4. Demonstrate an understanding of agent based AI architectures, Planning and logic based agents.

CO 5. Exploring Expert systems.

UNIT-I

Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques Problem solving techniques: States pace search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A*search, AO*search, Constraint

satisfaction problem, Agenda Driven Search, Mean-end analysis, Min- Max Search, Alpha-Beta Pruning, Iterative Deepening.

UNIT-II

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures.

UNIT-III

Non Monotonic and Statistical Reasoning: on monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

UNIT-IV

Planning and Learning Agents: Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

UNIT-V

Introduction to Learning and Expert system: Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

TEXTBOOKS :

1. AI: A Modern Approach StuartJ. Russel, Peter Norvig Pearson Education Latest Edition, 2012.
2. Artificial Intelligence Elaine Rich, Knight McGraw Hill Third Edition 2010.
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition 2011.

REFERENCE BOOKS :

1. Artificial Intelligence, Partick Henry Winston Addison Wesley Latest Edition 2012.
2. Artificial Intelligence George Luger Pears on Education Latest Edition 2010.

Course Code	Course Title						Core/Elective
OE501CE	DISASTER MITIGATION						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Environmental	L	T	D	P			
Sciences	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Define disaster and explain the different types of disasters.
- Describe the disaster management cycle and the role of NDMA in disaster management.
- Analyze the legal aspects of disaster management.
- Develop disaster mitigation plans.
- Participate in disaster response and recovery activities.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Demonstrate the concepts of disaster management

CO 2. Identify different types of disasters

CO 3. Explain the disaster management cycle

CO 4. Illustrate the role of NDMA in disaster management

CO 5. Explain the development of disaster mitigation plan

Unit-I:

Introduction to Disaster Management: Definition of disaster, Types of disasters, History of disaster management in India, National Disaster Management Authority (NDMA) and its role in disaster management, Disaster management cycle. Case studies of disasters in India and the world

Unit II:

Disaster Mitigation: Mitigation measures for different types of disasters, Use of technology in disaster mitigation, Disaster risk assessment, Disaster preparedness, Exercises and simulations on disaster mitigation.

Unit III:

Disaster Response: Search and rescue operations, Medical relief, Food and shelter, Restoration of essential services, Rehabilitation and reconstruction,

Unit IV:

Disaster Law and Policy: Disaster management acts of India, Disaster management policies of India, Legal aspects of disaster management

Unit V:

Disaster Communication and Public Awareness: Importance of communication in disaster management, Methods of disaster communication, Public awareness programs, Case studies of disaster communication and public awareness in India and the world.

TEXT BOOKS:

1. R.Subramanian, Disaster Management, Vikas Publishing House, 2018.
2. M. M. Sulphey, Disaster Management, PHI Learning, 2016.

REFERENCE BOOKS :

1. S. C. Sharma, Disaster Management: Concepts, Approaches and Techniques, Khanna Book Publishing House, 2017.
2. G. K. Ghosh, Disaster Management: Theory and Practice, APH Publishing Corporation, 2018.

Course Code	Course Title						Core/Elective
3OE501CS	OOPs USING JAVA						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

- The Java programming language: its syntax, idioms, patterns and styles.
- Object oriented concepts in Java and apply for solving the problems.
- How exception handling and multithreading makes Java robust.
- Explore java Standard API library such as io, util, applet, awt.
- Building of applications using Applets and Swings.

COURSE OUTCOMES:

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

CO 1. Understand the concept of OOP and analyze relationships among classes, objects.

CO 2. Develop programs using concepts like inheritance, packages, interfaces, Java I/O streams and strings.

CO 3. Utilize exception handling and Multithreading concepts to develop Java programs.

CO 4. Interpret the Java Collection API, Java utility classes, concept of files and serialization.

CO 5. Design GUI applications using concepts like AWT controls and Swings and client server programs using networking concepts.

UNIT-I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming. Introduction to Java : Javabuzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access

control, static, final, nested and inner classes, exploring string class, using command-linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final.

Polymorphism-dynamic binding, method over riding, abstract classes and methods.

UNIT-II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throw sand finally, re throwing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive and join, thread priorities, synchronization, inter thread communication, deadlock.

UNIT-III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces –Vector, Hash table, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner Java Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT-IV

GUI Programming with java: The AWT class hierarchy, MVC architecture.

Applet Revisited: Basics, architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC,JDBC Drivers &Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT-V

Exploring Swing: JLabel, ImageIcon, JText Field, the Swingbuttons, JTabbedpane, J Scroll Pane, J List, J Combo Box.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet. http package, handling HTTP requests and responses

TEXTBOOKS:

1. Java: The Complete Reference, X Edition, Herbert Schildt, Mcgraw Hill.
2. JavaFundamentals:A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. Java for Programming, P.J. Dietel X Edition, Pearson Education

REFERENCEBOOKS:

1. The Java Programming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, III Edition, Pearson 2008
2. An Introduction to OOP, T. Budd, III Edition, Pearson Education.
3. Introduction to Java Programming, Y.Daniel Liang, X Edition, Pearson Education.

Course Code	Course Title						Core/Elective
5OE501EC	Basics of Electronic Communication						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
BEE	3	-	-	-	40	60	3

COURSE OBJECTIVES:

- To provide an introduction to fundamental concepts in the understanding of communications systems.
- To describe the network model and some of the network layers including physicallayer, data link layer, network layer and transport layer.
- To discuss the evolution of wireless systems and current wireless technologies.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO 1. Understand the working of analog and digital communication systems.

CO 2. Explain the OSI network model and the working of data transmission.

CO 3. Describe the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

CO 4. Differentiate between analog and digital modulation techniques

CO 5. Understand the optical fibre communication link, structure, propagation and transmission properties.

UNIT–I

Introduction to Communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation Signal Radiation and Propagation: Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT– II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT– III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/ IPv6), Transport Layer – TCP, UDP.

UNIT-IV

Telecommunication Systems: Telephones, Telephone system, Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT-V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

TEXTBOOKS:

1. Louis E. Frenzel, "Principles of ElectronicCommunicationSystems",3rd edition, McGraw Hill, 2008.
2. George Kennedy, Bernard Davis, "Electronic Communication systems", 4th edition, McGraw Hill, 1999.

REFERENCEBOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking",5th edition, TMH, 2012.
2. Rappaport T.S. ,"Wireless communications",2nd edition, Pearson Education, 2010.
3. Wayne Tomasi, "Advanced Electronic Communications Systems",6th edition, Pearson Education.

Course Code	Course Title	Core/Elective					
4OE501EE	RENEWABLE	Elective					
	ENERGY SYSTEMS	L	T	P/D	Credits	CIE	SEE
	(OPEN ELECTIVE – I)	3	0	0	3	40	60

COURSE OBJECTIVES :

The objectives of this course is to impart knowledge of

1. To understand the concepts and Importance of renewable energy sources such as solar, wind, biomass, tidal power.
2. To make the students understand the advantages and disadvantages of different renewable energy sources.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1. Understand the advantages, disadvantages and applications of different non-conventional sources.
CO2. Analyze principle of operation and applications of different Fuel cells.
CO3. Analyze the principles of Solar and Wind Energy sources and its applications
CO4. Understand the principles of OTEC and GTE.
CO5. Analyze the biomass conversion technologies, Biogas generation and Biogas plants.

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy, V-I and P-V curves and the concept of MPPT.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energy collectors - Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

UNIT-IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation - Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

UNIT-V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers.

TEXTBOOKS :

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 2011.
2. David M Buchla and Thomas E Kissell ,Renewable Energy Systems, 1st Edition by, Pearson India.

REFERENCES/SUGGESTEDREADING:

1. M.M.El-Wakil, Power Plant Technology, McGraw Hill, 1984.
2. John Twidell, Tony Weir, Renewable Energy R73esources, 3rd Edition, Taylor and Francis.

Course Code	Course Title						Core/Elective
6OE501ME	START-UPENTREPRENEURSHIP						Open Elective
Prerequisite	Contac Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

Students should be able to understand

- To motivate students to take up entrepreneurship in future.
- To learn nuances of starting an enterprise & project management.
- To understand project formulation and choice Technology in Enterprise.
- To understand Intellectual properties, patents, Start-ups.

COURSEOUTCOMES:

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

CO 1. Understand Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.

CO 2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.

CO 3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.

CO 4. Understand the concept of Intellectual Property Rights and Patents

CO 5. Comprehend the aspects of Start-Ups.

Unit-I

Entrepreneurship: Definition, functions of Entrepreneurship, Characteristics and qualities of entrepreneurs, Entrepreneur vs. intrapreneur, need of innovation, Economic growth. Small Scale Industry in India, Linkage among small, medium and heavy industries.

Unit–II

Indian Industrial Environment: Competence, Opportunities and Challenges, Emergence of First generation entrepreneurs, women entrepreneurs. Conception and evaluation of ideas and their sources. Types of enterprises. Collaborative interaction for Technology development. Corporate Social Responsibility.

Unit–III

Project formulation: Introduction, Elements of Business Plan and its salient features, Analysis of market demand, Financial and profitability analysis and Technical analysis.

Unit-IV

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer oftechnology.

Unit-V

Aspects of Start-Up: What is Start-Up, Start-up Policy, start-up strategy, Progress of startups in India, Principles of future organizations, start-up sectors and action plan for start-ups by Govt. of India.

TEXT BOOKS:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House,
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata McGraw-Hill Publishing Company Ltd.
3. Ajit Parulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications, MacmillanIndia Ltd.

REFERENCE BOOKS:

1. Stephen R.Covey and A.Roger Merrill, "First Things First", Simon and Schuster Publication.
2. G. S. Sudha, "Organizational Behaviour".
3. Robert D.Hisrich, Michael P. Peters, "Entrepreneurship", Tata Me Graw Hill Publishing Company Ltd., 5lh Ed.
4. G.B.Reddy, Intellectual Property Rights and the Law 5thEd. Gogia Law Agency.

B.E. (Civil Engineering) - VI SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2PC613CE	Construction Engineering & Management	2	-	-	2	40	60	2
2	2PC614CE	Transportation Engineering	3	-	-	3	40	60	3
3	2PC615CE	Environmental Engineering	3	-	-	3	40	60	3
4	2PC616CE	Foundation Engineering	3	-	-	3	40	60	3
5	PE	Professional Elective - I	3	-	-	3	40	60	3
6	PE	Professional Elective - II	3	-	-	3	40	60	3
7	OE	Open Elective -II	3	-	-	3	40	60	3
Practical Courses									
8	2HS653HS	Soft Skills Laboratory	-	-	2	2	40	60	1
9	2PC657CE	Transportation Engineering Laboratory	-	-	2	2	40	60	1
10	2PC658CE	Environmental Engineering Laboratory	-	-	2	2	40	60	1
	PW	Practise School-2/ Mini Project #							
Total			**20**	**0**	**6**	**26**			**23**

\# To be conducted after the VI Semester in the Summer Vacation and to be evaluated in VII Semester

Professional Elective – I

S. No.	PE Stream	Course Title
1	2PE601CE	Prestressed Structures
2	2PE602CE	Ground Water Engineering

Professional Elective – II

S. No.	PE Stream	Course Title
1	2PE603CE	Structural Engineering Design and Detailing-1 (RCC)
2	2PE604CE	Advanced Surveying

Open Elective – II

S.No.	Course Code	Course Title
1	OE602CE	Green Building Technologies*

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

Course Code	Course Title						Core/Elective
2PC613CE	CONSTRUCTION ENGINEERING & MANAGEMENT						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	2

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Understand the techniques involved in construction project management and practices.
- Apply the concepts of construction planning and scheduling techniques likebar charts, mile stone charts, PERT and CPM
- Apply various resource management techniques in cost – time analysis and use of project management software for resource optimization in construction projects.
- Understand various types of contracts, labour acts and prepare tender documentation and detailed project reports.
- Acquaint with the concepts and application of optimization and linear programming in monitoring and control of construction projects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Understand the construction industry, construction practices, and management systems to construction projects

CO 2. Apply various network theories such as PERT, CPM in construction management to construction projects

CO 3. Analyze cost-time analysis, resource optimization techniques and apply project management software for resource optimization in construction projects.

CO 4. Understand various types of contract documents, tenders, detailed project reports and labor acts in construction practice.

CO 5. Apply optimization techniques and linear programming in construction practice.

Unit-I

Introduction: Introduction to Construction Industry - Significance, objectives and functions, stakeholders, roles, responsibilities and functional relationships, Construction projects – objectives and lifecycle, existing construction practices

and project management systems, Project scale, Economy of scale application in construction cost estimates.

Unit-II

Construction Management through Network Theory: Definitions and different types of Events, activity, dummy, Network rules, Network event numbering (Fulkerson Rule), Hierarchies of complex network, work break down structure, Liner Scheduling methods - bar charts, milestone charts, LOB, their limitations, difference between PERT and CPM, network-based scheduling techniques - PERT, CPM, AON and AOA in construction management. Numerical Problems.

Unit -III

Cost & Resource Optimization Techniques: Cost Model - Direct and Indirect Cost component of Project, Cost Slope, Project Cost-Time analysis and optimization. Resource usage profile, Histograms, Resource allocation, smoothing & levelling techniques. Project Updating. Introduction of Project management software such as PRIMAVERA or any open-source software - Building Information Modelling (BIM), etc.

Unit-IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, condition of contracts, safety, health and environment on project sites, accidents their causes, effects and preventive measures, costs of accidents, workmen compensation act, contract labor act.

Tender: Tender form, tender documents, notice inviting tenders, Work order. Project Delivery Methods: BOT, SBOO. BOOT, Public Private Partnership (PPP), Detailed project report (DPR)

Unit-V

Linear programming and optimization in construction: Introduction to optimization – Linear programming, Importance of optimization in construction, Simple problems on formulation of LP, Graphical method, Simplex method, Big M-Method, Case studies.

TEXT BOOKS:

1. Srinath L.S., "PERT and CPM: Principles and Application", East-West Press, 2001.
2. Seetharaman S., "Construction Engineering and Management", Umesh Publications, 2012.

REFERENCE BOOKS:

1. Gahloj. P.S. and Dhiv. B.M., "Construction Planning and Management", Wiley Eastern Ltd., 2018.
2. Punmia, B. C., and Khandelwal, K. K., "Project planning and control with PERT and CPM", 2006.

Course Code	Course Title						Core/Elective
2PC614CE	TRANSPORTATION ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge and skills to students so that they can:

- Define the different modes of transportation.
- Explain the factors that affect transportation demand.
- Calculate the capacity of transportation networks.
- Design and evaluate transportation facilities.
- Analyze the impact of transportation on the environment.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Demonstrate fundamental conceptsof transportation engineering.

CO 2. Apply concepts to solve transportation problems.

CO 3. Explain various traffic engineering studies and tests on materials.

CO 4. Apply the knowledge of pavement materials to a real-world problem.

CO 5. Remember the different types of transportation systems management

Unit-I

Introduction to Transportation Engineering: Definition; History of transportation engineering; different modes of transportation; transportation demand and supply; types of transportation infrastructure, such as roads, highways, bridges, and tunnels.

Road Network Design in India: Overview of road network in India; Classification of roads as per IRC;Alignment, Factors affecting alignment, cross sectional elements, engineering surveys, drawing and reports.

Unit-II

Elements of Traffic Engineering: Basic parameters of traffic volume, speed and density; traffic flow characteristics; Data collection and presentation: volume studies, speed studies, parking studies, and delay studies; capacity and level of service, Accident Data Recording, Condition Diagram and Collision Diagrams.

Unit-III

Traffic Signal Design: Signalized and unsignalized intersections, Design of Traffic Signals: Webster method, Benefits of using AI for smart traffic signal control.

Traffic regulations: Introduction of Traffic control systems and devices; Traffic Signs: Types and Specifications; Road markings: Need for Road Markings, Types of Road Markings.

Unit-IV

Pavement Materials: Sub grade soil, Asphalt materials and properties; Concrete materials and properties; bituminous and modified binders; reclaimed asphalt pavement, Testing and evaluation of materials.

Pavement design: Types of pavements; soil stabilization; rigid and flexible pavement layers; fundamentals of rigid and flexible pavement design; evaluation and maintenance of highways; Rehabilitation of pavements.

Unit-V

Transportation Systems Management: Traffic control, public transportation, and intelligent transportation systems; Impact of transportation on the environment.

Transportation Planning : Steps involved in transportation planning: data collection, forecasting, and impact analysis; transportation plans: master plans, corridor plans, and project plans.

Overview of AI and its applications in transportation engineering

TEXT BOOKS:

1. S.K.Khanna&M.F.S.Justo, A.Veeraragavan, Highway Engineering, 10th Ed., NemChand Publishers, 2018.
2. R Srinivasa Kumar, Transportation Engineering, Universities Press, 2020.

REFERENCE BOOKS:

1. Subhash C Saxena, Textbook of Highway and Traffic Engineering (3rd reprint), CBS Publishers, 2023.
2. C Venkatramaiah, Transportation Engineering, Volume I, Universities Press, 2015.

Course Code	Course Title						Core/Elective
2PC615CE	ENVIRONMENTAL ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- To learn sources and characteristic of raw water, quantity and quality of water for drinking purpose.
- Understand concepts and design of different water treatment unit.
- Acquire an understanding of the fundamental concepts and detailed technical knowledge of the technologies required for wastewater treatment.
- Explain the different sequential unit operations of wastewater treatment processes.
- Study of solids waste, air and noise pollution control methods, mechanism and devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Determine the water demand for different cities and Design the water supply network

CO 2. Design the components of water treatment plant and understand the concept of Building plumbing.

CO 3. Calculate the sewage flow using different approaches through various sources and design the components of a simple sewerage system

CO 4. Explain the knowledge on sludge, solid waste treatment and disposal

CO 5. Identify air and noise pollution problems, pollution control methods, mechanism and devices.

Unit-I

WATER SUPPLY & WATER TREATMENT

Objective of protected water supplies, population forecast, Surface and ground watersources of water, water analysis, description and design of coagulation, flocculation and sedimentation processes. Classification, description and design of

filtration, disinfection- necessity and methods and Softening processes, various types of pipe, valves and joints used in water supply, methods of layout of distribution pipes, Design distribution by Hardy Cross Method for simple networks.

Unit-II

WASTEWATER ENGINEERING

Definitions, System of sewerage, shapes of sewers, hydraulic formulae for design of sewer, Operation and maintenance of sewers, sewers appurtenances, Domestic and storm water quantity of sewage, sewage flow variations.B.O.D and C.O.D concepts.

Unit III

TREATMENT OF SEWAGE:

Wastewater treatment, descriptions details of preliminary treatment, Primary treatment- design of Sedimentation tank, Secondary treatment - theory and design concepts of Activated Sludge process.

Sludge: Sludge digestion and disposal methods, Septic tanks- design parameters and working principles. descriptions details of low-cost waste treatment- Oxidation ponds, Sequencing Batch Reactor (SBR), Water Stabilization ponds.

Unit-IV

MUNICIPAL SOLID WASTE

Characteristics, source and composition of solid waste, collection and transportation of solid waste, engineered system for solid waste management (reuse/recycle, energy recovery, treatment and disposal)

Air Pollution: Type of pollutants, their sources and impact of air pollution, meteorology and control, air quality standards and limits.

Noise Pollution: Impact of noise, Permissible limits of noise pollution. Measurement of noise and control of noise pollution.

Unit-V

BUILDING PLUMBING

Introduction to various types of house plumbing systems for water supply and wastewater disposal, high rise building plumbing, pressure reducing valves, break pressure tank, storage tanks, building drainage for high rise building, various kind of fixtures and fitting used.

TEXT BOOKS:

1. Dr. B.C. Punmia, Er. Ashok Kumar Jain, Dr. Arun K. Jain, 'Water Supply Engineering', Laxmi Publication LTD, 2016.
2. G.S. Birdie and J.S. Birdie, 'Water Supply and Sanitary Engineering', Dhanpat Rai Publication company, 2010.

REFERENCE BOOKS:

1. Santosh Kumar Garg, 'Environmental Engineering (Vol. II) Sewage Waste Disposal and Air PollutionEngineering', Khanna Publication, 1979.
2. Santosh Kumar Garg, 'Water Supply Engineering', Khanna Publication, 1977.

Course Code	Course Title						Core/Elective
2PC616CE	FOUNDATION ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Stress distribution in soils due to various types of loads
- Safe bearing and allowable bearing capacities of shallow foundations.
- Design and load carrying capacities of Pile foundations.
- Types, necessity and suitability of Caissons and Coffer dams.
- Methods of Geotechnical Investigation and Dewatering techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Define theories related to stress distribution of soil, types of foundations and their various bearing capacities as well as settlements.

CO 2. Explain Safe bearing capacity of shallow foundations, sinking and stability of well foundations.

CO 3. Explain necessity, types, methods and suitability of pile foundations, caissons, coffer dams, geotechnical investigations and dewatering techniques.

CO 4. Make use of field tests and settlement analysis to calculate vertical stresses, safe bearing capacity and settlements of shallow foundations.

CO 5. Make use of load tests and formulae to calculate load carrying capacities & efficiency of pile and pile groups.

Unit-I

Stress Distribution in Soils:Boussinesq's theory – Computation of increment in vertical stress due to application of a point load (its distribution on horizontal, vertical planes), uniformly distributed circular and rectangular areas –Pressure bulb – Significant depth - Construction and use of Newmark's chart – Westergaard's theory – Validity of elastic theories – Contact pressure distribution.

Unit-II

Introduction to Foundations : Functional requirements – types – differentiation of shallow and deep foundations – suitability

Safe Bearing Capacity of Shallow Foundations : Definitions - (a) Based on theories –Types of shear failures – Terazaghi's theory for safe bearing capacity of shallow foundations – Effect of type of shear failure/ shape of the footing / water table – Provisions of IS: 6403- 1981 (b) Based on field tests: Plate load test / Standard Penetration test

Allowable Bearing Capacity of Shallow Foundations : Settlement Analysis – Total settlement – Elastic settlement – Consolidation settlement (ultimate & after any given period – correction for constructionperiod) – Permissible uniform & differential settlements – Proportioning of footings.

Unit-III

Pile Foundations : Necessity – types based on load transfer mechanism / material / method of installation / functional use – Mono piling -Estimation of vertical load carrying capacity of a single pile – static formulae / Dynamic formulae / Pile load tests – Cyclic pile load test for separation of total capacity in to bearing and friction components – Pile groups – necessity – efficiency of Pile groups - estimation of group capacity – Negative Skin friction-- Design of pile foundations.

Unit-IV

Caissons : Necessity – types – Essential components of open (well) / box (floating) / Pneumatic caissons - suitability – Sinking of caissons – correction for tilt & shift.- Stability of Well Foundations.

Coffer dams: necessity – types – suitability.

Unit-V

Geotechnical Investigations: Necessity – Principles of exploration - objectives – Soil profile – collection of disturbed & undisturbed soil samples – samplers & quality of samples - methods – Trial pit / Bore hole method – Log of bore hole details.

Dewatering: Necessity – methods – sumps (ditches) / well point system (single / multi-stage) / deep well system / electro-osmosis method – merits & demerits – suitability.

TEXT BOOKS:

1. Arora, K.R.—"Soil Mechanics & Foundation Engineering", 7th Reprint Edition, Standard Publications,2019.
2. Punmia, B.C. & Jain A.K –"Soil Mechanics & Foundation Engineering", 17th Edition, Laxmi Publications, 2021

REFERENCE BOOKS:

1. Bowles, E. --"Foundation analysis and Design", 5th Edition, McGraw-HillPublications, 1996.
2. Das, B.M.--"Principles of Foundation Engineering", 7th Edition, Sengrece Publications, 2011.

Course Code	Course Title						Core/Elective
2PE601CE	PRESTRESSED STRUCTURES						Professional
Prerequisite	Contac Hours per Week						Elective
	L	T	D	P	CIE	SEE	Credits
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to

- Understand the importance of pre-stressed concrete and the evolution of pre-stressing to overcome the shortcoming of reinforced concrete and acquire knowledge about the methods of pre-stressing and pre-stressing devices for pre-tensioning and post-tensioning.
- Assess the losses of pre-stress in PSC members due various causes like friction, elastic shortage of concrete, shrinkage, creep, etc.
- Analyze sections of PSC beams with straight, concentric, eccentric, bent and parabolic tendons and design PSC beams of rectangular and I section for flexure and for shear
- Analyze the two span continuous beams
- Interpret the transmission mechanism of pre-stressing force by bond and compute deflection of beams under loads.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Explain the concept of pre-stressing and the behavior of concrete structures and recognize the general principles, methods of pre-stressing, and pre-stressing devices for pre- tensioning and post-tensioning.

CO 2. Determine losses of pre-stress in pre-stressed concrete structures.

CO 3. Apply the provisions of IS-1343(2012) code to the design of pre-stressed concrete structures for flexure and shear.

CO 4. Analyze the two-span continuous beam for different cable profile.

CO 5. Analyze the stresses in anchorage zones and design end anchorages for prestressed concrete beams and evaluate the short- and long-term deflections of beams.

Unit-I

Introduction: Historic development- General principles of pre-stressing pre-tensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of pre-stressing Materials- high

strength concrete and high tensile steel their characteristics. Methods and Systems of pre-stressing: Pre-tensioning and Post-tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.

Unit-II

Losses of Pre-stress : Loss of pre-stress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses.

Unit III

Flexure: Analysis of sections for flexure- beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams- Elastic design of PSC beams of rectangular and I section- Kern line, Concordant cable profile -Analysis of two-span continuous pre stressed concrete beams.

Unit-IV

Design for Shear: General Considerations- Principal tension and compression- Improving shear resistance of concrete by horizontal and vertical pre-stressing and by using inclined or parabolic cables- Analysis of rectangular and I beam for shear. Design of shear reinforcements- Bureau of Indian Standards (BIS) Code provisions.

Unit-V

Deflections: Importance of control of deflections- Factors influencing deflections — short term deflections of uncracked beams- prediction of long-term deflections- BIS code requirements.

End Block: Types of end blocks and Importance of end block, Analysis and design of end block by Guyon method and IS method for not more than two cables

TEXT BOOKS:

1. N. Krishna Raju ?Pre-stressed concrete,6thEdition,Tata McGraw Hill Book Education Pvt.Ltd. 2018
2. S. Ramamrutham, ? Prestressed concrete, 4th Edition, Dhanpat Rai & Sons, Delhi. 2006.

REFERENCE BOOKS:

1. T.Y. Lin and Burn?Design of pre-stress concrete structures, 3rd Edition,John, Wiley, New York 2010
2. A.H. Nilson--Design of Prestressed Concrete,2nd Edition, Wiley, New York 2011
3. https://nptel.ac.in/courses/105106117.

Course Code	Course Title						Core/Elective
2PE602CE	GROUND WATER ENGINEERING						Professional
Prerequisite	Contact Hours per Week				CIE	SEE	Elective
	L	T	D	P			Credits
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- The objective of this course is to impart knowledge of:
- Introduction to well hydraulicsproblems and perspectives of ground water
- Knowledge about various investigations related to ground water
- Quality and management of ground water
- To learn the hydraulics of different kinds of wells
- Conjunctive use of ground water along with other fresh water sources

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Illustrate the flow phenomenon in open channels.

CO 2. Demonstrate working principles of hydraulic pumps and turbines.

CO 3. Estimation of discharge flowing through streams and canals.

CO 4. Determination the type of flow in pipe, and discharge through pipes and losses in pipes.

CO 5. Analyze the force acting due to jets concept and its application in hydraulic machines.

Unit-I

Well hydraulics and well construction, geo-physical explorations, groundwater quality and management of groundwater resources; Problems and perspectives regarding groundwater in India

Unit-II

Hydrogeology: Darcy's Equation; flow characteristics; general flow equations; unsaturated flow; Well Hydraulics: Steady and unsteady radial flows in aquifers; partially penetrating wells; multiple well systems; characteristic well losses; specific capacity.

Unit-III

Surface and Subsurface investigations (Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction).

Unit-IV

Water Wells, Construction; completion, development, protection and rehabilitation of wells;

Unit-V

Groundwater quality : Groundwater Management: Basin management, investigations, conjunctive use, modeling, artificial recharge; Saline water intrusion.

TEXT BOOKS:

1. "H.M.Ragunath, Ground Water, Wiley Eastern Limited, New Delhi.
2. D.K.Todd, Ground Water Hydrology, John Wiley & Sons, Inc., USA.

REFERENCE BOOKS:

1. K.P.Karnath, Ground Water Ananment, Development and Management, Tata McGraw Hill Publishing Company New Delhi.
2. Walton, Ground Evaluation and Management, McGraw Hill.

Course Code	Course Title						Core/Elective
2PE603CE	STRUCTURAL ENGINEERING DESIGN AND DETAILING1 (RCC)						Professional Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Understand the concepts of design and detailing of combined rectangular and trapezoidal footings.
- Understand the design and detailing of cantilever and counterfort type of retaining walls.
- Learn the concepts of design and detailing of various water tanks.
- Grasp the knowledge from relevant IRC codes, design and detailing of RC solid slab bridge.
- Know the procedures for design and detailing of T-beam bridges

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Analyze for given load, design, and detail the rectangular and trapezoidal combined footings.

CO 2. Analyse for stability, design, the various components and detail the cantilever and counterfort type retaining walls.

CO 3. Interpret the specifications from relevant codes, determine the design forces, design various components, and detail the rectangular and circular water tanks including Intze tanks.

CO 4. Summarize the clauses from relevant IRC codes, design and detail the various components of Solid slab bridge.

CO 5. Analyze the slab panels using effective width method/ Pigeaud's curves, and design & detail the various components of T-Beam bridges.

Unit-I

Combined Footings: Limit state design & detailing of combined rectangular and trapezoidal footings

Unit-II

Retaining walls: Limit state design and detailing of cantilever and counterfort type of retaining walls under various conditions of backfill.

Unit -III

Water tanks: Elastic Design & Detailing of circular and rectangular ground level and over-head tanks, Design principles of Intze tank - Design of staging for wind loads.

Drives and Control for Robotics: Drive - Types of Drives, Types of transmission systems & Actuators.

Control Systems: Types of Controllers, Introduction to closed loop control.

Unit-IV

Bridges: Basic components- Types of bridges -Loads on bridges- IRC standards; Elastic design and detailing of two lanes, simply supported RC Solid Slab Bridge including Kerb.

Unit-V

T-beam bridges: Components of a T-beam bridge- Elastic design and detailing of two- lane, Simply Supported, Three girder T-beam bridge- Use of effective width method- Pigeaud?s curves method.

TEXT BOOKS:

1. N. Krishna Raju, "Advanced Reinforced Concrete Design (IS: 456-2000) ", CBS Publications 3rd Edition, 2016.
2. Vazirani and Ratwani," Design of Concrete Bridges", Khanna Publishers, 1998.

REFERENCE BOOKS:

1. D. S. Prakash Rao, "Design Principles and Detailing of Concrete Structures", Tata McGraw-Hill Publishing Co. Ltd., 1998.
2. AD. Johnson Victor, "Essentials of Bridge Engineering", paperback, Oxford & IBH, Publishing Co., New Delhi, 6th Edition, 2015.

Course Code	Course Title						Core/Elective
2PE604CE	ADVANCED SURVEYING						Professional Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Photogrammetric techniques of terrain measurement.
- Basics of remote sensing and Sensor Characteristics.
- Global Positioning System and methods of taking control points.
- Map projections and Data models in GIS.
- Spatial data and Terrain modelling analysis.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Discuss basics of Photogrammetry, flight planningand stereoscopic vision
CO 2. Determine elevations, scale and lengths of the lines from photographs
CO 3. Illustrate basics, energy interactions and sensor characteristics in Remote Sensing.
CO 4. Explain Segments, Errors and Positioning modes in GPS.
CO 5. Explain Map Projections, data models and spatial data creation and analysis in GIS.

Unit-I

Photogrammetric Surveying: Types of Photogrammetry; Terrestrial Photogrammetry – Definitions, Horizontal and vertical angles from terrestrial photograph, Elevation of a point from photographic measurement; Aerial Photogrammetry – Definitions, Scale of a vertical photograph, computation of length of line between different elevations measured from vertical photograph, Relief displacement, flight planning, basics of stereoscopic vision.

Unit-II

Remote Sensing : Definition, Electromagnetic spectrum, Basic Radiation laws; Components of Remote Sensing System; Energy Source, Energy-Atmosphere

Interaction, Energy Interaction with Atmosphere and Surface Materials, Spectral Signatures.

Aircrafts and Satellites, Orbital Characteristics of Sun- synchronous and Geostationary satellites; Remote Sensing Sensors - Types of Sensors, Active and Passive; Framing Systems (Cameras) - Scanning System; Sensor Characteristics: Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution, radiometric resolution.

Unit- III

Global Positioning System: Overview of GPS, Types of Global Navigation Satellite Systems, GPS Segments, Current GPS satellite constellation; GPS Errors and Biases – Selective Availability, Satellite and Receiver Clock Errors, Multipath Error, Ionospheric delay, Tropospheric delay; GPS positioning modes – Point, Relative (DGPS), Static, Fast static, Stop & go, RTK.

Unit-IV

Introduction to GIS: Introduction, Geo Spatial Data, Components of GIS, Applications of GIS;

Datum and Map Projections: Concept of Datum, Coordinate Systems and Map Projections, Transformations.

Data Models: Spatial and Non-Spatial Data models; Spatial Digital formats.

Spatial Data Creation: Scanners, digitizers; Sources of Errors & Corrections- Rotation and Resampling methods.

Unit-V

Spatial Data Analysis: Raster data analysis; Vector data analysis - Buffering, Overlay, Union, Intersect, Merging, splitting operations.

Digital Elevation Models : Types, Methods of Generation, Available Open source and Commercial Digital Elevation Models.

Terrain Modelling & Analysis : Contouring, Vertical profiling, Hill shading, 3D perspectives; Slope & Aspect analysis, Viewshed& watershed analysis.

TEXT BOOKS:

1. Punmia, B.C. & Jain A.K.—"Higher Surveying", 15th Edition, Laxmi Publications,2005.
2. K.T.Chang –"Introduction to Geographic Information Systems", 4th Edition, McGraw Hill International Edition, 2016

REFERENCE BOOKS:

1. Lillesand, T., Kiefer, R. W., &Chipman, J. – "Remote Sensing and Image Interpretation", 7th Edition, John Wiley& Sons, 2015.
2. M.Anji Reddy – "Textbook of Remote Sensing and Geographic Information Systems", 3rd Edition, BS Publications, 2008.

Course Code	Course Title						Core/Elective
2HS653HS	SOFT SKILLS LABORATORY						HS
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NILL	-	-	-	2	40	60	1

COURSE OBJECTIVES:

- To enable the students to listen to different speakers in different contexts for various purposes and learn target language expressions.
- To enable the students to develop confidence and interactive skills to speak professionally in different situations.
- To enable students to learn and develop various reading skills and strategies.
- To enable the students to develop written expression of thought and provide opportunities to explore ideas by utilizing various techniques.
- To equip the students to develop needed confidence and interactive skills to speak professionally and acquire skills to face any Interview.

COURSE OUTCOMES:

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

CO 1. Listen to a variety of speakers and texts and will be able to comprehend and perform the required tasks.

CO 2. Interact in a group professionally and communicate confidently in terms of both the spoken and written communication.

CO 3. Develop the skills and strategies of reading and writing.

CO 4. Face any Interview confidently by managing time, making decisions by speaking appropriately according to the context.

CO 5. Demonstrate right attitude and right skills to cope with team and communicate professionally.

LIST OF EXPERIMENTS

1. Listening Skills

- Listening to different situations by Native Speakers.
- Listening to Conversations.
- Listening to Motivational Speeches.

II. Speaking Skills

- Describing a person or a place or a thing using relevant adjectives.
- Picture Perception
- Oral Presentations.
- Etiquette in different situations.

III. Reading Skills

- Reading different Texts
- Reading Comprehension Passages.
- Skimming and Scanning
- Paraphrasing.

IV. Writing Skills

- Writing Slogans related to the image.
- Communicating on Social Media.

V. Interview Skills

- Skills required to attend an Interview
- Soft Skills to be demonstrated in a Job Interview.
- Debates and Group discussions.

TEXT BOOKS :

1. Andrea J. Rutherford.Basic Communication Skills for Technology. Pearson Education. Inc. New Delhi.
2. Antony Jay and Ros Jay. Effective Presentation. How to be a Top Class Presenter. Universities Press. (India) Limited.

REFERENCE BOOKS :

1. Robert M Sherfield and etal. “Developing Soft Skills” 4th edition, New Delhi: Pearson Education.
2. M.Ashraf Rizvi Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited. New Delhi.

Course Code	Course Title						Core/Elective
2PC657CE	TRANSPORTATIONENGINEERING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to

- Familiarize students with the basic principles of testing aggregates and bitumen.
- Provide students with hands-on experience with the tools and techniques used to test aggregates and bitumen.
- Develop students' problem-solving skills in transportation engineering.
- Apply the principles of transportation engineering to solve real-world problems.
- Develop students' critical thinking skills in transportation engineering.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Explain the principles of testing aggregates and bitumen.

CO 2. Explain the principles of traffic engineering, such as capacity, level of service, and traffic signal design.

CO 3. Apply the IS 2386 code to perform tests on aggregates and bitumen.

CO 4. Analyze traffic data to identify patterns and trends.

CO 5. Evaluate the effectiveness of transportation engineering solutions to real-world problems.

List of experiments:

A. Test on Aggregates (As per IS 2386 code):

1. Determination of flakiness Index & Elongation Index.
2. Determination of Aggregate Impact Value.
3. Determination of Aggregate Abrasion Value.

B. Tests on Bitumen:

4. Penetration test.
5. Determine the Elongation length of bitumen.
6. Determine the Melting point of bitumen.
7. Determination of Specific Gravity for bitumen.
8. Measures the viscosity of bitumen.

C. Experiments on traffic:

9. Determination of traffic volume of a given road segment.
10. Speed and Travel time Studies.
11. Turning Movement Counts (including on Intersections).
12. Accident data collection and analysis.

D. **Open-sourcesoftware's in Transportation Engineering:** VISSIM, Open Street Map, Trans CAD, SUMO (Simulation of Urban Mobility), OSRM (Open-Source Routing Machine) etc.

Note : Students are expected to perform at least 10 experiments.

Course Code	Course Title						Core/Elective
2PC658CE	ENVIRONMENTAL ENGINEERING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to impart knowledge of

- Familiarize with the procedures of water quality analysis.
- Understanding of professional and ethical responsibility in the areas of testing.
- Ability to communicate effectively the characteristics of samples.
- The broad education to understand the impact of engineering solutions in a global and societal context with respect to problems.
- Analyzing the importance of performing the experiment.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO 1. Analyse the water samples for the determination of pH, Acidity, Alkalinity, Total solids, Dissolved oxygen, BOD, COD etc.
CO 2. Ability to analyze the water and waste water samples and classify them.
CO 3. Ability to identify the potable water.
CO 4. Ability to provide the type of treatment required.
CO 5. Demonstrate professional behavior in conducting the experiments and presenting the results effectively.

List of experiments:

1. Determination of Total dissolved solids (Organic & Inorganic).
2. Determination of pH and EC.
3. Determination of turbidity.
4. Determination of total hardness.
5. Determination of alkalinity.
6. Determination of chlorides.
7. Determination of residual chlorine.
8. Determination of Dissolved oxygen (D.O).
9. Determination of coagulant dose – Jar test.
10. Determination of iron.
11. Determination of nitrates.
12. Determination of Biological Oxygen Demand (B.O.D.).
13. Determination of Chemical Oxygen Demand (C.O.D.)Simulation of PLC.

OPEN ELECTIVES

Course Code	Course Title						Core/Elective
1OE602AD	DEEP LEARNING						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

- To Develop and Train Deep Neural Networks.
- To Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection andrecognition.
- To Build and train RNNs, work with NLP and Word Embeddings.
- To The internal structure of LSTM and GRU and the differences between them.

COURSE OUTCOMES:

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

CO 1. Feature Extraction from Image and Video Data

CO 2. Implement Image Segmentation and Instance Segmentation in Images

CO 3. Implement image recognition and image classification using a pre trained network (TransferLearning)

CO 4. Traffic Information analysis using Twitter Data

CO 5. Auto encoder for Classification & Feature Extraction

UNIT-I

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.

UNIT-II

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.

UNIT-III

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers.

Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R- CNN, Mask-RCNN, YOLO

UNIT-IV

About NLP & its Toolkits. Language Modeling. Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN). Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to- Sequence Models (Seq2Seq). Gated recurrent unit GRU.

UNIT-V

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational

TEXT BOOKS :

1. Deep Learning a Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017.
2. Learn Keras for Deep Neural Networks, JojoMoolayil, Apress, 2018.
3. Deep Learning Projects Using Tensor Flow 2, Vinita Silaparasetty, Apress, 2020.

REFERENCE BOOKS :

1. Deep Learning with Python, François Chollet, Manning, Shelter Island, 2017.
2. Pro Deep Learning with TensorFlow, SantanuPattanayak, Apress, 2017.

Course Code	Course Title						Core/Elective
OE602CE	GREEN BUILDING TECHNOLOGIES						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Environmental Sciences	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- To impart knowledge of the principles behind the green building technologies
- To know the importance of sustainable use of natural resources and energy.
- To understand the principles of effective energy and resources management in buildings
- To bring awareness of the basic criteria in the green building rating systems
- To understand the methodologies to reduce, recycle and reuse towards sustainability.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Define a green building, along with its features, benefits and rating systems

CO 2. Describe the criteria used for site selection and water efficiency methods

CO 3. Explain the energy efficiency terms and methods used in green building practices

CO 4. Select materials for sustainable built environment & adopt waste management methods

CO 5. Describe the methods used to maintain indoor environmental quality.

Unit-I:

Introduction to Green Buildings: Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

Unit-II:

Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

Unit-III:

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy.

Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

Unit-IV:

Building materials: Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolona cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

Unit-V:

Indoor Environmental Quality for Occupant Comfort and Wellbeing : Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.

Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

TEXT BOOKS:

1. Michael Bauer, Peter Mösle and Michael Schwarz "Green Building – Guidebook for Sustainable Architecture" Springer, 2010.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.

REFERENCE BOOKS:

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. 'Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.

Course Code	Course Title						Core/Elective
3OE602CS	SOFTWARE ENGINEERING						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

- Describe and compare various software development methods and understand the context in which each approach might be applicable.
- To impart knowledge on various phases, methodologies and practices of software development.
- To apply the project management and analysis principles to software project development.
- To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric.
- To apply the design & testing principles to software project development.

COURSE OUTCOMES:

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

CO 1. Acquired working knowledge of alternative approaches and techniques for each phase of SDLC.

CO 2. Judge an appropriate process model(s) for software project attributes and analyze requirements for project development.

CO 3. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting

CO 4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system

CO 5. Apply the software engineering principles in real time project development

UNIT-I

Introduction to Software: What is software? Types of software, Characteristics of Software Attributes of good software.

Software Engineering: What is software engineering, Software engineering costs? What are the key challenges facing software engineering, Systems engineering& software Engineering, SDLC.

Software Development Process Models: prescriptive Models,Water fall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

UNIT-II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modelling Principles, Construction Principles, Deployment.

Software Requirement Analysis and Specification: System and software requirements, Types of software requirements, Elicitation and analysis of requirements, Requirement validation, Requirements specification, Feasibility

UNIT-III

Building the Analysis Model: Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling.

Design Engineering: Design Process and Quality, Design Concepts, the Design Model,

PerformingUser Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.

Coding: Programming languages and development tools, Selecting languages and tools Good programming practices, Coding Standards

UNIT-V

Software Testing and Quality Assurance: Verification and validation Techniques of testing Black-box and White-box testing Inspections Levels of testing Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing Design of test cases, Quality management activities: Product and process quality Standards, ISO900, Capability Maturity Model (CMM), Risk management

Debugging: Debugging Techniques, The Art of Debugging.

Current trends in Software Engineering: Software Engineering for projects and products.

TEXTBOOKS :

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, VII Edition, McGraw Hill, 2009.
2. Software Engineering. Ian Sommerville, VII edition, Addison-Wesley, 2004.
3. Fundamentals of Software Engineering Rajib Mall, V Edition, PHI, 2009.

REFERENCE BOOKS :

1. Software Engineering Fundamentals, Ali Behforooz and Frederick J. Hudson, Oxford University Press, 1996.
2. An Integrated Approach to Software Engineering, Pankaj Jalote, III Edition, Narosa Publishing House, 2000.
3. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, VIII Edition, John Wiley.

Course Code	Course Title						Core/Elective
5OE602EC	Fundamentals of IOT						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
Controllers, Communication protocols, web services	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

- To introduce the fundamentals, applications and requisite infrastructure of IOT.
- To describe Internet principles and communication technologies relevant to IoT.
- To discuss hardware and software aspects of designing an IoT system.
- To explain the concepts of cloud computing and data analytics.
- To illustrate the business models and manufacturing strategies of IoT products.

COURSE OUTCOMES:

CO 1. Understand the various applications of IoT and other enabling technologies.

CO 2. Comprehend various protocols and communication technologies used in IoT.

CO 3. Construct simple IoT systems with requisite hardware and python programming.

CO 4. Understand the relevance of cloud computing and data analytics to IoT.

CO 5. Apply the business model of IoT from developing prototype to launching a product.

UNIT-I

Introduction to Internet of Things: Introduction to Internet of Things: Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and logistics, Smart Agriculture and Industry, Smart Industry and smart Health.

UNIT-II

Internet Principles and communication technology: Internet Communications: An Overview –IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS,

UNIT-III

Prototyping and Programming: Cost Vs Ease of Production, Prototypes and Production, Open-Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling.

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT, IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT-IV

Cloud computing and Data analytics: Introduction to Cloud storage models-SAAS, PAAS, IAAS. Communication APIs, Amazon web services for IoT, SkynetIoT Messaging Platform. Introduction to Data Analytics for IoT - Apache Hadoop- Map reduce job execution workflow.

UNIT-V

IoT Case Studies: Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation, Business model for IoT product manufacturing, IoT Startups, Mass manufacturing, Ethical issues in IoT.

TEXT BOOKS:

1. Internet of Things- Converging Technologies for smart environments and integrated ecosystems, River Publishers.
2. Adrian Mc Ewen (Author), Hakim Cassimally, “Designing the Internet of Things”, Wiley India Publishers.

REFERENCE BOOKS:

1. Fundamentals of Python, Kenneth A Lambert and B.L. Juneja, Cenage Learning.
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti, Arshdeep Bahga, VPT Publisher, 1st Ed., 2014.

Course Code	Course Title	Core/Elective					
4OE602EE	ELECTRIC VEHICLE	Elective					
	TECHNOLOGY	L	T	P/D	Credits	CIE	SEE
	(OPEN ELECTIVE – II)	3	0	0	3	40	60

COURSE OBJECTIVES :

The objective of this course is to make the student

1 Know the history of electric hybrid electric vehicles (EV & HEV) and emphasize the need and importance of EV-HEV for sustainable future.

2 Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies

3 Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications and Energy Sources.

COURSE OUTCOMES :

At the end of the course students will be able to

CO1. To identify and describe the history and evolvement of electric & hybrid electric vehicles to emphasize on the need and importance of EV/HEV for sustainable future.

CO2. To identify and describe the principles of various EV/HEVs drive train topologies along with their power flow control and fuel efficiency estimation.

CO3. To design and select electric propulsion system components for EV/HEV drives suitability for the desirable performance and control.

CO4. To compare and evaluate various energy sources and energy storage components for EV and HEV applications.

CO5. Select various types of propulsion units and their control depending upon the application.

UNIT - I

Introduction : History of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/ HEV applications, vehicle power source characterization, and transmission characteristics. Vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion.

UNIT - II

Drive-Train Topologies: Series, Parallel, Series -Parallel and Complex configurations of HEV, basics of hybrid traction system, various hybrid drive-train topologies, power flow control in drive-train topologies, fuel efficiency analysis.

UNIT - III

Electrical Machines and Power Converters for Hybrid and Electric Vehicles: Electric system components for EV/HEV, suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Permanent magnet and switch reluctance machines, configuration and control of drives. Power Converters- Converters for EV and HEV applications.

UNIT - IV

Energy Sources for EV/HEV: Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheels and ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridization of different energy sources.

UNIT-V

Electric Vehicles Charging Station: Type of Charging station, Selection and Sizing of charging station, Components of charging Station and Single line diagram of charging station. Contactless inductive charging- Stationary Inductive charging, resonant and compensation circuit topologies.

TEXTBOOKS:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiely, USA, 2012.
2. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, 2nd Edition, CRC Press, 2011.

REFERENCES/SUGGESTEDREADING:

1. Chris Mi, M. Abdul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspective, Wiely, 2011
2. Simora Onori, Hybrid Electric Vehicles Energy Management Strategies, Springer.

Course Code	Course Title						Core/Elective
6OE602ME	3D PRINTING TECHNOLOGIES						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	40	60	3

COURSEOBJECTIVES:

- To understand the fundamental concepts of 3D Printing, its advantages &limitations.
- To know the various types of STL file errors and other data formats used in additive manufacturing Technology.
- To know the working principle, advantages, disadvantages & applications of liquid, solid and powder based 3D Printing technologies.
- To know the diversified applications of 3D Printing technologies and explore them in different industrial sectors.

COURSEOUTCOMES:

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

CO 1. Describe the fundamentals of 3D printing, classify and explain advantages and disadvantages of 3D Printing technologies.

CO 2. Select the suitable CAD data formats and software used in 3D Printing technology.

CO 3. Describe the operating principles, capabilities and limitations of liquid, solid & powder based 3D Printing Technologies.

CO 4. Compare different 3D printing technologies based on their process capabilities and applications.

CO 5. Apply the capabilities and knowledge of 3D printing in different industrial sectors.

Unit-I

Prototyping Fundamentals: Historical Development, Fundamentals of3D Printing, Advantages and Limitations of 3D Printing, commonly used terms, 3D Printing Process Chain, 3D Modelling, Data conversion and transmission, Checking & Preparing, Building, Post processing, Classification of 3D Printing processes, Fundamental Automated Processes, Distinction between 3D Printing and Conventional Machining Processes.

Data Formats & Software: Data formats; conversion and transmission, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs, Newly Proposed Formats. Software's Features: Magics, Mimics, Solid View, Cura, ITK Snap.

Unit-II

Liquid based Systems: Stereo Lithography Apparatus (SLA): Models and Specifications, Process, working principle, photopolymers, photo polymerization, Layering Technology, laser and laser scanning, Applications, Advantages and Disadvantages.

Poly jet: Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Unit-III

Solid-based Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages. Fused Deposition Modelling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Multi Jet Modelling (MJM): Models and specifications, Process, Working principle, Applications, Advantages and Disadvantages.

Unit-IV

Powder Based Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Three Dimensional Printing (3DP): Models and Specifications, Process, working principle, Applications, Advantages and Disadvantages.

Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages.

Unit-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewellery Industry, Coin Industry, GIS application, Construction field, Arts and Architecture, Pattern for investment and vacuum casting, Medical Models and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants &Prosthesis, Design and Production Medical Devices, Forensic Science and Anthropology and Web Based Rapid Prototyping Systems.

TEXT BOOKS:

1. Chee Kai Chua and Kah Fai Leong,"3D Printing and Additive Manufacturing Principles and Applications" Fifth Edition, World scientific
2. 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" Springer, Second Edition.

REFERENCE BOOKS:

1. Ian Gibson, David W Rosen, Brent Stucker, "Additive Manufacturing Technologies:
2. Frank W. Liou, "Rapid Prototyping & Engineering Applications"- CRC Press, Taylor & Francis Group.
3. Rafiq Noorani, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley & Sons.

B.E. (Civil Engineering) - VII SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	2PC717CE	Estimation and Specification	2	-	-	2	40	60	2
2	2PC718CE	Highway Engineering and Pavement Design	3	-	-	3	40	60	3
3	PE	Professional Elective - III	3	-	-	3	40	60	3
4	PE	Professional Elective - IV	3	-	-	3	40	60	3
5	PE	Professional Elective - V	3	-	-	3	40	60	3
6	PE	Professional Elective - VI	3	-	-	3	40	60	3
7	OE	Open Elective - III	3	-	-	3	40	60	3
Practical Courses									
8	PW702CE	Guided Self-Study Software Certification courses	-	-	2	2	50		2
9	PW703CE	Technical Report and Seminar/Mini Project (Case Study Based)	-	-	2	2	50		2
Total			**20**	**0**	**4**	**24**			**24**

Professional Elective – III

Sl.No.	PE Stream	Course Title
1	2PE705CE	Structural Engineering Design and Detailing-2 (Steel)
2	2PE706CE	Sustainable Civil Engineering Materials

Professional Elective – IV

Sl.No.	PE Stream	Course Title
1.	2PE707CE	Repair, Retrofitting and Maintenance of Structures
2.	2PE708CE	Data Analytics in Civil Engineering

Professional Elective – V

Sl.No.	PE Stream	Course Title
1.	2PE709CE	Principles of Green building practices
2.	2PE710CE	Construction Project Management

Professional Elective – VI

Sl.No.	PE Stream	Course Title
1.	2PE711CE	Principles of Climate change
2.	2PE712CE	Infrastructure Engineering

Open Elective – III

Sl.No.	Course Code	Course Title
1.	OE703CE	Essentials of Road Safety Engineering*

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

Course Code	Course Title						Core/Elective
2PC717CE	ESTIMATION AND SPECIFICATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	40	60	2

COURSE OBJECTIVES:

It is intended to make the students to :

- Acquire knowledge on various types of specifications used in construction
- Evaluate the actual value of land and buildings
- Evaluate quantities of materials used in various construction work
- Understand the concept of quantity Estimation and prepare estimates and bar bending schedules for various RCC works
- Learn to prepare rate analysis for various item of works in construction.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Describe the types of estimates and different specifications required for construction works.

CO 2. Compute and prepare estimates for buildings using longwall-short wall method and center-line method.

CO 3. Compute and prepare estimates for roads, culverts, retaining walls, overhead tanks and irrigation canals.

CO 4. Estimate the steel quantities required for various Civil Engineering works and also prepare bar bending schedule.

CO 5. Analyse rates of different items of work based on specifications using Schedule of rates.

Unit-I

Specification writing: Definitions, purpose and importance of specifications, Types of specifications, General and detailed specifications for major items of building, Central Public Works Department (CPWD) Specifications, modes of measurements,

general rules for the measurements and its units of Different items of Civil Engineering works.

Unit-II

Detailed estimation: Definition, purpose, types of estimates, factors influencing estimation, various methods of approximate estimate of buildings, Detailed estimated for Flat roof building (load bearing and RCC framed) – long and short wall method-center line method.

Unit-III

Detailed estimate of road works for WBM roads, Bituminous and CC road (including earth work),single cell, rectangular box culvert, retaining walls, overhead water tank and earth work of irrigation canals (Cutting and banking).

Unit-IV

Estimation of reinforcement quantities: Estimation of steel quantities and preparation of bar bending schedule(BBS) - RCC framed works for Slabs, Beams and Columns, Footings (Rectangular, Isolated), Stair Case, Overhead rectangular tank and Retaining wall.

Unit-V

Rate analysis of civil work: Preparation of analysis of rates and theoretical requirements of materials for major items of works of buildings, bituminous and Concrete roads.

TEXT BOOKS:

1. Dutta, B.N. "Estimating and Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributers Pvt. Ltd., New Delhi. (2016).
2. Chakraborthi, M. "Estimating, Costing and Specifications in Civil Engineering". Chakraborthi, Kolkata. (2002).

REFERENCE BOOKS:

1. P.T. Joglekar, "Practical information for Quantity Surveyors, Contract managers, Architects, Engineers & Builders", Institute of Surveyors, New Delhi, 3rd Edition 1992.
2. B. S. Patil, "Civil Engineering Contracts and Estimation", Orient Black swan Private Ltd; Fourth edition 2015.

Course Code	Course Title						Core/Elective
2PC718CE	HIGHWAY ENGINEERING AND PAVEMENT DESIGN						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Identify and analyze highway categories based on traffic and purpose.
- Implement geometric design elements for safe and efficient highway layouts.
- Utilize theories to analyze stress in flexible and rigid pavements.
- Assess factors influencing pavement design, including traffic and climate.
- Apply empirical and mechanistic-empirical methods for pavement design.

Course Outcomes:

After completing the course, student will be able to:

CO1: Understand highway categories and assess their impact on design.

CO2: Apply geometric design principles effectively for safe and efficient highways.

CO3: Analyze stress in flexible and rigid pavements using relevant theories

CO4: Understand factors influencing pavement design for optimal performance.

CO5: Understand various pavement design approaches for both flexible and rigid pavements.

Unit-I

Functional Classification of Highway Systems: Different highway categories based on traffic volume and purpose; Design Controls: Influence of topography, driver behavior, vehicle characteristics, traffic capacity, and level of service on highway design; Geometric Design Fundamentals: Objectives of geometric design and key elements like road margins, camber, skid resistance, and road roughness.

Unit-II

Flexible Pavement Stresses: Vehicle-Pavement Interaction, Stress inducing factors in flexible pavement, Stress in Flexible Pavements: Visco-Elastic Theory and Assumptions. Layered system concepts.

Rigid Pavement Stresses: Westergaard's theory and Assumptions, Stresses due loading, warping and Frictional Stresses, critical locations of wheel loads on a rigid pavement.

Unit-III

Pavement Fundamentals: Different pavement types based on materials and functions. Pavement layer functionalities; Pavement Design Factors: Impact of traffic (ESAL concepts, 4th power law, VDF), climate, axle types (standard, legal, gross weight), tire pressure; Traffic Analysis: Determine ESAL, VDF, and lane/directional distributions.

Unit-IV

Flexible Pavement Design: Methods and Concepts: Empirical methods, based on historical data, and their limitations; Overview of the Mechanistic-Empirical (M-E) method, Benefits for pavement design;

Flexible Pavement Design Concepts: Specific design principles and the Indian Road Congress (IRC) method (IRC 37-2018).

Unit-V

Design of Rigid Pavements: Types of Rigid Pavements, Pavement Joints, Introduction to Mechanistic Design Process, main factors are considered for the design of rigid pavements. Design Criteria, IRC specifications, Dowel bar design and design of tie bars as per IRC:58-2015.

TEXT BOOKS:

1. SK Khanna, CEO Justo & A Veeraragavan, Highway Engineering, Nem Chand & Bros, 10th edition, 2017
2. Dr. L.R. Kadiyali, Principles and Practices of Highway Engineering, Khanna Publishers, 7th Edition, 2017

REFERENCE BOOKS:

1. Yang H. Huang, Pavement Analysis and Design, Pearson Education, 2nd Edition, 2008.
2. HSS Committee, Relevant IRC Codes, Indian Road Congress, First Revision, 2019.

Course Code	Course Title						Core/Elective
2PE705CE	STRUCTURAL ENGINEERING DESIGN AND DETAILING-2 (STEEL)						Professional Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Gain exposure to a few basic types of steel structures (Plate Girders, Gantry girders, Trussed girders etc.)
- Attain fundamental knowledge of design of plate girder, gantry girder, steel railway bridges (plate girder & truss girder type), rocker & roller bearings and is able to interpret the specifications of relevant codes.
- Consider economy in the design of these structures without suffering the safety, in a given situation.
- Acquire adequate conceptual knowledge and skills to extend the same to investigate into critical issues, compare various options & choose best solution for the problems in the areas of highway, industrial and railway steel structures.
- Understand the intricacies of detailing aspects of these structures and their connections.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Design a welded plate girder for industrial and infrastructural purpose, as per the specifications of relevant codes.

CO 2. Design a gantry girder for industrial workshops as per the specifications of relevant codes.

CO 3. Design Roller & Rocker bearings for railway bridges

CO 4. Design and detail a deck type riveted plate girder bridge using railway code and bridge rules.

CO 5. Design and detail a through type riveted truss girder bridge using railway code and bridge rules.

Unit-I

Design of Plate girders: Design of welded plate girder for static loads–Economical Depth, Design of Cross Section, Flange curtailment, intermediate and bearing stiffeners, connections- as per IS 800-2007.

Unit-II

Design of Gantry girders: Basic principles, Loads, Codal provisions, Detailed Design- Cross section and connections, Drawing- general layout and cross section

Unit-III

Introduction to Railway Bridges and Design of bearings: Bridges: Deck and through type bridges – Economical span – Indian standard railway broad gauge train loadings – permissible stresses.

Bearings: Types and general description of various bearings, detailed Design of Rocker and roller bearings for railway bridges

Unit-IV

Design of Deck type riveted plate girder railway bridges: Economical depth, detailed design of Cross section, connections, intermediate and bearing stiffeners, Wind effects-Design of Cross frames Drawing-General layout, generation of longitudinal and cross sections

Unit-V

Design of Through type riveted truss girder railway bridges: Truss configurations, Detailed design of stringer beams, Cross girders and Truss girders; Wind effects-Design of top lateral and bottom Lateral bracing, Portal and sway bracings; Drawing-General layout, generation of longitudinal and cross sections

TEXT BOOKS :

1. S .K. Duggal, "Design of Steel Structures, Limit State Method", 2nd Edition, Tata McGraw Hill Publishing, 2014
2. A.S Arya and J.L Ajmani, "Design of Steel Structures", Nem Chand & Bros, 2011.

REFERENCE BOOKS :

1. N. Subramanian, "Design of Steel Structures, Limit State Method", Oxford University Press, 2008.
2. B.C. Punmia and Dr. Ashok Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications, 2015.

Course Code	Course Title						Core/Elective
2PE706CE	SUSTAINABLE CIVIL ENGINEERING MATERIALS						Professional Elective
Prerequisite	Contact Hours per Week				CIE	SEE	
Building Materials	L	T	D	P			Credits
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Introduce sustainability in civil engineering, apply Life Cycle Assessment (LCA) for environmental evaluation, and address associated challenges.
- Analyze carbon emissions in cement production, explore alternative cements, and emphasize resource-efficient concrete solutions.
- Investigate operational energy reduction, net zero building techniques, and prioritize minimizing resource utilization and water consumption.
- Examine radiation budget, surface water balance, and promote energy-efficient building envelopes using sustainable insulation materials.
- Understand LEED rating systems, assess green projects, and pursue LEED Green Associate certification for sustainable construction practices.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Understand sustainability in civil engineering, analyze environmental challenges, and apply Life Cycle Assessment (LCA) for evaluation.

CO 2. Assess carbon emissions in cement production, explore alternative cements, and promote resource-efficient concrete solutions.

CO 3. Investigate operational energy reduction, net zero building techniques, and evaluate materials for minimizing resource utilization and water consumption.

CO 4. Examine radiation budget, surface water balance, and implement energy-efficient building envelopes using sustainable insulation materials and technologies.

CO 5. Explore sustainable building rating systems like LEED, analyze green projects, and pursue LEED Green Associate certification.

Unit-I

An Introduction to Sustainability in Civil Engineering: The concept of sustainability: Triple bottom line environmental effect, social life effect, economic effect) Environmental challenges in civil engineering construction, Life Cycle Assessment (LCA) - framework for evaluating environmental impact.

Unit-II

Role of Material: Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete. Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete.

Unit-III

Operational energy reduction and net zero building, Use of Building Integrated Photo Voltaic (BIPV) and efficient building materials, alternative cements and cementitious materials, sustainable issues for concrete, minimization of natural resource utilization, reduction in water consumption in concrete, recycled aggregate, evaluation of their potential to reduce the negative environmental impacts of construction activity.

Unit-IV

Radiation budget, Surface water balance, Energy Efficiency and Building Envelopes, Sustainable Insulation Materials (Natural Fibers, Recycled Content), Green Roofs, Energy-Efficient Window Technologies.

Unit-V

Sustainable Building Rating Systems: Rating systems for the design, construction, operation, and maintenance of green buildings through Leadership in Energy and Environmental Design (LEED), Case Study of recent green construction projects in India – Certification of LEED Green Associate professional licensing.

TEXT BOOKS:

1. Sustainable Construction - Green Building Design and Delivery by Charles J. Kibert, John Wiley & Sons, 5th edition, 2021.
2. Introduction to Green Building and Built Environment by IGBC. B.S. Publications, 2023.

REFERENCE BOOKS:

1. Materials for Sustainable Sites: A Complete Guide to the Evaluation, Selection and Use of Sustainable Construction Materials by Meg Calkins 1st Edition, John Wiley & Sons, Inc. Hoboken, NJ, 2009.
2. NPTEL course on Sustainable materials and green buildings by B. Bhattacharjee, Professor, IIT Delhi - https://nptel.ac.in/courses/105/102/105102195/#

Course Code	Course Title						Core/Elective
2PE707CE	REPAIR, RETROFITTING AND MAINTENANCE OF STRUCTURES						Professional Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Understand the basic concepts of building maintenance.
- Understand the causes, mechanisms and prevention of deterioration of structures.
- Understand the methods of condition assessment of structures.
- Learning the materials, methodology and techniques of repair.
- Learning the methods and strategies of retrofitting of structures.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO1: Distinguish between various definitions related to building repair and maintenance.

CO2: Differentiate the types of defects, damage and explain the various deterioration mechanisms in structures.

CO3: Classify and explain the various non-destructive tests and condition assessment procedures.

CO4: Describe various repair materials and techniques.

CO5: Explain the various retrofitting and rehabilitation procedures.

Unit-I

Introduction: Definition for Repair, Retrofitting, Strengthening and Rehabilitation. Physical and Chemical causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to various conditions.

Types of Defects and Damages in Structures: During pre-construction stage, construction stage and post construction stage. Cracks – Types, Causes and Characteristics.

Unit-II

Mechanisms of Deterioration of Structures & Their Prevention:

Concrete Structures: Defects in fresh concrete- Early frost damage, plastic shrinkage, plastic settlement (subsidence), subgrade settlement, formwork movements. Deterioration in hardened concrete: (a) Physical causes - aggregate shrinkage, drying

shrinkage, crazing (b) Chemical causes: acid attack, sulphate attack, chloride attack, carbonation, alkali aggregate reaction, corrosion of reinforcement, (c) Thermal causes: Freeze-thaw, temperature variations, differential thermal expansions, humidity influences, (d) Structural causes: improper design loads, accidental overloads, creep Steel Structures: Causes and types of deterioration, mechanism of corrosion, prevention of deterioration.

Unit-III

Condition Assessment and Non-destructive Testing & Evaluation: Definition, objectives and stages of condition assessment. Destructive and partially destructive tests. Non-destructive tests (NDTs). Classification of NDT procedures, Visual Inspection, Ultrasonic Testing methods (Impact echo, Pulse velocity, Pulse echo), Rebound hammer (IS 13311), Windsor probe test, penetration resistance, pull out tests, core sampling and testing, Chemical tests- Carbonation tests and chloride content, Corrosion potential assessment, half-cell potentiometer test, resistivity measurement.

Unit-IV

Repair Materials and Techniques: Repair Methodology, Repair materials (cement-based, polymer-based, resin based, microcrete, composites, etc.), compatibility considerations,

Repair techniques: Using mortars, dry pack, epoxy bonded pack, pre-placed aggregate concrete, gunite, shotcrete, grouting, polymer impregnation, resin injection, routing & sealing, stitching, surface patching, overlays & surface coatings, autogenous healing, gravity filling, drilling and plugging.

Unit-V

Retrofitting & Rehabilitation Procedures: Strengthening of Existing Structures – Overview, general procedures, Techniques: section enlargement, composite construction, post-tensioning, stress reduction, strengthening by reinforcement, methods of strengthening in beams, slabs, columns (plate bonding, RC jacketing, FRP methods, concrete overlays, etc.) strengthening of substructure (shoring, underpinning)

TEXT BOOKS:

1. Varghese P. C., Maintenance, Repair & Rehabilitation & Minor Works of Buildings, PHI Learning Pvt. Ltd., 2015
2. Modi P.I. and Patel C.N., Repair and Rehabilitation of Concrete Structures, PHI Learning Pvt. Ltd, Delhi., 2016.

REFERENCE BOOKS:

1. Hand book on "Repair and Rehabilitation of RCC Buildings", Published by Director General, CPWD, Govt. of India, 2002.
2. Guide Book on Non-destructive Testing of Concrete Structures, Training course series No. 17, International Atomic Energy Agency, Vienna, 2002.

Course Code	Course Title						Core/Elective
2PE708CE	DATA ANALYTICS IN CIVIL ENGINEERING						Professional
Prerequisite	Contact Hours per Week				CIE	SEE	Elective
	L	T	D	P			Credits
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Basics of statistics and probability.
- Continuous Probability distributions.
- Discrete Probability distributions.
- Correlation and Regression analysis.
- Descriptive and exploratory analysis and applications for civil engineering problems.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Define the terminology of basic statistics and probability.

CO 2. Explain the characteristics of different discrete and continuous distributions.

CO 3. Solve the problems using discrete and continuous distributions and draw conclusions.

CO 4. Apply correlation and Regression analysis

CO 5. Identify data collection process required for descriptive and exploratory models for problems in civil engineering.

Unit-I

Introduction to statistics and Probability: Types of Data and Variables, Frequency, Frequency Distribution; Sample Space, Events, Probability of an Event, Properties & Rules of Probability; Conditional Probability.

Unit-II

Analytical Models for Random Phenomena:

Random variables; Analytical Descriptors (Mean, Expectation, Variance, Standard Deviation)

Discrete Probability Distribution: Probability Mass Function; Binomial Probability; Poisson Probability; Gamma Distribution; Geometric Distribution

Unit-III

Continuous Probability Distribution: Probability Density Function; Normal Probability Distribution; Properties of Normal Curve; Exponential Distribution.

Unit-IV

Correlation and Regression: Introduction; Coefficient of correlation; Curve of Regression; Line of Regression coefficients; Properties of regression coefficients.

Unit-V

Experimental and observational study design: sample selection, recruitment, and data collection method selection. Descriptive and exploratory data analysis, including: measures of central tendency, histograms, density distributions, and box plots. Case Studies related to civil engineering problems.

TEXT BOOKS:

1. Ray, Sharma and Chaudhary, Mathematical Statistics, 12th Edition, Ram Prasad Publications, 2022
2. Alfredo H-S. Ang and Wilson H. Tang, Probability Concepts in Engineering (Emphasis on Applications to Civil and Environmental Engineering, 2nd Edition, John Wiley, 2006.

REFERENCE BOOKS:

1. SubhashishSamaddar and SatishNargundkar, Data Analytics: Effective methods for Presenting Results, CRC press, 2012.
2. S.M Yadav, Application of soft computing techniques in civil engineering, MV Learning, 2018.

Course Code	Course Title						Core/Elective
2PE709CE	PRINCIPLES OF GREEN BUILDING PRACTICES						Professional Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Evaluate and select eco-friendly building sites.
- Optimize building design for energy efficiency and comfort.
- Implement water conservation strategies.
- Minimize energy consumption through efficient practices.
- Promote the use of sustainable building materials.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Evaluate and choose eco-friendly building sites, considering location, amenities, and ecology.

CO 2. Implement strategies to optimize energy and water usage, including efficient landscaping and renewable energy integration.

CO 3. Select sustainable building materials, minimizing environmental impact and waste generation.

CO 4. Apply site analysis techniques to design buildings for energy efficiency and occupant comfort.

CO 5. Promote resource conservation and reduce carbon footprint through green building practices.

Unit-I

Site Selection and Planning: Introduction to Green Buildings:Definition and objectives, Site Selection: Importance of Site Selection, Factors influencing site selection, Site Ecology and Surveys, understanding site ecology, conducting site surveys for green building projects; Site Planning: Site and climate analysis, Sun path analysis, Wind rose analysis; Minimizing disturbances to the site; Topographic microclimate considerations; Addressing heat island effect; Soil erosion control measures; Provision of facilities for differently-abled individuals

Unit-II

Introduction to Water Management: Importance of water conservation in green building, Principles of water management in buildings; Specific Water Consumption in Buildings: Calculating water consumption in buildings, understanding water balance in buildings; Approach for Water Efficiency: Strategies for reducing water consumption, implementing water-efficient landscaping and irrigation systems, Recycling and reusing treated wastewater, Rainwater Harvesting: Recharge methods and techniques, Estimating rainwater harvesting potential, Implementation of rainwater harvesting systems.

Unit-III

Energy Standards and Codes: Overview of energy standards and regulations, Compliance requirements for green buildings; Energy Efficiency in Building Envelope: Strategies for improving energy efficiency in building design, Importance of insulation and air sealing; HVAC System Efficiency: Optimizing heating, ventilation, and air conditioning systems for energy efficiency; Lighting Systems Efficiency: Implementing energy-efficient lighting solutions, Utilization of natural lighting techniques; Renewable Energy Systems: Integration of renewable energy technologies in buildings, Advantages and limitations of renewable energy sources.

Unit-IV

Sustainable Building Materials: Introduction to Sustainable Materials: Principles of sustainable material selection, Types of sustainable materials; Ecolabelling of Products: Understanding ecolabels and certifications for building materials. Criteria for evaluating environmentally friendly products; Waste Management in Buildings: Strategies for minimizing construction waste, Post-occupancy waste management practices.

Unit-V

Indoor Environmental Quality: Indoor Air Quality: Importance of indoor air quality in green buildings, Strategies for improving indoor air quality; Thermal Comfort: Factors influencing thermal comfort in indoor environments, Design considerations for achieving thermal comfort, Acoustical Comfort: Impact of noise on indoor environmental quality, Soundproofing techniques for buildings; Ergonomic Comfort: Designing spaces for ergonomic comfort and functionality; Visual Comfort: Importance of natural light and visual comfort in building design, Implementing strategies for optimizing visual comfort.

Introduction to codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc

TEXT BOOKS:

1. IGBC, Introduction to Green Buildings & Build Environment, BSP Books Pvt. Ltd., 2023.
2. Mr. Vinod B R & Mrs.shobha R, Green Building Materials and Techniques, Notion Press Media Pvt Ltd., 2023.

REFERENCE BOOKS:

1. IGBC Green Homes Rating System, Version 3.0., Abridged reference guide, 2019, Indian Green Building Council Publishers
2. K.S. Jagadish, B.V. Venkatarama Reddy and K.S. NanjundaRao, Alternative building materials and technologies, New Age Publications, Third Edition, 2023.

Course Code	Course Title						Core/Elective
2PE710CE	CONSTRUCTION PROJECT MANAGEMENT						Professional
Prerequisite	Contact Hours per Week				CIE	SEE	Elective
	L	T	D	P			Credits
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Understand the Significance of Construction management.
- Describe different Techniques of Construction management projects.
- Delving into the outcome of Time- cost management to enhance project effectiveness.
- Comprehensive management of contracts, tenders, and Safety protocols in construction projects.
- Formulating the construction management Budget by using Linear Programing.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Identify and report the importance and necessity of construction management.

CO 2. Employ bar charts, networks to determine the critical path and alter the construction schedules accordingly.

CO 3. Interpret the terms related to costs and time, and there by solve problems on crashing of networks.

CO 4. Categorize various construction contracts, acts and examine various documents related to construction.

CO 5. Interpret the concept of Linear Programming in Construction, and solve problems on Graphical and Simplex methods

Unit-I

Significance of Construction Management: Objectives and functions of construction management, construction projects, construction schedule, construction management team, principles of organization and types of organization.

Unit-II

Construction Planning: Construction planning, bar charts, network techniques in construction management – CPM, Expected likely, pessimistic and optimistic time, normal distribution curve and network problems of PERT

Unit-III

Time Cost Analysis: Cost reduction in construction Management. Cost time analysis in network planning, updating, Earned value Management, Optimization, simple problems of civil engineering works.

Unit-IV

Contracts: Introduction, types of construction contracts and their advantages and disadvantages, conditions of contracts, Introduction to Indian contract act.

Tender: Tender form, Tender Documents, Tender Notice, e-tendering, Government e-procurement system, GEM (Government e Market) procurement, Work orders, Earnest money, Security Deposit, Arbitration.

Unit-V

Safety in construction: Safety measures, Direct and Indirect loss due to accident, Location hazard and Elimination, workmen compensation act, construction labour act. Demolition of buildings – safety measures in storage and handling of materials & equipment.

Linear programming and optimization in construction: Introduction to optimization – Linear programming, Importance of optimization in construction, Simple problems on formulation of LP, Graphical method, Simplex method.

TEXT BOOKS:

1. Peret, F, Construction Project Management an Integrated approach, Taylor and Francis, Taylor and Francis Group, London & New York, 2009
2. Punmia B.C., and Khandelwal, PERT and CPM, Laxmi Publications, 2016.

REFERENCE BOOKS:

1. Gahloj. P.S. and Dhiv. B.M., Construction Planning and Management, Wiley Eastern Ltd., 2018.
2. Kumar NeerajJha., Construction Project Management: Theory and Practice, Pearson Education, India, 2015.

Course Code	Course Title						Core/Elective
2PE711CE	PRINCIPLES OF CLIMATE CHANGE						Professional
Prerequisite	Contact Hours per Week				CIE	SEE	Elective
	L	T	D	P			Credits
-	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Understand the impacts of climate change on natural environment.
- Understand basic concepts of General Circulation Models and their importance.
- Understand climate changes and its impact on climate specifically hydrology.
- Know the features of Indian Summer Monsoon Rainfall (ISMR) and their characteristics.
- Understand the downscaling principles of statistical downscaling and dynamical downscaling.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Describe the impacts of climate change on natural environment

CO 2. Explain the fundamentals of global water balance.

CO 3. Explain about climate changes and its impact on climate specifically hydrology.

CO 4. Brief introduction of climate modelling using statistical downscaling techniques.

CO 5. Bias correction methods in climate science.

Unit-I

Climate System: Weather and Climate- Overview of earth-atmosphere- vertical structure of atmosphere- Heat Balance of Earth Atmosphere- Radiation and temperature- Temperature variation- Laws of Radiation, Radiation Balance- variation with latitude.

Unit-II

Introduction of Global water balance: cycling of water on land- role of water cycle- simple water balance climate variables affecting precipitation- Precipitation and

Weather, Humidity, Vapor Pressure atmospheric stability-causes of instability-classification of clouds-precipitation process.

Unit-III

Monsoon Systems: Global wind circulation- clouds- Types of Clouds-Indian summer monsoon Rainfall (ISMR)- characteristics- Inter-annual variability- Floods- droughts-drought Indicators climate extremes.

Unit-IV

Causes of Climate Change: Impacts of climate change on Hydrology-Modelling of climate change- IPCC scenarios- IPCC Assessment Report (AR5)-physical science basis- Coupled Model Inter-comparison Project (CMIP)- CMIP6 data downloading procedure- Reanalysis data products.

Unit-V

General Circulation Models: Bias correction methods -Down-scaling – Types of down-scaling Dynamical down-scaling- Regional Climate Models - concepts of statistical down-scaling- data reduction techniques - principal component analysis-application of Regression methods.

TEXT BOOKS:

1. Gordon Bonon, Ecological Climatology Concept and Applications, 3rd Edition, Cambridge University Press,2015.
2. Rasmus Benestad, Inger Hanssen- Bauer and Deliang Chen, Empirical - Statistical Downscaling World Scientific Publishing Co. Pvt. Ltd, 2008.

REFERENCE BOOKS:

1. Ven Te Chow, David R. Maidment and Larry W. Mays, Applied Hydrology,1th Edition, Mc Graw Hill Indian Editions, 2017.
2. Dr.Bandita Naik, Introduction to Climate Change, 1st Publication, Lambert Academic Publication, 2022.

Course Code	Course Title						Core/Elective
2PE712CE	INFRASTRUCTURE ENGINEERING						Professional
Prerequisite	Contact Hours per Week				CIE	SEE	Elective
	L	T	D	P			Credits
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to:

- Understand infrastructure engineering theories, distinguish urban vs. rural projects, and analyze sectors like power, water, sanitation, and transportation.
- Evaluate infrastructure privatization, compare public vs. private roles, and address associated challenges.
- Demonstrate understanding of infrastructure planning, risk assessment, and propose mitigation strategies.
- Assess social and environmental impacts, and identify relevant environmental regulations.
- Identify successful implementation strategies, establish risk management frameworks, and evaluate government's role.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Explain the basic theory of infrastructure engineering, Defining, economic zone and compare urban infrastructure and Rural Infrastructure projects, Summarize, the Infrastructure Projects in power Sector, Water Supply and Sanitation Sector, Transportation Sector.

CO 2. Explain Infrastructure Privatization, Compare public and private sector role in infrastructure development, List Problems with Infrastructure Privatization

CO 3. Explaining infrastructure planning and implementation, Identifying Risks related to infrastructure Projects.

CO 4. Asses the Social & Environmental impacts due to infrastructure Projects. List the Environmental laws.

CO 5. Identify the strategies for successful Infrastructure project implementation, Risk Management framework for infrastructure projects. Explain, Role of Government in infrastructure implementation.

Unit-I

An Overview of Infrastructure Engineering: Urban Infrastructure and Rural Infrastructure in general. NITIAYOG 5-year plans,An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages in Infrastructure Project, Concept of Lifecycle., etc.,. An Overview of Infrastructure Projects in power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors, Overhead metro rail system and Telecommunications.

Unit-II

Public and Private Sector Role in Infrastructure Development: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Liberation and Globalization of PPP. Problems with Infrastructure Privatization, Challenges in Privatization Water Supply, Power, Infrastructure, Road Transportation Infrastructure in India – Case studies.

Unit-III

Infrastructure Planning and Implementation: SWOT Analysis, Mapping and Facing the Landscape of Risks in Infrastructure Projects, Core Economic and Demand Risks, Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure - Case studies.

Unit-IV

Environmental and Social Impact Assessment Aspects: Categories, Attributes and Parameters, Identification of Environmental and Social Impacts over Project Area and over Project Cycle. Special Considerations Involving Land and Water Interrelationships - Environmental Laws and Regulations, PPP Projects

Unit-V

Strategies for Successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects (Water, power and irrigation etc), Shaping the Planning Phase of Infrastructure Projects. Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TEXT BOOKS:

1. Grigg, Neil, "Infrastructure Engineering and Management", Wiley, 1988.
2. Anjaneyulu, Y &Manickam, V, "Environmental Impact Assessment Methodology". B.S. Publications, Hyderabad, 2012.

REFERENCE BOOKS:

1. Haas and Hudson, Zaniewski". Modern Pavement Management", Krieger, Malabar, 1994
2. Hudson, Hasnuddin, "Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation and Renovation", McGraw Hill, 1997.

Course Code	Course Title						Core/Elective
PW702CE	GUIDED SELF-STUDY SOFTWARE CERTIFICATION COURSES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	50	-	2

COURSE OBJECTIVES:

It is intended to make the students to:

- Familiarize students with essential civil engineering software applications.
- Develop proficiency in utilizing software tools independently.
- Enhance problem-solving skills through software application.
- Cultivate self-directed learning abilities.
- Prepare students for industry-standard software certifications.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Proficiency in using civil engineering software.

CO 2. Independent navigation and utilization of software.

CO 3. Application of software tools to solve engineering problems.

CO 4. Development of self-directed learning skills.

CO 5. Attainment of industry-recognized software certifications.

Course Overview:

This course aims to provide students with guided self-study opportunities to obtain certification in various software applications relevant to the field. Through structured modules and resources, students will learn to independently navigate and utilize software tools commonly used in civil engineering practice.

Guidelines:

1. The course will focus on specific software applications commonly used in civil engineering practice.
2. The course consists of guided self-study materials, including tutorials, instructional videos, practice exercises, and recommended readings.
3. Students will learn civil engineering software online/offline.

4. Flexibility will be provided for students to pace their learning according to individual preferences and schedules.
5. Students have to submit the completion certificate along with the final report, which includes assignments, exercises, case studies, etc.

Evaluation Criteria :

- Completion of Assignments and Assessments: 20 marks
- Software Proficiency: 10 marks
- Engagement in Discussions and Collaborative Activities: 10 marks
- Certification Exam Performance: 10 marks

Course Code	Course Title						Core/Elective
PW703CE	TECHNICAL REPORT AND SEMINAR (CASE STUDY BASED)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	50	-	2

COURSE OBJECTIVES:

It is intended to make the students to:

- Literature Review, familiarity with research Journals
- Critical reading, understanding, summarizing, explaining the Case Studies related to Civil Engineering.
- Acquiring skills in technical report writing
- Summarizing and presenting the work before the Panel
- Importance of working effectively in a team

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Identify their domain interest through critical review of literature

CO 2. Explain the civil engineering techniques, processes and tools used in the respective case study

CO 3. Develop the technical skill in preparing a well-structured report on the chosen topic

CO 4. Develop the skill of presenting a structured seminar using Power Point presentation tools.

CO 5. Adapt to work in a team or as an individual effectively.

Guidelines:

1. Students should select one case study topic within the domains of Structural &Geotechnical Engineering, Transportation Engineering, or Water Resources & Environmental Engineering. Each topic should have relevance to contemporary issues or challenges within the chosen domain.
2. Once the topic is selected, students will be assigned a faculty specializing in the chosen domain. Students should consult with the assigned faculty for guidance.

3. Students should conduct a comprehensive literature review, utilizing journals, online sources, and other scholarly references to gather information related to their chosen case study topic.Site visits may be required to gather relevant data or observations pertinent to the case study. Students are expected to document their findings and insights throughout this process.
4. A batch of maximum 3 students is allowed to carry out Case Study.
5. After completion of study, each batch of students should submit a detailed report in spiral bound in a prescribed format as suggested by the department followed by a seminar.
6. The seminar must be clearly structured and the power point presentation shall include following aspects:
   (a) Introduction of the Case study Topic
   (b) Literature Review
   (c) Consolidation of available information
   (d) Summary and Conclusions
   (e) References
7. Seminar must be delivered for 15 minutes followed by 5 minutes of Question and Answer Session by the Panel members.
8. For the award of sessional marks, students are judged by three faculty members (Panel) and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation. The Panel will be senior faculty appointed by Head of the Department.

Evaluation Criteria:

Technical Report and Seminar : 50 marks	**Activity**	**Weightage**
Distribution of Marks	Contemporary relevance of topic and Literature review	10
	Report preparation in Prescribed format	15
	Presentation Skills	15
	Ability to answer questions	10

OPEN ELECTIVES

Course Code	Course Title						Core/Elective
6OE703ME	INTRODUCTION TO ROBOTICS						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Familiarize with basic terminologies of the robotic science and essential knowledge required to get started in the field of Robotics.
- Learn different types of grippers and sensors used in robotics.
- Understand sensor selection criteria.
- Learn programming languages for robot programming.
- Understand the socio economic aspects and interdisciplinary applications of robotics.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Understand the principles and functions of robotic components.

CO 2. Analyze the role of sensors, actuators, and controllers in robotic systems.

CO 3. Apply kinematic principles to model and control robot movement.

CO 4. Develop basic programming skills for robot control and simulation.

CO 5. Understand socio economic aspects of robotics.

Unit-I

Introduction to Robotics:

Brief History, Basic Concepts of Robotics such as Definition, Three laws, Types of robots, Elements of Robotic Systems, DOF, Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc .Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

Unit-II

Grippers and Sensors for Robotics:

Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper,

Force analysis for various basic gripper system.

Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

Unit-III

Drives and Control for Robotics: Drive - Types of Drives, Types of transmission systems & Actuators.

Control Systems: Types of Controllers, Introduction to closed loop control.

Unit -IV

Programming and Languages for Robotics: Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages, Generations of Robotic Languages, Introduction to VAL,RAIL, AML, Python, ROS etc., Development of languages since WAVE till ROS.

Unit -V

Socio-Economic aspect of Robotisation: Socio-Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, New trends & recent updates in robotics.

TEXT BOOKS:

1. "Robotics: Modelling, Planning and Control" by Bruno Siciliano, Springer.
2. "Introduction to Robotics: Mechanics and Control" by John J. Craig, Pearson.

REFERENCE BOOKS:

1. "Robotics: Control, Sensing, Vision, and Intelligence" by C.S.G. Lee and K. S. Fu.
2. "Robot Modeling and Control" by Mark W. Spong.
3. "Robotics: Control, Sensing, Vision, and Intelligence" by C.S.G. Lee and K. S. Fu, McGraw-Hill Education.
4. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, Pearson.

Course Code	Course Title						Core/Elective
4OE703EE	PROGRAMMABLE LOGIC CONTROLLERS						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Understanding of PLC programming, ladder logic.
- Analysis and classification of the process control
- Understanding PLC hardware units and utilizing them

COURSE OUTCOMES:

Aftercompletingthe course,studentwillbeable to:

CO 1. Describe typical components of a Programmable Logic Controller.

CO 2. State basic PLC terminology and their meanings.

CO 3. Use latch, timer, counter, and other intermediate programming functions.

CO 4. Explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.

CO 5. Design and program a small, automated industrial production line.

UNIT–I:

Introduction to PLC

What is PLC, concept of PLC, Building blocks of PLC, Functions of various blocks, and limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc.

UNIT– II:

Working of PLC

Basic operation and principles of PLC, Scan Cycle, Memory structures, I/O structure, Programming terminal, power supply

UNIT-III:

Instruction Set

Basic instructions like latch, master control self-holding relays, Timer instruction like retentive timers, resetting of timers, Counter instructions like up counter, down

counter, resetting of counters, Arithmetic Instructions (ADD,SUB,DIV,MUL etc.), MOV instruction, RTC(Real Time Clock Function), Watch Dug Timer, Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal.

UNIT–IV:

Ladder Diagram Programming

Programming based on basic instructions, timer, counter, and comparison instructions using ladder program.

UNIT–V:

Applications of PLCs

Object counter,On-off control, Car parking, Sequential starting of motors, Traffic light control, Motor in forward and reverse direction, Star-Delta, DOL Starters, Filling of Bottles, Room Automation.

TEXTBOOKS:

1. Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA
2. Introduction to PLCs by Gary Dunning. McGraw Hill
3. Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh

REFERENCES/SUGGESTEDREADING:

1. Programmable Logic Controller and Microcontrollers by Gurpreet Kaur and SK Sahdev by Uneek Publications, Jalandhar.
2. Module on "Allen BradlagPlC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh
3. Module on "PLC Applications based on SLC 5/03" By Rajesh Kumar, NITTTR Chandigarh
4. CHUNGPA, "User's Manual :Universal PLC Training System CPS-3580U", English ver1, 2020.
5. Handbook, P. L. C. "Practical Guide to Programmable Logic Controllers." AutomationDirect. com.

Course Code	Course Title						Core/Elective
1OE703AD	MACHINE LEARNING						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- To learn the concepts of machine learning and types of learning
- To study various supervised learning algorithms.
- To learn ensemble techniques and various unsupervised learning algorithms.
- To understand assessment methods and evaluation parameters of machine learning algorithms

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Describe types of data and their pre-processing methods

CO 2. Describe supervised, unsupervised learning methods and their appropriate evaluation procedures and metrics

CO 3. Apply different supervised and unsupervised machine learning algorithms to different datasets

CO 4. Evaluate different machine learning approaches and infers the best learning model for a given scenario

UNIT-I

Introduction: Types of Machine Learning Algorithms: Parametric and Non-parametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning.

Data Objects and Attribute Types: Nominal Attributes, Binary Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.

Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode. Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation.

UNIT-II

Representation and Learning: Feature Vectors, Feature Spaces

Supervised Algorithms: Regression: Linear Regression, Logistic Regression. **Evaluation Measures:** SSE, RMSE, R2

UNIT-III

Classification: Decision Tree, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines.

Evaluation of classification: cross validation, hold out The Confusion Matrix, Accuracy, precision, recall, F-Score, Receiver Operator Characteristic (ROC) Curve

UNIT-IV

Unsupervised Learning: Cluster Analysis: Similarity Measures.

Categories of clustering algorithms, k-means, Hierarchical Clustering.

UNIT-V

Ensemble Algorithms: Bagging, Random Forest, Boosting

TEXTBOOKS:

1. Machine Learning, Tom Mitchell, McGraw-Hill Science/Engineering/Math; (1997).
2. Data Mining -Concepts and Techniques, Jiawei Han, MichelineKamber, Jian Pei, III Edition, Morgan Kauffmann Publisher, 2012.

REFERENCE BOOKS:

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, II Edition, Chapman & Hall.
2. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer. (2006)
3. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson, 2014.

Course Code	Course Title						Core/Elective
OE703CE	ESSENTIALS OF ROAD SAFETY ENGINEERING						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- Comprehend global and Indian road accident trends to grasp fundamental road safety principles.
- Apply statistical and engineering tools to analyze traffic safety data effectively.
- Design road infrastructure with safety features considering vehicle and human factors.
- Manage traffic effectively to enhance road safety outcomes.
- Conduct thorough road safety audits and propose evidence-based improvement strategies.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Understand fundamental principles of road safety.

CO 2. Analyze traffic safety data using statistical methods and engineering techniques.

CO 3. Apply geometric design principles and integrate safety features into road infrastructure.

CO 4. Master traffic management systems to enhance road safety.

CO 5. Conduct road safety audits and develop comprehensive safety management systems.

Unit-I:

Global and Indian Road Safety Landscape: Current state of road safety, leading causes of accidents, comparison with global trends.

Accident Characteristics: Analyzing real-world accident data, understanding the "who, what, when, where, and why" of crashes.

Unit-II:

Traffic Engineering Fundamentals: Traffic flow, capacity analysis, role of traffic control devices like signs and signals.

Statistical Methods for Action: Applying regression analysis and other statistical tools to identify correlations between factors and accidents, predicting high-risk areas.

Unit-III:

Accident Investigations and Risk Management: Conducting thorough accident investigations, understanding root causes, and preventing future incidents.

Human Factors and Vehicle Characteristics: The impact of human behavior, perception limitations, and vehicle design features on road safety.

Road Design for Safety: Geometric design elements influencing safety (lane width, curves, sight distance) and road equipment (guardrails, delineators).

Road Lifecycle Approach: Strategies for safe and efficient road maintenance, reconstruction, and rehabilitation.

Unit-IV:

Traffic Signals & Street Lighting: Principles of traffic signal design considering traffic flow and pedestrian needs. Importance of proper street lighting for nighttime safety.

Provisions for Vulnerable Users: Dedicated infrastructure and design considerations for the safety of pedestrians, cyclists, and other vulnerable road users.

The Power of Signs and Markings: Different types of road signs and pavement markings, design standards, and their role in guiding drivers and improving safety.

Unit-V:

Traffic Management Systems (TMS) & Intelligent Transportation Systems (ITS): Implementing technology to improve traffic flow and mitigate accidents.

Road Safety Audits: Conducting comprehensive road safety audits to identify potential safety issues in existing or planned road infrastructure.

Safety from Start to Finish: Best practices for construction site safety, including worker protection measures and proper signage.

TEXT BOOKS:

1. Sarkar, Pradip Kumar, Maitri, Vinay, Joshi, G.J., Transportation Planning: Principles, Practices And Policies, Third Edition, 2021.
2. L.R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers, 9th Edition, 2019.

REFERENCE BOOKS:

1. Geetam Tiwari (Editor), Dinesh Mohan (Editor), Transport Planning and Traffic Safety, CRC Press, 1st edition, 2016.
2. HSS Committee, Manual on Road Safety Audit (IRC:SP-088), Indian Road Congress, First Revision, 2019.

Course Code	Course Title						Core/Elective
3OE703CS	HUMAN COMPUTER INTERACTION						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

- To gain an overview of Human-Computer Interaction (HCI),
- To understand user interface design and alternatives to traditional "keyboard and mouse" computing.
- To become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans.
- To apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks.
- To analyze the importance of a design and evaluation methodology that begins with and maintains a focus on the user.

COURSE OUTCOMES:

Aftercompletingthe course,studentwillbeable to:

CO 1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.

CO 2. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.

CO 3. Apply an interactive design process and universal design principles to designing HCI systems.

CO 4. Describe and use HCI design principles, standards and guidelines.

CO 5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems

UNIT-I

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design.A brief history of Screen design.

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT-II

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT-III

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colours, uses problems, choosing colours

UNIT -IV

HCI in the software process, The software life cycle Usability Engineering Iterative design and proto typing Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction

UNIT-V

Cognitive models Goal and task hierarchies

Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities Ubiquitous computing applications research

Design Focus: Ambient Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience

Design Focus: Applications of augmented reality Information and data visualization

Design Focus: Getting the size right.

TEXT BOOKS :

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech.
2. Human – Computer Interaction. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg,Pearson Education

REFERENCE BOOKS :

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.

Course Code	Course Title						Core/Elective
5OE703EC	MEDICAL ELECTRONICS						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

This course aims to familiarize

- To familiarize students with the fundamental principles of medical electronics and the nature of bioelectric signals.
- To provide students with the knowledge and skills necessary for the acquisition, processing, and interpretation of biosignals such as ECG, EEG, EOG, and EMG.
- To enable students to understand the common artifacts and sources of noise in biosignals and develop techniques for artifact removal.
- To introduce students to the clinical applications of biosignal analysis in the diagnosis and monitoring of various medical conditions.
- To foster an understanding of emerging trends and technologies in medical electronics and their potential impact on healthcare.

COURSE OUTCOMES:

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

CO 1. Demonstrate an understanding of the principles underlying bioelectric signals and their relevance in medical diagnostics.

CO 2. Apply appropriate techniques for the acquisition and preprocessing of biosignals using specialized instrumentation.

CO 3. Analyze and interpret biosignals such as ECG, EEG, EOG, and EMG to identify normal and abnormal patterns.

CO 4. Implement signal processing algorithms to remove artifacts and enhance the quality of biosignals for accurate diagnosis.

CO 5. Evaluate the clinical significance of biosignal analysis in the context of specific medical conditions and treatment strategies.

UNIT-I

Medical Electronics Overview: Definition, scope, and importance in healthcare. Bioelectric Signals Basics: Nature, characteristics, and acquisition techniques. Signal Processing Fundamentals: Basics and artifact removal techniques.

UNIT – II

Physiology of the Heart: Understanding the cardiac cycle and ECG signal generation. ECG Signal Acquisition: Electrodes, instruments, and techniques. ECG Interpretation: Normal/abnormal waveforms analysis. ECG Artifacts and Noise: Sources and minimization methods.

UNIT – III

Fundamentals of Brain Signals: EEG signal generation and EEG signal acquisition techniques. EEG Signal Analysis: Preprocessing, feature extraction, and classification. EEG Artifacts: Identification and mitigation strategies.

UNIT – IV

Muscle Physiology: EMG signal generation and EMG signal acquisition techniques. EMG Signal Interpretation: Normal/abnormal waveforms analysis, Noise Sources and minimization methods.

UNIT – V

Other Biosignals Introduction: EOG and EDA overview. Wearable Medical Electronics: Continuous monitoring and diagnosis applications. Medical Electronics Trends: Recent advancements and future directions. Case Studies and Practical Applications: Real-world examples.

TEXT BOOKS:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Engineering", 4th Edition, Academic Press, 2012.
2. C. Raja Rao and Sujoy K. Guha, "Principles of Medical Electronics and Biomedical Instrumentation", 5th Edition, McGraw Hill Education, 2018.

REFERENCE BOOKS:

1. Malcolm S. Milner, Iain Hunter, and David G. Sixto Jr., "Biomedical Signal Analysis: A Practical Guide", 3rd Edition, Artech House, 2012.
2. IEEE Transactions on Biomedical Engineering.

Course Code	Course Title						Core/Elective
5OE704EC	INDUSTRIAL ELECTRONICS						Open Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
BEE	3	-	-	-	40	60	3

COURSE OBJECTIVES:

This course aims at

- Introducing electronic device characteristics suitable for industrial applications
- Designing AC to DC, DC to AC Converters, Amplifiers , inverters and SMPS
- Understanding various voltage control techniques in power converters.
- Comprehending quadrant operation of various power converters
- Introducing various electronic techniques for industrial heating to minimize EM interference.

COURSE OUTCOMES:

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

CO 1. Understand Industrial Semiconductor devices SCR , DIAC, TRAIC, and MOSFET respectively.

CO 2. Comprehend DC amplifiers, Operational amplifier and Instrumentation amplifier.

CO 3. Design and analysis of DC to DC converters and DC to AC converters and different types of Choppers.

CO 4. Develop skills to build and troubleshoot power electronic circuits.

CO 5. Synthesis of PWM Inverters, UPS and Switched mode regulators

UNIT - I

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT (Qualitative Treatment only), Protections and thermal considerations. Brief introduction to power devices: DIAC and TRIAC, MOS controlled thyristor, Power Integrated Circuit (Smart Power), Concept of fast recovery and Schottky diodes as free-wheeling and feedback diodes.

UNIT – II

DC Amplifiers: Need for DC amplifiers, DC amplifiers: Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Operational Amplifiers, and Instrumentation Amplifiers.

Choppers circuits: Principle, methods and Configurations operations of Type A, Type B, Type C, Type D and type E choppers, TRIACS: Triggering modes, Firing Circuits, Control techniques for choppers: TRC and CLC.

UNIT – III

Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques: Short Circuit, over voltage and Thermal Protection. Switched Mode and IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators.

UNIT – IV

Single-Phase Inverters: Principle of operation of full bridge square wave, quasi square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters voltage and harmonic control at output of inverter, Filters at the output of inverters, Single phase current source inverter. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings.

UNIT – V

Industrial Applications-I: Industrial timers, Classification, types, Electronic Timers –Classification, RC and Digital timers. Electronic DC Motor Control.

Industrial Applications-II: High Frequency heating, principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating: principle, material properties, Electrodes and their Coupling to RF generator.

TEXT BOOKS:

1. Theodore. H. Bogart, “Electronic Devices and circuits”, Pearson Education, 6th Edition, 2003.
2. P.C. Sen., “Modern Power Electronics", 2nd Edition, Chand & Co., 2004.
3. V.R. Moorthi, “Power Electronics”, Oxford University Press, 2005.

REFERENCE BOOKS :

1. G. K. Mithal and Maneesha Gupta, “Industrial and Power Electronics”, Khanna Publishers, 19th Edition, 2003.
2. Ned Mohan, Robbins, “Power electronics”, 3rd Edition, John Wiley and sons, 2002.
3. Biswanth Paul,” Industrial Electronics and Control”, PHI Learning, 3rd edition 2014.
4. S.Chatterjee and Bhattacharya, "Industrial Electronics and Control”, Technical education series,1st edition 2017.

B.E. (Civil Engineering) - VIII SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		Credits
			Hours per week				Maximum Marks		
			L	T	P/D	Total Hours	CIE	SEE	
Theory Courses									
1	PW804CE	Major Project (OR) Professional Practice School-II	-	-	20	20	100	100	10
		Total							**10**

Open Elective – IV

S. No.	Course Code	Course Title
1.	OE804CE	Remote Sensing and GIS*

* Offered by Civil Engineering Department to other departments. CE Students are not eligible to take this course.

Course Code	Course Title						Core/Elective
PW804CE	MAJOR PROJECT						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	10	100	100	10

COURSE OBJECTIVES:

The objective of this course is to impart knowledge and skills to students so that they can:

- Encourage students to conduct independent, practical, and original research in the field of Civil Engineering.
- Develop skills in reviewing and appraising existing literature related to Civil Engineering projects.
- Enhance research, analysis, writing, and editing abilities through an extended exploration of a single topic.
- Train students to disseminate research findings through presentations and publications.
- Foster teamwork and collaborative problem-solving by engaging students in group-based activities related to planning, experimentation, and technical reporting.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1. Identify, locate, and critically evaluate relevant literature and resources related to the project topic.

CO 2. Formulate clear, achievable, measurable objectives and comprehensive action plans for their project.

CO 3. Evaluate and select suitable methods and modern tools for solving complex civil engineering problems

CO 4. Evaluate methods for solving engineering problems, considering their environmental and societal implications, and select solutions that promote sustainability and societal well-being

CO 5. Function effectively within a team to develop and implement comprehensive action plans for project execution

Instructions to Students:

Undergraduate projects should center on finding a solution to a real-world problem. The project might be categorized as modelling, simulation, hardware, or software. Any component, including analysis, design, and synthesis, may be included.

Project Preliminary:

Identify a project that is appropriate for the field of study. Create a project team with no more than four students. Students can do the project individually also. Choose a project supervisor. Submit the project proposal to the internal departmental committee, which is made up of the Head of the Department, the faculty coordinator, the faculty supervisor(s), and two or more faculty members (apart from the external expert), and get the committee to approve it.

Course Plan:

1. Carrying of Literature survey.
2. Formulation of objectives.
3. Formulation of design/methodology.
4. Evaluation and completion of the method for solving the problem related to the given topic.
5. Developing a thorough action plan that involves teamwork in order to carry out the investigation.
6. Comprehensive Analysis, Modelling, Simulation, Design, Problem-Solving, and Experimentation as Required.
7. Final product/process development, testing, outcomes, conclusions, and future steps
8. Preparing a report in the standard format for being evaluated by the Internal Departmental Committee
9. Preparing a paper for conference presentation/ Publication in Journals, if Possible
10. Final project presentation and viva voce by the faculty coordinator including external expert.

Project Work Evaluation

Internal Evaluation

Maximum Marks: 100

Project Final Marks distribution is a follow :

i) Two Progress assessment: 40 marks by the faculty supervisor(s)

ii) Assessments and final project report: 60 marks by the internal faculty coordinator/ review committee.

Seminar: 100 Marks	**Activity**	**Weightage**
Mid- I Semester Evaluation (50)	Supervisor	20
	Examiners	30
MID-II Semester Evaluation (50)	Supervisor	20
	Examiners	30

External Evaluation by external examiner

Maximum Marks: 100

Project Final Marks distribution is a follow:

i) Project presentation and viva voce: 50 marks

ii) Project Report Assessment: 50 marks

Note : All the three evaluations are mandatory for course completion and for awarding the final grade.

METHODIST COLLEGE OF ENGINEERING & TECHNOLOGY

Approved by AICTE, New-Dehli.
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Abids, HYDERABAD-500001, Telangana.

METHODIST COLLEGE OF ENGINEERING & TECHNOLOGY

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M21 – SCHEME OF INSTRUCTIONS and SYLLABI of III – VIII Semesters for B.E. Four Year Degree Programme in Civil Engineering

(With Effect from the Academic Year 2022-23)
(As approved in Academic Council Meeting)

Empower Youth - Architects of Future World