FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Years 2020-2024)

and

Syllabi

B.E. I and II Semester of

Four Year Degree Programme

in

Civil Engineering

(With effect from the academic year 2020– 2021)
(As approved in the faculty meeting held on 04.01.2021)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

30.01.2021

SEMESTER-WISE SYLLABI OF COURSES

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Civil Engineering) I- SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	BS 201 MT	Mathematics -I	3	1	-	30	70	4
2	BS 214 CH	Chemistry	3	1	-	30	70	4
3	ES 302 CS	Programming and Problem Solving	3	-	-	30	70	3
4	MC802CE	Environmental Sciences	2	-	-	30	70	-
Practical/ Laboratory Courses								
5	BS253 CH	Chemistry Laboratory	-	-	3	25	50	1.5
6	ES351 CS	Programming and Problem Solving Laboratory	-	-	2	25	50	1
7	ES 352 ME	Workshop Practice	-	-	2 x 3hrs	50	50	3
			9	**1**	**12**			**16.5**

***Mandatory Requirement: Three weeks induction program to be conducted before commencement of the coursework of Semester-I as per the guidelines given by AICTE**

MATHEMATICS-I

BS 201 MT

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1.To introduce the concepts of sequences, series and their properties
2.To introduce the concepts of functions of several variables and multiple integrals
3. To study vector differential and integral calculus

Outcomes:

The students will able to
1. Find the nature of sequences and series
2. Evaluate multiple integrals
3. Apply this knowledge to solve the curriculum problems

UNIT – I

Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence.

UNIT – II

Calculus of one Variable: Rolle's theorem, Lagrange's, Cauchy's mean value theorems, Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes.

UNIT – III

Multivariable Calculus (Differentiation)*:* Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT – IV

Multivariable Calculus (Integration)*:* Double integrals, Change of order of integration, Change of Variables from Cartesian to plane polar coordinates, Triple integrals.

UNIT – V

Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested Reading:

1. R.K. Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9^{th} Edition, 2012.
3. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43^{rd} Edition, 2014.
4. G.B. Thomas, Maurice Weir and Joel Hass, *Thomas' Calculus*, Peterson, 12^{th}

Edition,2010.
5. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.

CHEMISTRY

BS 214 CH

Instruction: 3 periods per week+1period tutorial *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. Correlate the properties of materials with their internal structure and use the for Engineering applications
2. Apply the principals of electrochemistry in storage of electrical energy in batteries.
3. Gains knowledge in causes of corrosion and its prevention.
4. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.
5. Exposed to qualitative and quantitative parameters of chemical fuels.

Outcomes:

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

1. Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries.
2. Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.
3. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment.
4. Explain the influence of chemical structure on properties of materials and their choice in engineering applications
5. Classify chemical fuels and grade them through qualitative analysis.

UNIT – I:

Water and its treatment

Hardness of Water: Types of hardness-temporary and permanent, units and interrelation between them, Boiler troubles–Scale & sludge, Priming and foaming, Caustic embrittlement - Treatment of boiler feed water–Internal treatment (Colloidal and Calgon conditioning)– External treatment – Zeolite process, ion exchange process. Potable water - Steps involved in treatment of potable water–Disinfecting water by chlorination and ozonization – Reverse Osmosis &its significance.

UNIT – II

Corrosion and its control

Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: galvanic, water-line and pitting corrosion.
Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods. Surface coatings – metallic coatings – methods of application. Electroless plating of Nickel.

UNIT – III

Inorganic Engineering Materials

Refractories: Refractories, Properties of Refractories, Manufacture of Refractories, Common Refractory Bricks.

Polymers: Classification of polymers, Types of Polymerization–addition and condensation, differences between addition and condensation polymers, Mechanism of free radical addition polymerization.

Plastics: Thermoplastic &Thermosetting resins, differences between thermoplastic and thermosetting polymers. Preparation, properties and engineering applications of PVC, Teflon and Bakelite.

Glasses and Ceramics: Glasses, Manufacture of Glasses, Types of Glasses, Glass– Reinforced glass material, Advanced Ceramics.

UNIT – IV

Adhesives

Introduction- adhesive action, Development adhesive strength. Physical factors influencing adhesive action. Chemical factors influencing adhesive action. Bonding process by adhesive. Classification of adhesive.

UNIT – V

Explosives and Propellents

Explosives – Classifications of explosives – Primary explosives- Low explosives and high explosives. Precautions during storage of explosives. Blasting fuses. Manufacture of important explosives. Classification of propellents- Rocket propellents.

Suggested Reading:

1. Engineering Chemistry by P C Jain and M Jain Dhanpat Rai & Sons (15^{th} Edn), New Delhi.
2. Chemistry in Engineering and Technology by J C Kuriacose and J Rajaram, TMH, New Delhi
3. Engineering Chemistry by O G Palanna, TMH, and New Delhi.
4. Engineering Chemistry by S S Dara, S Chand & Sons, New Delhi.
5. Engineering Chemistry by Sashi Chawla. Dhanpat Rai & Sons, New Delhi.
6. Engineering Chemistry by Shikha Agrawal, Cambridge, New Delhi.
7. Engineering Chemistry by Prasanta Rath, Cengage Learning India Pvt. Ltd.

PROGRAMMING AND PROBLEM SOLVING

ES 302 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To introduce the basic concepts of Computing environment, number systems and flowcharts
2. To familiarize the basic constructs of C language – data types, operators and expressions
3. To understand modular and structured programming constructs in C
4. To learn the usage of structured data types and memory management using pointers
5. To learn the concepts of data handling using pointers

Outcomes:

The students will able to

1. Formulate simple algorithms for arithmetic and logical problems.
2. Translate the algorithms to programs (in c language).
3. Test and execute the programs and correct syntax and logical errors.
4. Implement conditional branching, iteration and recursion.
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. Use arrays, pointers and structures to formulate algorithms and programs.
7. Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

UNIT – I

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.).
Idea of Algorithm: steps to solve logical and numerical problems.
***Representation of Algorithm*:** Flowchart / Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

UNIT – II

***Control Structures*:** Arithmetic expressions and precedence, Conditional Branching and Loops**,** Writing and evaluation of conditionals and consequent branching.
***Arrays*:** Arrays (1-D, 2-D), Character arrays and Strings

UNIT – III

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble and Selection), Finding roots of Equations. ***Functions:*** Functions (including using built in libraries), Parameter passing in functions, call by value. ***Passing arrays to functions*:** idea of call by reference

UNIT – IV

Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series. ***Structure:*** Structures, Defining structures and Array of Structures

UNIT – V

Pointers **-** Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), **Introduction to File Handling.**

Suggested Reading:

1. Byron Gottfried, Schism's Outline of Programming with C, McGraw-Hill
2. A.K. Sharma, Computer Fundamentals and Programming in C, Universities Press, 2nd Edition, 2018.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India.

ENVIRONMENTAL SCIENCE

MC 802 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :Non-Credit

Course Objectives

1. To create awareness and impart basic knowledge about the environment and its allied problems.
2. To know the functions of ecosystems.
3. To understand importance of biological diversity.
4. To study different pollutions and their impact on environment.
5. To know social and environment related issues and their preventive measures.

Course Outcomes

After completing this course, the student will be able to:

1. Adopt environmental ethics to attain sustainable development.
2. Develop an attitude of concern for the environment.
3. Conservation of natural resources and biological diversity.
4. Creating awareness of Green technologies for nation's security.
5. Imparts awareness for environmental laws and regulations.

UNIT-I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification**.** Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

UNIT-II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

UNIT-III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.

UNIT-IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

Suggested Readings:

1. A.K. De, *Environmental Chemistry,* Wiley Eastern Ltd.
2. E.P. Odum, *Fundamentals of Ecology*, W.B. Sunders Co., USA.
3. M.N. Rao and A.K. Datta, *Waste Water Treatment,* Oxford and IBK Publications.
4. Benny Joseph, *Environmental Studies,* Tata McGraw Hill, 2005.
5. V.K. Sharma, *Disaster Management,* National Centre for Disaster Management, IIPE,1999.

CHEMISTRY LABORATORY

BS 253 CH

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 25marks *SEE: 50 marks*
Credits : 1.5

Objectives:

1. Conduct experiments, take measurements and analyse the data though hands-on experience in order to demonstrate understanding of the theoretical concepts of quantitative Analysis while working in small group.
2. Interpret the electro analytical principles with experimental results graphically
3. Demonstrate writing skills through clear laboratory reports

Outcomes:

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

1. Apply the principles of Colourimetry and Electrochemistry in quantitative estimations.
2. Estimate the rate constants of reactions from concentration of reactants/ products as a function of time.
3. Synthesize small drug molecules.

List of Experiments:

1. Introduction to Chemical Analysis.
2. Techniques of Weighing.

Volumetric Analysis:

3. Preparation of Standard Mohr's salt solution, Standardization of $KMnO_4$ and estimation ferrous ion
4. Estimation Iron(II) by Dichromatometry

Water Analysis:

5. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness.
6. Preparation of Standard Sodium Carbonate Solution, Standardization of HCl and Estimation of Carbonate and Bicarbonate Alkalinity.

Conductometry:

7. Estimation of HCl

8. Estimation of CH_3COOH and mixture of acids

Potentiometry

9. Estimation of HCl

10. Estimation of Iron

pH Metry:

11. Estimation of HCl

Colorimetry:

12. Verification of Beer-Lambert's law and estimation of Manganese.

Chemical Kinetics:

13. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.

Drug Synthesis

14. Preparation of Aspirin

Note: Minimum ten experiments should be conducted in the semester

Suggested Reading:

1. Senior Practical Physical Chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co. Delhi)
2. An Introduction to Practical Chemistry, K. K. Sharma and D.S. Sharma (Vikas publishing N. Delhi)

PROGRAMMING AND PROBLEM SOLVING LABORATORY

ES 351 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

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

Outcomes:

The students will able to

1. Choose appropriate data type for implementing programs in C language.
2. Design and implement modular programs involving input output operations, decision making and looping constructs.
3. Implement search and sort operations on arrays.
4. Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
5. Design and implement programs to store data in structures and files.

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. Conversion of binary to decimal, octal, hexadecimal and vice versa.
4. Generating Pascal triangle, pyramid of numbers.
5. Recursion: factorial, Fibonacci, GCD.
6. Matrix addition and multiplication using arrays, linear search and binary search using recursive and non-recursive procedures.
7. Bubble sort and selection sort.
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Functions for string manipulations.
10. Programs on structures and unions.
11. Finding the number of characters, words and lines of given text file.
12. File handling programs

Suggested Reading:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. A.K. Sharma, Computer Fundamentals and Programming in C, Universities Press, 2018.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India.

WORKSHOP PRACTICE

ES 352 ME

Instruction: 6 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 50 marks*
Credits : 3

Objectives:

1. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
2. To provide hands on experience about use of different engineering materials, tools, equipment's and processes those are common in the engineering field.
3. To gain a good basic working knowledge required for the production of various engineering products.
4. To Study different hand operated power tools, uses and their demonstration.
5. Adopt safety practices while working with various tools

Outcomes:

1. Demonstrate an understanding of and comply with workshop safety regulations.
2. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiselling.
3. Study and practice on machine tools and their operations
4. Undertake jobs connected with Engineering Workshop trades including fitting, carpentry, sheet metal, house wiring, welding, smithy and foundry.
5. Apply basic electrical engineering knowledge for house wiring practice

LIST OF EXPERIMENTS:

A. TRADE FOR EXERCISES:

1. Carpentry
2. Fitting
3. House wiring
4. Sheet metal working
5. Smithy
6. Welding
7. Plumbing

B. TRADES FOR DEMONSTRATION AND EXPOSURE:

1. Machining (Lathe & Drilling)
2. Injection moulding
3. Mould making and casting
4. Basic Electronics lab instruments

C. PRESENTATIONS AND VIDEO LECTURES

1. Manufacturing Methods
2. Rapid Prototyping
3. Glass Cutting
4. 3D printing
5. CNC LATHE

D. **IT WORKSHOP**: Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

Note: At least two exercises from each trade.

Suggested Reading:

1. Venugopal, K, "Workshop manual", Anuradha Publications, Kumbakonam, TN, 2012
2. K.C. John, "Mechanical Workshop" 2nd Edn., PHI, 2010.
3. Hajra Choudary, "Elements of Workshop Technology" Vol. 1, Asian Publishers, Edn., 1993.
4. G.S. Sawhney, "Mechanical Experiments and Workshop Practice", I.K. International Publishing House, New Delhi, 2009.

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Civil Engineering) II – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	HS 101 EG	English	2	-	-	30	70	2
2	BS 203MT	Mathematics -II	3	1	-	30	70	4
3	BS 202 PH	Engineering Physics	3	1	-	30	70	4
4	ES 302 CE	Engineering Mechanics	3	1	-	30	70	4
Practical/ Laboratory Courses								
5	HS 151 EG	English Laboratory	-	-	2	25	50	1
6	BS 251 PH	Physics Laboratory	-	-	3	25	50	1.5
7	ES 353 CE	Engineering Graphics	-	-	2 x 3hrs	50	50	3
			11	**2**	**10**			**19.5**

* These courses, namely, Engineering Mechanics and Engineering Graphics and Design are also offered as service courses by the Department of Civil Engineering to the other departments.

ENGLISH

HS101 EG

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 2

Objectives:

To enhance the English language abilities of Engineering students, especially in reading and writing, by

1. Using authentic material for language learning
2. Exposing them to a variety of content-rich texts
3. Strengthening their grammar and vocabulary
4. Improving their reading and comprehension skills
5. Honing their writing skills
6. Encouraging them to think creatively and critically

Outcomes:

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

1. Read, understand, and interpret a variety of written texts
2. Use appropriate vocabulary and correct grammar
3. Undertake guided and extended writing with confidence.

UNIT – I

Reading : RK Narayan, "A Horse and Two Goats"
Vocabulary : Word formation—Prefixes, Suffixes, Root Words
Grammar : Articles, Prepositions, Determiners
Writing : Guided Writing (Expanding the outline/Writing from verbal cues)

UNIT – II

Reading : Rudyard Kipling, "If"
Vocabulary : Word formation—Compounding and Blending, Contractions
Grammar : Transitions, Connectives
Writing : Paragraph Writing

UNIT – III

Reading : Martin Luther King Jr., "I Have a dream"
Vocabulary : Synonyms, Antonyms, One Word Substitutes
Grammar : Voice
Writing : Letter Writing

UNIT – IV

Reading : Robert Frost, "Road Not Taken"
Vocabulary : Homophones, Homonyms, Homographs
Grammar : Narration (Direct-Indirect Speech)
Writing : Report Writing

UNIT – V

Reading : George Orwell, “The Sporting Spirit” (Excerpt)
Vocabulary : Inclusive Language, Euphemisms
Grammar : Tense
Writing : SOP

Suggested Reading:

1. Board of Editors. Language and Life: A Skills Approach. Orient BlackSwan, 2018.
2. Sudharshana, NP and C Savitha. English for Engineers. Cambridge University Press, 2018.
3. Kumar, Sanjay and Pushp Lata. English Language and Communication Skills for Engineers. Oxford University Press, 2018.

MATHEMATICS-II

BS 203 MT

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
2. To provide an overview of ordinary differential equations
3. To study special functions like Legendre and Beta Gamma functions
4. To learn Laplace Transforms and its properties

Outcomes:

1. Solve system of linear equations and eigen value problems
2. Solve certain first order and higher order differential equations
3. Solve basic problems of Beta Gamma and Legender's Function.
4. Apply Laplace Transforms; solve ordinary Differential Equations by using it.

UNIT – I

Matrices: Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of eigen values, Cayley - Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.

UNIT – II

Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

UNIT – III

Differential Equations of Higher Orders: Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation.

UNIT – IV

Special Function: Gamma Functions, Beta Functions, Relation Between Beta and Gamma Function, Error Functions. Power Series Method, Lengender's Differential Equations and Legender's Polynomial $P_n(x)$, Rodrigue's Formula (without proof).

UNIT – V

Laplace Transforms: Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transforms and inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary Differential Equations using Laplace Transforms.

Suggested Reading:

1. R.K. Jain & S.R.K. lyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition,2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, 2012.
3. Dr.B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition,2014.
4. B.V. Ramana, *Higher Engineering Mathematics*, 23rd reprint, 2015.
5. N. Bali, M. Goyal, A text book of Engineering *Mathematics*, Laxmi publications,2010
6. H.K. Dass, Er. Rajnish Varma, *Higher Engineering Mathematics*, Schand Technical Third Edition.

ENGINEERING PHYSICS

BS 202 PH

Instruction: 3 periods per week+ 1period for tutorial *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. Aware of limits of classical free electron free theory and to apply band theory of solids
2. Acquire knowledge on various properties of semiconductors.
3. Grasp the intricacies in semiconductor-optical interaction

Outcomes:

1. Distinguish materials based on band theory of solids
2. Classify semiconductors on the basis doping and to estimate conductivity and learn transport phenomenon in semiconductors
3. Appreciate use of optical absorption by semiconductors.

UNIT – I

Crystallography: Introduction, Types of crystal systems, Bravais lattices, Lattiee planes and Miller Indices (Cubic system), Inter planar spacing (Cubic system), Bragg's law, Powder diffraction method.

Crystal Defects: Classification of point defects, Concentration of Schottky defects in metals and ionic crystals, Concentration of Frankel defects, Line defects, Screw and Edge dislocations, Burger's vector

UNIT – II

Band Theory of Solids & Semiconductors: Classical free electron theory (qualitative), Kronig Penney model (qualitative treatment), Energy band formation in solids, Intrinsic and Extrinsic semiconductors, Concept of a hole, Carrier concentration and conductivity in intrinsic semiconductors, Formation of P-N junction diode and its I – V characteristics, Thermistor and its characteristics, Hall effect and its applications.

Dielectric Materials: Dielectrics, Types of polarizations, Electronic, Ionic, Orientational and Space charge polarizations, Expression for Electronic polarizability, Frequency and temperature dependence of dielectric polarizations, Determination of dielectric constant by capacitance Bridge method, Ferro electricity, Barium titanate, Applications of Ferroelectrics.

UNIT – III

Wave Mechanics: Matter waves –de-Broglie wavelength, properties of wave function, Physical significance, Schrodinger time dependent and time in-dependent wave equation. Particle in a 1-D box.

Electromagnetic theory: Basic laws of electricity and magnetism, Maxwell's equations in integral and differential forms, Conduction and displacement current, Relation between D, E and P – ***Electromagnetic waves:*** Equation of plane wave in free space, Poynting theorem.

UNIT – IV

Magnetic Materials: Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials, Weiss molecular field theory of ferromagnetism, Magnetic domains, Hysteresis curve, soft and hard magnetic materials, Ferrites: Applications of ferrites.

Superconductivity: Introduction, General properties of super conductors, Meissner effect, Type I and Type II superconductors, BCS theory (qualitative), Introduction to High T_c superconductors, Applications of superconductors.

UNIT – V

Lasers: Characteristics of Lasers, spontaneous and stimulated emission of radiation, Einstein's Coefficients, population inversion, Ruby Laser, Helium Neon Laser, Semi-Conductor Laser and applications of lasers.

Fiber Optics: Introduction, Propagation of light through an optical fiber, Acceptance angle, Numerical aperture (NA), Types of Optical fibers and Refractive index profiles, Fiber drawing process (double Crucible Method), Losses in optical fibers, applications of optical fibers.

Suggested Reading:

1. B.K. Pandey and S. Chaturvedi Engineering Physics Cengage Learning 2012
2. A.K. Bhandhopadhya, Nano Materials, New Age International, 1st Edition, 2007
3. M.S. Avadhanulu and P.G. Kshirusagar, Engg. Physics, S. Chand & Co. 1st Edition, 1992.
4. C.M. Srivastava and C. Srinivasan – Science of Engg Materials, New Age International.
5. R.K Gaur and S.L Gupta- Engineering Physics, Dhanpathrai Publications, New edition.
6. Sanjay D Jain & Girish G Sahasrabudhe -Engineering Physics, University Press

ENGINEERING MECHANICS

ES 302 CE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

The objectives of this course is to impart knowledge of

1. Resultant and equilibrium of force system ,concept of friction,analyze the Perfectframes.
2. Obtaining centroids and moments of inertia for various sections.
3. Basic concepts of dynamics, Kinematics and Kinetics and their applications to problem solving

Outcomes:

After completing this course, the student will be able to:

1. Apply the fundamental concepts of forces, Resultant and Equilibrium conditions for static loads
2. Analyse forces in members of a Perfect frame using method of joints and method of sections, analyze friction for single and connected bodies
3. Determine the centroid and moment of inertia for various sections
4. Apply the basic concepts of dynamics for rectilinear and curvilinear motion and kinetics Using D' Alembert's Principle
5. Solve problems involving work energy principles and impulse momentum theory.

UNIT – I

*Introduction to Engineering Mechanics***:** Basic Concepts
*System of Forces***:** Coplanar Concurrent Forces, Components in Space – Resultant of coplanar and spatial systems, Moment of Force and Couple and its Application to coplanar system
*Equilibrium of Systems of Forces***:** Free Body Diagrams, Equations of Equilibrium and applications to Coplanar System.

UNIT – II

*Friction***:** Theory of friction, Laws of friction, Friction connected to single and connected bodies, Wedge friction.
*Analysis of Perfect Frames***:** Types of Frames, Assumptions for forces in members of perfect frame, Method of joints and Method of sections for Cantilever Trusses, Simply supported Trusses.

UNIT – III

*Centroid***:** Centroid of simple areas (from basic principles), Centroid of Composite areas.
Centre of Gravity: Centre of gravity of simple bodies (from basic principles).
Area Moment of Inertia: Definition, Moment of inertia of simple areas (from basic principles), Polar Moment of Inertia, Transfer formula, Moment of Inertia of Composite areas.
*Mass moment of Inertia***:** Mass moment of inertia of simple bodies (from basic principles).

UNIT – IV

*Kinematics***:** Introduction, Motion of particle, Rectilinear and Curvilinear motions, Velocity and Acceleration, Types of Rigid body, Angular motion, Fixed axis rotation.
*Kinetics:*Introduction, fundamental equation of kinetics for a particle, D' Alembert's principle

for particle motion, connected system and Fixed Axis Rotation

UNIT – V

*Work - Energy Method***:** Introduction, Equations for Translation, Work-Energy Applications to Particle Motion, Connected System and Fixed Axis Rotation.

*Impulse Momentum Method***:** Linear impulse momentum, law of conservation of momentum, coefficient of restitution, Elastic impact.

Suggested Reading:

1. Ferdinand L. Singer, *Engineering Mechanics Statics and Dynamics*, Harper Collins publishers inc, New York, 1994.
2. Ferdinand L. Singer, K. Vijaya Kumar Reddy, J. Suresh Kumar, *Singer's Engineering Mechanics*, BS Publications, Hyderabad, 2011.
3. S.S Bhavakatti, K. G. Rajashekarappa *Engineering Mechanics*, New age International publishers, Delhi,1994.
4. Rajeshakharan, S. and Sankara Subrahmanyam, G., *Engineering Mechanics Statics and Dynamics,* Vikas Publications, Delhi, 2005.
5. Junarkar, S.B. and H.J. Shah., *Applied Mechanics*, Charotar Publishing House Pvt. Ltd, Anand, 2015.

ENGLISH LABORATORY

HS 151 EG

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1. Learn IPA
2. Learn minimal pairs and types of syllables
3. Overcome the difficulties with sounds of English
4. Learn to participate well in gds, Debates and Presentations
5. Communicate with appropriate body language and expressions

Outcomes:

1. Learn IPA
2. Learn minimal pairs and types of syllables
3. Overcome the difficulties with sounds of English
4. Learn to participate well in gds, Debates and Presentations
5. Communicate with appropriate body language, expressions

1. Introduction to English Phonetics: Organs of Speech: respiratory, articulatory and phonatory systems; ***Sounds of English:*** Introduction to International Phonetic Alphabet; Minimal pairs; Syllable; Word Stress; Introduction of rhythm and intonation; Difficulties of Indians speakers with stress and intonation.

2. Speaking Activities: Self Introduction, Picture perception, JAM.

3. Group discussion, Debate, Presentation skills

4. Listening Activities: Listening to different types of materials for effective comprehension

5. Role play: Use of dialogues in a variety of situations and settings

Suggested Reading:

1 E. Suresh Kumar, a Handbook for English Language Laboratories (with CD).
2 Revised edition, Cambridge University Press India Pvt. Ltd. 2014
3 T. Balasubramanian. A Textbook of English Phonetics for Indian Students. Macmillan, 2008.
4 J. Sethi et al., A Practical Course in English Pronunciation (with CD). Prentice Hall of India, 2005.
5 Hari Mohan Prasad. How to Prepare for Group Discussions and Interviews. Tata McGraw Hill, 2006.

PHYSICS LABORATORY

BS 251 PH

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1.5

Objectives:

1. Make precise measurements using basic physical principles and acquire skills to handle the instruments
2. Relates the theoretical Knowledge to the behaviour of Practical Physical world.
3. Analyse errors in the experimental data.
4. Plot graphs between various physical parameters.

Outcomes:

1. Conduct experiments, take measurements independently.
2. Write appropriate laboratory reports.
3. Compute and compare the experimental results and draw relevant conclusions.
4. Use the graphical representation of data and estimate results from graphs

LIST OF EXPERIMENTS

1. To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT).

2. To draw the I - V Characteristics of P-N Junction diode and to evaluate the resistance.

3. To find the values of Electrical conductivity and energy gap of Ge crystal.

4. Determination of rigidity of modulus of Torsion pendulum.

5. Determination of carrier concentration, Mobility and Hall Coefficient of Ge crystal using Hall Effect Experiment.

6. To determine the constants of A, B and **α** using Thermistor characteristics.

7. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out

i)Coercivity ii) Retentivity and iii) Hysteresis loss.

8. To draw the I - V Characteristics of a solar cell and to calculate the

i) Fill factor Efficiency and ii) Series resistance.

9. To Determine the Numerical aperture (NA) of Optical fiber.

10. To determine the wave length of the given Laser source

Note: Minimum eight experiments should be conducted in the semester

Suggested Reading:

1. N.K. De, "Basic Electrical Engineering", Universities Press, 2015.
2. J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K. Kataria & Sons Publications, 2002.
3. J.B. Gupta, "Utilization of Electric Power and Electric Traction" S.K. Kataria & Sons Publications, 2010

ENGINEERING GRAPHICS

ES 353 CE

Instruction: 2L +4D periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 50 marks*
Credits: 3

Objectives:

1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. Communicate effectively using graphical methods
3. Understand the techniques, skills, and modern engineering tools necessary for engineering practice.

Outcomes:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards and solid modelling
4. Exposure to computer-aided geometric design
5. Exposure to creating working drawings

Sheet No	Description of the Topic	Contact Hours	
		Lecture	Drawing
1	Principles of Engineering Graphics and their significance, usage of drawing instruments.	1	
2	**Conic Sections – I** Construction of ellipse, parabola and hyperbola given focus and eccentricity.	1	2
3	**Conic Sections – II** Construction of ellipse (given major and minor axis), parabola (given base and height), rectangular hyperbola.		2
4	**Cycloids** (cycloid & epicycloids)	1	2
5	**Involutes** (involute of triangle, square & circle)		2
6	**Scales** (plain & diagonal scales)	1	4
7	**Introduction to AutoCAD** Basic commands and simple drawings.		4
8	**Orthographic Projection** Projections of points situated in different quadrants.	1	2
9	**Projections of straight lines – I** Line parallel to both the reference planes, line perpendicular or inclined to one reference plane.	1	2
10	**Projections of straight lines – II** Line inclined to both the reference planes.	1	2
11	**Projections of planes – I** Perpendicular planes	1	2
12	**Projections of planes – II** Oblique planes		2
13	**Projections of solids – I** Polyhedra and solids of revolution, Projections of solids in	1	2

	simple position.		
14	**Projection of solids – II** Projections of solids when the axes inclined to one or both the reference planes.	1	4
15	**Section of solids – I** When the sectional plane is parallel or perpendicular to one reference plane.	1	2
16	**Section of solids – II** When the sectional plane is inclined to one reference plane.		2
17	**Development of surfaces – I** Prisms and Cylinders	1	2
18	**Development of surfaces – II** Pyramids and Cones		2
19	**Intersection of surfaces – I** Intersection of cylinder and cylinder	1	2
20	**Intersection of surfaces – II** Intersection of cylinder and cone		2
21	**Isometric projection – I** Planes and simple solids	1	2
22	**Isometric projection – II** Combination of two or three solids		2
23	Conversion of Isometric Views to Orthographic Views	1	2

Note:

1. At least 20 sheets must be covered.
2. Sheet number 1 to 6 (Graph sheets / drawing sheets)
3. Sheet number 7 to 23 (AutoCAD drawings).

Suggested Readings

1 Bhatt N.D., Panchal V.M. & Ingle P.R., *Engineering Drawing*, Charotar Publishing House, 2014
2 Shah, M.B. & Rana B.C., Engineering Drawing and Computer Graphics, Pearson Education, 2008
3 S.N Lal, Engineering Drawing with Introduction to Auto CAD, Cengage Learning India Pvt Lid, New Delhi, 2018
4 Agrawal B. & Agrawal C. M., Engineering Graphics, TMH Publication, 2012
5 Narayana, K.L. & P Kannaiah, Text book on Engineering Drawing, Scitech Publishers, 2008
6 Corresponding set of CAD Software Theory and User Manuals

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Years 2020-2024)

and

Syllabi

B.E. III to IV Semester

of

Four Year Degree Programme

in

Civil Engineering

(With effect from the academic year 2020– 2021)

(As approved in the faculty meeting held on xx-11-2020)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

14.09.2021

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Civil Engineering) III – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	BS 205 MT	Mathematics – III	3	1	-	30	70	4
2	ES 301 EE	Basic Electrical Engineering	3	-	-	30	70	3
3	PC 401 CE	Building Materials and Construction	3	-	-	30	70	3
4	PC 402 CE	Solid Mechanics	3	-	-	30	70	3
5	PC 403 CE	Fluid Mechanics	3	-	-	30	70	3
6	PC 404 CE	Surveying and Geomatics	3	-	-	30	70	3
Practical/ Laboratory Courses								
7	PC 451CE	Fluid Mechanics Laboratory	-	-	2	25	50	1
8	PC 452CE	Surveying Laboratory	-	-	2	25	50	1
9	ES 354CE	Building Drawing & Drafting Laboratory	-	-	2 x 3 hrs	25	50	3
			20	**1**	**10**			**24**

MATHEMATICS - III

BS 205 MT

Instruction: 3 + 1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

The objectives of this course is to impart knowledge of:

- Solution methodologies for second order Partial Differential Equations with applications in engineering
- Formulate second order linear equations, boundary conditions, wave and diffusion equations.
- Overview of probability and statistics to engineers

Outcomes:

After completing this course, the student will be able to:

- Solve problems in engineering involving PDEs.
- Evaluate second-order linear equations & initial and boundary conditions
- Find solutions for heat diffusion and vibration problems
- Formulate and solve problems involving random variables
- Apply statistical methods and hypothesis testing for analyzing experimental data

UNIT – I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

UNIT – II

Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, one dimensional diffusion equation and its solution by separation of variables

UNIT – III

Discrete random variables, expectation of discrete random variables, moments, variance of a sum, continuous random variables & their properties, distribution- functions, and densities.

UNIT – IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

UNIT – V

Test of significance; Large sample test for single proportion, difference of properties, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi- square test for goodness of fit and independence of attributes.

Suggested Reading:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
2. Advanced Engineering Mathematics, R.K. Jain & Iyengar, Narosa Publications.
3. Engineering Mathematics, P. Sivaramakrishna Das & C. Vijaya Kumar, Pearson India Education Services Pvt. Ltd.
4. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
5. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
6. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall,2003.
7. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
8. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.
9. T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
10. Mathematical Statistics, S.C. Gupta & V.K. Kapoor, S. Chand Publications.

For the academic years 2020-2024

BASIC ELECTRICAL ENGINEERING

ES 301 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

The objectives of this course is to impart knowledge of:

- Basics in Electrical circuits.
- Working principles of Electrical Machines and single phase transformers
- Different Electrical installations

Outcomes:

After completing this course, the student will be able to:

- Analyse Electrical circuits to compute and measure the parameters of Electrical Energy.
- Illustrate the working principles of Electrical DC Machines.
- Identify and test various Electrical switchgear, single phase transformers and assess the ratings needed in given application.
- Describe the working principles of electrical AC machines.
- Discuss the various Electrical Installations

UNIT – I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT – II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT – III

Transformers and 3-ph Induction Motors: Transformers: Electromagnetic induction, Faradays laws, statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections.
Three Phase Induction motor: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications.

UNIT – IV

***Single-phase induction motor & DC Machines: Single-phase induction motor*:** Construction and principle of operation, Capacitor start & capacitor run motor, applications
DC Generators: Dynamically induced emf, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications
DC Motors: principle of operation of DC Motor, Types of DC motors, applications.

UNIT – V

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

Suggested Reading:

1. N.K. De, "Basic Electrical Engineering", Universities Press, 2015.
2. J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K. Kataria & Sons Publications, 2002.
3. J.B. Gupta, "Utilization of Electric Power and Electric Traction" S.K. Kataria & Sons Publications, 2010
4. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "Basic Elactrical Engineering" Tata McGraw Hill, Publications,2009
5. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "Basic Elactrical Engineering" Tata McGraw Hill, Publications,2009

BUILDING MATERIALS AND CONSTRUCTION

PC 401 CE

Instruction:3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of:

- Physical properties, uses, manufacturing processes of building materials that are used in structural components
- Application of protective materials for structural members
- Different types of construction procedures for different components of a building

Outcomes:

After completing this course, the student will be able to:

- Classify the types of construction materials like bricks, stones, steel, timber and their uses
- Demonstrate the composition, properties and tests of cement and aggregates
- Explain the manufacturing of concrete, properties and tests of fresh & hardened concrete
- Discuss the types, properties of miscellaneous building materials like pointing, white & color washing, plastering, paints, varnishes, flooring, glass, bitumen etc.
- Illustrate the importance of energy conservation, damp proof coarse and fire protection in buildings

UNIT – I

***Stones*:** Uses of stones as building materials. Characteristics of good building stones. Classification of stones. Quarrying, various methods. Dressing and polishing of stones.

***Bricks*:** Composition of brick clay. Methods of manufacturing bricks. Preparation of brick earth. Tempering, Pug mill. Various steps of moulding, drying and method of burning of bricks; clamps, intermittent and continues kilns, Bull's trench kiln, Hoffman's kiln. Characteristics of good building bricks, classification of bricks. Introduction to light weight bricks.

***Building Blocks*:** Hollow building blocks for walls and roofing. Load bearing and non-load bearing blocks. Provisions of IS 2572. Manufacturing process of Fly ash bricks.

UNIT – II

***Cement*:** Chemical composition of the ingredients for manufacturing cement. Outline of manufacturing process, flow diagram. Tests on cement. IS:269 specifications for Ordinary Portland Cement, various types of cements.

***Blended Cements*:** Various type and their uses.

***Fine Aggregate*:** Characteristics of good mortar sand, availability of sand and its classifications. Alternatives to natural sand. Bulking of sand.

***Coarse Aggregate*:** Characteristics of good coarse aggregates for manufacture of concrete. Test on aggregates. Light weight aggregates.

Unit – III

***Mortar*:** Different types of mortars, preparation, setting and curing. Manufacturing methods of mortar.

***Concrete*:** Batching, mixing, transporting, compacting and curing, Ready-mix concrete.

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

UNIT – IV

***Timber*:** Timber as a building material and its uses. Various types of timber. Seasoning and its importance. Preservation of wood. Laminates and their uses.

***Paints, Varnish and Distemper*:** Constituents, 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.

Emerging Building Materials: Energy conservation in buildings. Recycled materials, local materials and industrial waste products as a means of sustainable development, Glass, composites and smart materials.

UNIT – V

***Form work and scaffolding*:** Requirements, types, materials, accessories, reuses and maintenance.

***Floors*:** Characteristics of good floors. Common types of floors. Stone flooring, concrete flooring, terrazzo flooring. Ceramic and mosaic tiles. Industrial floors. Methods of construction and maintenance.

***Plastering, Pointing and White / Color Washing*:** Types of plastering, preparation of surfaces, and defects. Types of pointing, preparation of surfaces. Preparation and application of white wash and colour wash.

***Fire protection in structures*:** Classification of fire, general causes of fire, detection of fire, methods for fire control, Analysis for structural components for fire resistance (wood, steel, concrete and masonry).

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

Suggested Reading:

1. VN. Vazirani, and S.P. Chandola, ***Engineering Materials***, Khanna Publishers 1993.
2. Sushil Kumar, ***Building Construction***, Standard Publilshers 1992.
3. S.P. Arora and S.P. Bindra, ***Text book on Building Construction***, Dhanpath Raj Publications, 1999.
4. National Building Code of India, 2005.
5. Gurucharan Singh, ***Building materials and construction***, Standard book house, 2010
6. Central Building Research Institute, *Advances in Building Materials and Construction,* Roorkee, 2004.

Additional Reading :

1. IS 432 : 1982, *Indian Standard Specification for Mild Steel and Hard-Drawn Steel Wire for Concrete Reinforcement,* Part I and II, Bureau of Indian Standards, New Delhi, 1982.
2. IS 1077 : 1992, *Indian Standard Common Burnt Clay Building Bricks __ Specification,* Bureau of Indian Standards, New Delhi, 1992.
3. IS 1786 : 1985 *Indian Standard Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement, Bureau of Indian Standards, New Delhi, 1985.*
4. IS 2117 : 1991, *Indian Standard Guide for Manufacture of Hand-made Common Burnt Clay Building Bricks,* Bureau of Indian Standards, New Delhi, 1991.

5. IS 2248: 1992, *Indian Standard Glossary of Terms relating to Clay Products for Buildings,* Bureau of Indian Standards, New Delhi, 1992.
6. IS 2572: 1963 *Indian Standard Code of Practice for Construction of Hollow Concrete Block Masonry,* Bureau of Indian Standards, New Delhi, 1963.
7. IS 3495 (Parts 1 - 4): 1992, *Indian Standard Method of Test for Burnt Clay Building Bricks,* Bureau of Indian Standards, New Delhi, 1992.
8. IS 11650: 1991, *Indian Standard Guide for Manufacture of Common Burnt Clay Building Bricks by Semi-Mechnised Process,* Bureau of Indian Standards, New Delhi, 1991.
9. IS 12269: 1987, *Indian Standard Specifications for Grade 53 Ordinary Portland cement,* Bureau of Indian Standards, New Delhi, 1990.
10. IS 13767: 1993, *Indian Standard Burnt Clay Flash Building Bricks Specification,* Bureau of Indian Standards, New Delhi, 1993.
11. IS 14867: 1999, *Indian Standard False Work for Concrete Structures Guidelines,* Bureau of Indian Standards, New Delhi, 1999

SOLID MECHANICS

PC402CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

The objectives of this course is to impart knowledge of and problem solving skills in:

- Concepts of the stresses and strains, evaluating compound stresses, evaluation of stresses & strains in thin-walled pressure vessels
- Evaluating shear forces and bending moments in beams, determination of the bending stresses, shearing stresses, combined action of direct load and bending moment in beams
- Pure torsion theory and application to different types of springs

Outcomes:

After completing this course, the student will be able to:

- Apply the fundamental concepts of stress and strain in the analysis and design of axially loaded members
- Analyze the combined stresses at a point to evaluate principal stresses and their applications in evaluating failure criteria in various materials and pressure vessels
- Analyze determinate beams to draw shear forces, bending moments and to determine the bending stress distribution in beams
- Determine the shear stress distribution in beams and also the stresses in beams subjected to combined axial and bending loads.
- Evaluate the stresses of circular members subjected to torsion and analyze different types of springs.

UNIT – I

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.

***Strain Energy*:** Strain energy and resilience in statically determinate bars subjected to gradually applied, suddenly applied, impact and shock loads (axial loads only).

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.

Suggested Reading:

1. D.S. Prakash Rao, *Strength of Materials- A Practical Approach*, Universities Press, Hyderabad, 1999.
2. R. K. Bansal, *A Textbook of Strength of Materials (Mechanics of Solids – S.I. Units)*, Laxmi Publications Pvt. Ltd., 6th Edition, 2015
3. R.K. Rajput, *A Textbook of Strength of Materials*, S. Chand Publications, New Delhi, 2007.
4. R. Subramanian, *Strength of Materials*, Oxford University Press, New Delhi, 2016.
5. S. S. Bhavikatti, Strength of materials, Vikas Publishing House, Delhi, 2002.
6. Ferdinand P Beer, Johnston and De Wolf., *Mechanics of Materials*, Tata McGraw-Hill, Delhi, 2004.

FLUID MECHANICS

PC403 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of:

- Concepts and principles of fluid mechanics–statics, kinematics and dynamics
- Properties of fluid pressure, pressure measurements and problems in fluid statics
- Fluid kinematics, including types of flows, fluid path lines and continuity equations

Outcomes:

After completing this course, the student will be able to:

- Classify the fluids based on their properties
- Solve problems on pressure calculations, hydrostatic forces on bodies and buoyancy
- Relate types of flows with the corresponding mathematical equations
- Apply Euler's, Bernoulli's and Momentum equation to solve fluid dynamic problems
- 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, Micromanometers. 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 irrotational flow, compressible and incompressible flow, ideal and real fluid flow,one,two-andthree-dimensionalflows.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 flownets.

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

Compressible Flow: Compressibility of liquids and gases, Differential form of continuity equation, Bernoulli's energy equation for isothermal and adiabatic conditions, Velocity of pressure wave, wave velocity for adiabatic and isothermal conditions, Mach Number and Mach cone, stagnation pressure, density and temperature.

Suggested Reading:

1. *Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House, 2017*
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
4. K.L.Kumar,'*Engineering Fluid Mechanics*',Eurasia Publishing House Pvt Ltd.,New Delhi,2009
5. Vallentine,H.R., '*Applied Hydrodynamics'*, Butterworths & Co Ltd., London,1959

SURVEYING AND GEOMATICS

PC 404 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Course Objectives:

The objectives of this course is to impart knowledge of:

- Concepts & Principles of basic and modern Surveying
- Field applications and concepts of leveling survey, trigonometrical levelling & Contouring
- Importance of theodolite, EDMs, total station and their practical applications

Course Outcomes:

After completing this course, the student will be able to:

- Explain the terminologies and concepts involved in basic and modern surveying equipment & technologies and also defines the concepts of horizontal and vertical curves
- Demonstrate the working principles and applications of basic and modern surveying instruments like chain, prismatic compass, plane table, dumpy level, theodolite and total station.
- Apply the knowledge of surveying & levelling in calculating lengths, bearings, reduced levels, elevation differences and plotting of a ground
- Apply the knowledge of theodolite and trigonometry in finding horizontal and vertical angles, heights of inaccessible points
- Make use of knowledge of curves concept in surveying, in setting out both horizontal and vertical curves for the purpose of roadway and railway alignment

UNIT – I

INTRODUCTION TO SURVEYING: Classification and principles of surveying;

Linear Measurements*:* Accessories for linear measurements; Ranging; Chain and Tape corrections; Principle of Chain surveying- Well conditioned triangle; Offset; Cross staff.

Angular Measurements**:** Types of meridians; Bearing systems and conversions; magnetic declination; Fore & Back Bearings and local attraction. Principle of Compass surveying; Traversing - Open & Closed traverse and their checks. Prismatic and Surveyor's compass.

Plane Table surveying: Accessories of Plane Table; Orientation and its importance; methods of plane table surveying - Radiation, Intersection, Traversing, Resection- Two point problem; 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; Methods of contouring - Direct and Indirect

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

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

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; **Basics of Tacheometry**, Trigonometric levelling: Calculations of elevations and distances of accessible and inaccessible objects by single and double plane methods.

Modern Field Survey Systems: Principle & Types of EDM instruments

Total Station: Parts of a Total Station; Advantages and Applications

UNIT – IV

Curves: Theory of simple curves, setting out of simple curves by linear and angular methods; Elements of simple compound curve & Reverse curve; 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

Suggested Reading:

1. B.C. Punmia, Surveying Vol.1, 2 & 3, Lakshmi Publishers, NewDelhi,1994.
2. Basak, N. N. Surveying & Levelling. McGraw-Hill Education, 1994.
3. Arora K.R., Surveying Vol. 1 & 2, Standard Book House, New Delhi, 2005.
4. T.M. Lillesand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons,1994.
5. M. Chandra, Advanced Surveying, New Age International Publishers, New Delhi, 2000.
6. Anji Reddy, M., Remote Sensing and Geographical Information System, B.S. Publications, 2001

FLUID MECHANICS LABORATORY

PC 451 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits :1

Objectives:

The objectives of this course is to impart knowledge of:

- verifying the principles studied in fluid mechanics
- calibrating various flow measuring devices by determining coefficient of discharge.
- verification of Bernoulli's principle and to identify laminar and turbulent flow characteristics.

Outcomes:

After completing this course, the student will be able to:

- Compute discharge flowing through streams and canals.
- Determine discharge through pipes and losses in pipes.
- Apply Bernoulli's principle in hydraulics
- Determine discharge flowing through tanks and open channels .
- Identify the type of flow in pipe a pipe.

List of Experiments:

1. Determination of coefficient of discharge of a Rectangular Notch with end contractions
2. Determination of coefficient of discharge of a Circular orifice
3. Determination of coefficient of discharge of a Mouth piece
4. Determination of coefficient of discharge of V- Notch
5. Determination of coefficient of discharge of a Venturimeter
6. Determination of coefficient of discharge of an Orifice meter
7. Classification of flow by Reynold's Experiment
8. Determination of Darcy's friction factor
9. Verification of Bernoulli's theorem
10. Study of free Vortex flow.

Suggested Reading:

1 *S. K. Som, and Biswas, G, 'Fluid Mechanics and Fluid Machines', Tata McGraw-Hill Publishing Co., New Delhi, 1998*
2 *Yuan, S. W., 'Foundation of Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi, 1976*
3 *C.S.P. Ojha, R.Berndtsson, P.N. Chandramouli, 'Fluid Mechanics and Machinery', Oxford University Press, New Delhi, 2010*
4 *A. K. Mohanty, 'Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi, 1994*
5 *P.N. Modi and S. N. Seth 'Hydraulics and Fluid Mechanics Including Hydraulics Machines', Standard Book House, New Delhi, 2013.*

SURVEYING LABORATORY

PC 452 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Course Objectives:

The objectives of this course is to impart knowledge of:

- Study and understanding the different methods involved in survey field work
- Importance of theodolite, total station and their practical applications
- Basic concept of trigonometrical leveling and field applications

Course Outcomes:

After completing this course, the student will be able to:

- Illustrate the working principles and handling procedures of basic surveying instruments like chain, prismatic compass, plane table in finding out linear and angular measurements
- Make use of surveying equipments in computing lengths, areas & bearings of given field work
- Demonstrate the levelling instruments and apply the knowledge of levelling in finding out the reduced levels of ground
- Demonstrate the working principles and handling procedures of theodolite and total station
- Apply the knowledge of trigonometrical levelling in finding out reduced levels of elevated objects which are both accessible and inaccessible using theodolite and total station

List of Experiments:

1. Applications of chain traversing to locate a building and field objects by taking perpendicular and oblique offsets and recording in the field book.
2. Study of prismatic compass and setting out a polygon
3. Plane table survey: Radiation & Intersection methods
4. Introduction to levelling: Differential levelling using dumpy/Auto level
5. Profile and cross-sectional levelling using Dumpy/Auto level
6. Measurement of horizontal angles by repetition and reiteration methods using Vernier Theodolite.
7. Measurement of vertical angle: Application to simple problems of height and distance by measuring angle of elevation and depression
8. 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.
9. 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.

10. Setting out of a simple circular curve by linear method
11. Setting out of a simple circular curve by angular method
12. Introduction to Total station and applications: To determine difference in elevation of any two given points. The introduction includes, setting up of the Total station over a station, input values, field measurements, downloading of the data into a computer.
13. 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.
14. Total station and applications: Determination of area enclosed in a closed traverse having minimum
    5 stations. Plot the measured values by using a software package.
15. Global Positioning System (GPS): Determination of Latitude and Longitude of any four stations and computation of the area.

Note: At least 10 experiments must be performed during the semester

Suggested Reading:

1 http://nptel.ac.in/
2 http://mhrd.gov.in/e-contents
3 http://vlab.co.in/

BUILDING DRAWING AND DRAFTING LABORATORY

ES 354 CE

Instruction: 6 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of:

- 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.

Outcomes:

After completing this course, the student will be able to:

- Illustrate the basic principles of building planning and drawings as per codal provisions
- Apply the tools of AUTOCAD software to prepare structural drawings of various building components
- Draw plan, elevation and sectional drawings of residential, hostel, hospital, school buildings in AutoCAD software
- Create electrical, plumbing and sanitary drawings of a building.
- Develop isometric views of Single storey and Double storey residential buildings.

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Sheet No	Description of the Topic	Contact Hours	
		Lecture	Drawing
Introduction to Computer Aided Drafting			
1	Introduction to 2D, co-ordinate systems, reference planes, Commands - Initial settings, Line commands, Edit Commands, Copy commands, Move Commands, Modify commands, Layers, Text and Dimensioning, Blocks.	2	1
Drawing related to different building elements			
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,	1	2
3	**Doors & Windows** Detailed drawing (plan, section and elevation) of doors and windows – framed paneled and glazed	1	2
4	**Staircase** Detailed drawing (plan, section and elevation) of different forms of staircases – open well and dog legged.	1	2
5	**Footings** Detailed drawing (Plan and section) of different types of footings	1	2
6	**Roofs and floors** Detailed drawing (section elevation) of different types of	1	2

	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, steel, composite - detailed elevations and enlarged detail of joints in trusses	1	2
Planning of buildings			
8	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.	2	-
Comprehensive drawing of buildings (Site plan, floor plan, elevation and sections in accordance with functional requirements for the following):			
9	Simple residential buildings with flat and pitched roof	1	4
10	School, rural hospital, library and hostel buildings	1	4
11	Five floors apartment building	1	4
12	Workshop – Trussed roof-North light roof truss	1	4
13	Elevations of different buildings	1	2
14	Electrical Drawing of a Building	1	1
15	Plumbing and Sanitary Drawing of a Building	1	1
Isometric view of buildings			
16	Single storey residential building	1	2
17	Double storey residential building	1	2

Note:

1. At least 12 sheets must be covered.
2. All drawings must be through commercially available software like AutoCAD, etc.

Suggested Readings:

1 Gurucharan Singh and Jagdish Singh, *Building planning, designing and scheduling*, Standard Publishers-Delhi, 2005

2 S.N Lal, "*Engineering Drawing with Introduction to Auto CAD",* Cengage Learning India Pvt Ltd, New Delhi, 2018.

3 Malik R.S., Meo, G.S. (2009) "*Civil Engineering Drawing",* Computech Publication Ltd New Asian

4 Sikka, V.B. (2013), "*A Course in Civil Engineering Drawing*", S.K.Kataria& Sons.

5 M.G. Shah, C.M. Kale and S.Y. Patki, *Building Drawing*, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2009

6 National Building Code, Bureau of Indian Standards, New Delhi, 2005.

7 IS:962 – 1967 Code of Practice for Architectural and Building Drawing.

8 IS:4021 – 1983 Specification for Timber Door, Window and Ventilator Frames

For the academic years 2020-2024

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Civil Engineering) IV– SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pr/ Drg	CIE	SEE	
Theory Courses								
1	HS 103CM	Finance and Accounting	3	-	-	30	70	3
2	HS102 EG	Effective Technical Communication in English	2	-	-	30	70	2
3	ES 304 CE	Engineering Geology	3	-	-	30	70	3
4	PC 405CE	Mechanics of Materials	3	-	-	30	70	3
5	PC 406CE	Hydraulic Engineering	3	-	-	30	70	3
6	PC 407 CE	Design of Reinforced Concrete Structures	3	-	-	30	70	3
7	PC408 CE	Hydrology	3	-	-	30	70	3
Practical/ Laboratory Courses								
8	ES 355 CE	Engineering Geology Laboratory	-	-	2	25	50	1
9	PC 453 CE	Mechanics of Materials Laboratory	-	-	2	25	50	1
10	PC 454 CE	Hydraulic Engineering Laboratory	-	-	2	25	50	1
		Survey Camp *						
			20	**-**	**6**			**23**

* Survey Camp is to be conducted after the IV Semester in the Summer Vacation. To be evaluated in V Sem

FINANCE AND ACCOUNTING

HS 103 CM

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

The objectives of this course is to impart knowledge of:

- Basic understanding of Financial and Accounting aspects of a business unit
- Inputs to evaluate the viability of projects
- Skills necessary to analyse the financial statements

Outcomes:

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

- Evaluate the financial performance of the business unit.
- Take decisions on selection of projects.
- Compute the procurement of finances
- Analyze the liquidity, solvency and profitability of the business unit.
- Evaluate the overall financial functioning of an enterprise.

UNIT – I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT – II

Final Accounts*:* Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit- Balance Sheet (including problems with minor adjustments)

UNIT – III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT – IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities- Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT – V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis- liquidity, solvency, turnover and profitability ratios.

Suggested Reading:

1 Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, Pearson Education
2 Rajasekharan, Financial Accounting, Pearson Education
3 Sharma.S.K. and Rachan Sareen, Financial Management, Sultan Chand
4 Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education
5 Sharan, Fundamentals of Financial Management, Pearson Education

For the academic years 2020-2024

EFFECTIVE TECHNICAL COMMUNICATION IN ENGLISH

HS 103 EG

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 2

Course Objectives

The objectives of this course is to impart knowledge of:

- Features of technical communication
- Techniques of report writing and manual writing
- Aspects of data transfer and presentations.

Course Outcomes

After successful completion of the course, the students would be able to:

- Develop technical communication effectively
- Utilize different types of professional correspondence
- Make use of various techniques of report writing
- Adapt adequate skills of manual writing
- Enhance their skills of information transfer and presentations

UNIT I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

UNIT III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication: Principles and Practice* (3rd ed.). New Delhi, OUP.
2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). New Delhi, Tata McGraw Hill Education.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). New Delhi, Tata McGraw Hill Education.
4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced technical communication*. New Delhi, PHI Learning.
5. Jungk, Dale. (2004). *Applied writing for technicians*. New York, McGraw-Hill Higher Education.

For the academic years 2020-2024

ENGINEERING GEOLOGY

ES 304 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

The objectives of this course is to impart knowledge of:

- Mineralogy, rock formation & types and geological structures
- Utility of rocks as a construction material with qualifying properties
- Geological problems associated with dams, reservoirs, tunnels and other geological hazards

Outcomes:

After completing this course, the student will be able to:

- Identify various minerals, rocks and analyse geological structures.
- Explain rock weathering, classify various soils and understand hydrogeology.
- Classify landforms based on their geomorphology and evaluate the engineering properties of rocks**.**
- Examine rocks for their suitability in various construction applications.
- Investigate and identify the geological problems in dams, reservoirs and tunnels, and explain the geological causes of earthquakes, tsunamis and landslides.

UNIT-I

Introduction: Engineering geology useful to civil engineering

Mineralogy: Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to weathering, Rock forming minerals.

Rocks: Igneous, sedimentary and metamorphic rocks Geological description and Indian occurrence of Granite, Basalt, Dolerite, Gabbro, Laterite, Sandstone Shale, Limestone Slate, Gneiss, Quartzite, Marble, Khondalite and chamockite.

Geological Structures: Folds, joints and faults: Fundamental types, mechanism origin and classification; Field identification and Engineering analysis of geological structures

UNIT-II

Rock Weathering: Processes and end-products of weathering; susceptibility of rocks to weathering, Assessment of the degree of weathering and its classification.

Geology of Soils**:** Formation, geological classification, description and Engineering use of soils Types of Indian soils.

Hydrogeology: Hydrologic cycle, water table, aquifers, occurrence of ground water in various lithological formations, geological control for ground water movement, springs, ground water exploration and ground water provinces of India.

UNIT–III

Geomorphology: Evolution, characteristics features and Engineering, considerations of fluviatile, Aeolian, glacial and marine land forms.

Rock Mechanics: Engineering properties of rocks Stress-Strain behaviour of rocks. Site Investigation: Aerial Photographs, Electrical: Resistivity and Seismic refraction methods.

UNIT- IV

Rock as a Construction Material: Geological considerations for the selection of Concrete aggregate, Highway and Runway aggregates, building stones, Decorative stones, Roofing and facing stones.

Geology of Dams and Reservoirs: Types of Dams, Problems associated with Dam foundations and reservoirs, Engineering Geological investigations for demand water tightness in reservoir site, Analysis of dam failure; Engineering Geology of major Dam sites of India

UNIT–V

Tunnels: Stand-up time of different rocks, Engineering Geological investigations of tunnels in rock, problems in tunnelling.

Geological Hazards: Geological aspects of Earthquakes, Tsunamis and Landslides;

Suggested Readings:

1. F.G. Bell, *Engineering Geology*, Elsevier, 2007.
2. Dimitri P. Krynine and William R. Judd, *Principles of Engineering Geology & Geotechnics*, CBS Publishers & Distributors, First Edition, 1998.
3. B.P. Attewel and I.W. Fanner, *Principles of Engineering Geology*, Chapman and Hall 1976.
4. Officers of the Geological Survey of India, *Engineering Geology Case Histories*, Miscellaneous Pub. No. 29, 1975

MECHANICS OF MATERIALS

PC405CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of and problem solving skills in

- Methods of evaluation of deflections of beams due to transverse loads, Phenomenon of buckling of columns.
- Analysis of Unsymmetrical Bending, Concept of Shear centre, Static and Kinematics Indeterminacy
- Analysis of indeterminate beams, Concept of strain energy principle and its applications to evaluate the displacements and redundant forces using energy principles

Outcomes:

After completing this course, the student will be able to:

- Calculate the deflections of determinate beams due to transverse loads by various methods
- Evaluate the crippling load of columns for various end conditions using different formulas
- Analyze the Unsymmetrical Bending, Locating the Shear centre, Determining Static and Kinematics Indeterminacy
- Analyze statically indeterminate beams such as propped cantilever, fixed beams and continuous beams and draw the shear force and bending moment diagrams
- Analyze the beams and frames and to find deflections by energy principle

UNIT – I

***Deflections in Beams*:** Slope and deflection by double integration 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 method.

UNIT – II

***Columns and Struts*:** Euler's theory for long columns, different end conditions, equivalent length, Rankine's theory, Secant & Perry formula for eccentrical 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 and rigid jointed 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

***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.

Suggested Reading:

1. D.S. Prakash Rao, *Strength of Materials- A Practical Approach*, Universities Press, Hyderabad, 1999.
2. R.K. Rajput, *A Textbook of Strength of Materials*, S. Chand Publications, New Delhi, 2007.
3. R.K. Bansal, *Strength of materials*, Laxmi Publications, New Delhi, 2010.
4. S. S. Bhavikatti, *Strength of materials*, Vikas Publishing House, Delhi, 2002
5. S. S. Bhavikatti, *Structural Analysis I & II*, Vikas Publishing House, Delhi, 2002.
6. Devdas Menon, *Structural Analysis*, Narosa Publishing House, New Delhi, 2009.

For the academic years 2020-2024

HYDRAULIC ENGINEERING

PC 406 CE

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:
The objectives of this course is to impart knowledge of:

- Various hydraulic engineering problems in open channel flows
- Principles of turbines and pumps
- Theory and practice problems in hydraulic engineering

Outcomes:
After completing this course, the student will be able to:

- Illustrate the flow through pipes and losses in pipe floe
- Solve various engineering problems in open channels
- Describe the hydraulic jump and its uses.
- Discuss the dimensional analysis
- 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, lower critical Reynolds number, 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, Moody's diagram.
Minor losses, hydraulic gradient line, Pipe flow systems-pipes in series, equivalent pipes, pipes in parallel.
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UNIT – II

***Dimensional Analysis and Hydraulic Similitude*-** Buckingham pi theorem, Rayleigh method, dimensionless groups, similitude, model studies, types of models. Application of dimensional analysis and model studies to fluid flow problem.
Unsteady flow in pipes: Water hammer phenomenon, pressure rise due to gradual and sudden valve closure, critical period of the pipeline, rigid and elastic pipes.

UNIT – III

Introduction to 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.
Uniform Flow - Characteristics and development of uniform flow, Chezy's formula, Manning's

formula. Factors affecting Manning's Roughness Coefficient "n". Most economical section of channel. Computation of normal depth in rectangular and trapezoidal channels

Hydraulic jump and its applications.

UNIT – IV

Turbines: Classification of turbines. Work done and efficiency in Pelton Wheel, Francis 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 and efficiency, work done by impeller, priming of pump and minimum starting speed, specific speed and performance of centrifugal pumps.

Suggested Reading:

1 *Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House, 2017*
2 *Fluid Mechanics And Hydraulic Machines, K. Subramanya, Tata McGraw Hill, 2018*
3 *Flow in Open channel, K. Subramanya, Tata McGraw Hill, 2019*

For the academic years 2020-2024

DESIGN OF REINFORCED CONCRETE STRUCTURES

PC407 CE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

The objectives of this course is to impart knowledge of:

- IS codal provisions as applicable for the design
- Solid background of principles of structural design of Reinforced Concrete Members
- Hands- on- experience and skill to design structural Reinforced Concrete elements

Outcomes:

After completion of course student will be able to:

- Analyse and Design a single reinforced section by applying the design philosophy of working and Limit state method of Design.
- Analyse and Design a doubly reinforced section and Tee section and apply check for deflection..
- Analyse and Design a section subjected to shear and Torsion, and apply check for development length.
- Analyse and Design one way and two way slabs
- Analyse and design of columns and Footings

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 RCC beams: 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.

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

UNIT – II

Limit state of Collapse – 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

Suggested Reading:

1. David Darwin, Charles W. Dolan, Arthur H. Nilson, "*Design of Concrete Structures*" , 15th Edition, McGraw Hill, 2016.
2. Krishna Raju N. and Pranesh R.N., *Reinforced Concrete Design*, New Age International Pvt.2003Ltd., 2003..
3. H. J. Shah, "*Reinforced Concrete (Elementary reinforced concrete)",* 11th Edition, Volume I, Charotar Publications, 2016.
4. B. C. Punmia, *"Reinforced concrete structures*", 7th Edition, Laxmi Publications, 1992
5. A.K Jain, *"Reinforced Concrete- Limit State Design",* 7th edition, Nem Chand and Bros publications, 2012.
6. Neelam Sharma, *"Reinforced Cement concrete Design"* S.K. Kataria and Sons publications 2017

Relevant IS Codes:

1) IS: 456-2000, *"Code of Practice for Plain and Reinforced concrete",* Bureau of IndianStandards, 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 andReinforced 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) ForBuildings And Structures Parts (1, 2, 3, 4 & 5)",* Bureau of Indian Standards, New Delhi,India.

HYDROLOGY

PE 408 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Course Objectives:

The objectives of this course is to impart knowledge of:

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

Course Outcomes

After completion of course student will be able to:

- Outline the interaction among various processes in the hydrologic cycle.
- Estimate the Design flood for Water Resources structures
- Evaluate drawdown and yield in aquifers
- Develop the Rainfall – Runoff relationship
- Determine of crop – water requirements

UNIT – I

Introduction – Hydrologic cycle, Importance and scope of hydrology, 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, mean rainfall over an area, estimation of missing precipitation data, presentation of rainfall data, probable maximum precipitation(PMP), rainfall data in India.

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).

Floods: Definition, causes and impact of floods, control measures of floods, estimation of floods, flood frequency studies- Weibul's and Gumble's method.

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

Irrigation-Definition, necessity of irrigation, frequency of irrigation, types of irrigation methods, advantages and ill-effects of irrigation.

Soil water-plant Relationship-Water requirement of crops, crops and crop seasons in India, cropping pattern. Vertical distribution of soil moisture, soil moisture tension, soil moisture stress, soil moisture constants, plant water relationship, moisture stress and plant response, consumptive use, crop factor, duty and delta, factors affecting duty.

Suggested Reading:

1) K. Subramanya, ***Engineering Hydrology,*** Tata McGraw Hill Publishing Co.Ltd. 1996.

2) H.M. Raghunath, ***Hydrology – Principles, Analysis and Design***, New Age International Publishers, 1996.

3) Michael, A.M, ***Irrigation Theory & Practice***, Vikas Publishing House, New Delhi, 1978

4) Ray K. Linsley, Jr, Max A. Kohler, Joseph L. H. Paulhus, ***Hydrology for Engineers***, McGraw-Hill Book Company, 1980

5) Ven Te Chow, ***Hand book of Applied Hydrology***, McGraw-Hill Book Company, New York, 1964

ENGINEERING GEOLOGY LABORATORY

ES 355 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:
The objectives of this course is to impart knowledge of:

- Hands-on experience to study the geological aspects of various rocks.
- Evaluate the physical and engineering properties of minerals and rocks
- Provides exposure to various geological tests.

Outcomes:
After completing this course, the student will be able to:

- Identify the physical and engineering properties of minerals and rocks
- Analyze and measure structural aspects of rocks using models
- Carry out field experiment and studies such as VES
- Perform studies such as Stereoscopic study of photographs, seismic refraction survey and Slake durability test
- Study the topographical and GSI maps

LIST OF EXPERIMENTS

1. Identification and description of physical properties of minerals
2. Identification and description of geological and geotechnical characteristics of rocks
3. Determination of apparent specific gravity, porosity and water absorption of different rocks
4. Study of structural geology models (wooden models)
5. Measurement of dip of planar feature by clinometers compass
6. Vertical electrical sounding VES field experiment
7. Stereoscopic study of aerial photographs pertaining to landforms, vegetation and water bodies
8. Seismic refraction survey to determine depth to bedrock
9. Study of topographical maps
10. Structural geology problems (strike, dip, three point problems)
11. Study of geological survey of India (GSI works) maps and reports
12. Slake durability test on soft rock

Note: At least 10 experiments should be conducted in the semester

MECHANICS OF MATERIALS LABORATORY

PC453CE

Instruction: 2 periods per week
CIE: 25marks *SEE: 50marks*
Credits : 1

Objectives:
The objectives of this course is to impart knowledge of:

- Stress- strain behavior of ductile material and compressive strength of brick.
- Deflection for different types of beams for different materials.
- Rigidity modulus by conducting spring and torsion test, hardness number and Impact strength of different materials

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

- Demonstrate the Stress-strain behavior of ductile material
- Compare Young's modulus of different materials by conducting deflection test on different types of beams
- Calculate rigidity modulus by spring test and torsion test.
- Evaluate compressive strength of brick.
- Find Hardness number and Impact strength of given Specimens.

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. Compression test on brick.
5. Bending test on simply supported beam of Timber.
6. Izod impact test
7. Compression test on close coiled helical spring.
8. Torsion test on a specimen of ductile material.
9. Bending test on Cantilever beam of Aluminum.
10. Bending test on Simply supported beam of Steel.
11. Bending test on Fixed beam of Copper.
12. Charpy impact test.

Note: At least 10 experiments should be conducted.

HYDRAULICS ENGINEERING LABORATORY

PC 454 CE

Instruction: 2periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits :1

Objectives:

The objectives of this course is to impart knowledge of:

- Practical applications of open and curved channels
- Application of force concepts on jets and hydraulic machines
- Determination of characteristic curves of turbines and pumps

Outcomes:

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

- Illustrate the flow phenomenon in open channels
- Analyze the force acting due to jets concept and its application in hydraulic machines
- Demonstrate working principles of hydraulic pumps and turbines
- Infer the specific energy diagram by tilting flume
- Determine minor losses in pipes

List of Experiments:

1. Study of Uniform flow in open channels-Smooth and Rough. Determination of Rugosity Coefficients.
2. Determination of a vane coefficient
3. Study of universal characteristic curves of a Pelton Wheel
4. Study of universal characteristic curves of a Francis turbine
5. Study of flow Characteristics over a broad crested weir
6. Determination of basic characteristics of a hydraulic jump
7. Study of flow Characteristics of venture flume.
8. Study of Specific Energy diagram- Tilting flume
9. Study of main characteristic curves of a Centrifugal pump
10. Determination of Minor losses in pipe

Suggested Reading:

1 *S. K. Som, and Biswas, G, 'Fluid Mechanics and Fluid Machines', Tata McGraw-Hill Publishing Co., New Delhi, 1998*
2 *Yuan, S. W., 'Foundation of Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi, 1976*
3 *C.S.P. Ojha, R.Berndtsson, P.N. Chandramouli, 'Fluid Mechanics and Machinery', Oxford University Press, New Delhi, 2010*
4 *A.K.Mohanty, 'Fluid Mechnics', Prentice-Hall India Pvt. Ltd., New Delhi, 1994*
5 *P.N. Modi, 'Hydraulics and Fluid Mechanics Including Hydraulics Machines', Standard Book House, New Delhi, 2013.*

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2020-2021)

and

Syllabi

B.E. V and VI-Semester

of

Four Year Degree Programme

in

Civil Engineering

(With effect from the academic year 2020– 2021)

(As approved in the faculty meeting held on 15-02-2020)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad

2020

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V – Semester
(CIVIL ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC321CE**	Structural Analysis - I	3	1	-	3	30	70	3	3
2	**PC322CE**	Hydraulic Engineering	3	-	-	3	30	70	3	3
3	**PC323CE**	Structural Engineering Design and Detailing	2	1	-	3	30	70	3	3
4	**PC324CE**	Geotechnical Engineering	2	1	-	3	30	70	3	3
5	**PC325CE**	Hydrology & Water Resources Engineering	2	1	-	3	30	70	3	3
6	**PC326CE**	Transportation Engineering	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	**PC351CE**	Fluid Mechanics Lab	-	-	2	2	25	50	3	1
8	**PC352CE**	Geotechnical Engineering Lab	-	-	2	2	25	50	3	1
9	**PC353CE**	Transportation Engineering Lab	-	-	2	2	25	50	3	1
			15	**03**	**06**	**24**	**345**	**780**		**21**

PC: Professional Course
L: Lectures **T:** Tutorial **Pr :** Practical **Drg:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour.
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI – Semester
(CIVIL ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC331CE**	Environmental Engineering	3	-	-	3	30	70	3	3
2	**PC332CE**	Estimation and Specifications	3	-	-	3	30	70	3	3
3		Professional Elective – 1	3	-	-	3	30	70	3	3
4		Professional Elective – 2	3	-	-	3	30	70	3	3
5		Professional Elective – 3	3	-	-	3	30	70	3	3
6		Open Elective – 1	3	-	-	3	30	70	3	3
7		Open Elective – 2	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	**PC361CE**	Environmental Engineering Laboratory	-	-	2	2	25	50	3	1
9	**PC362CE**	Computer Aided Civil Engineering Drafting, Analysis & Design Lab	-	-	2	2	25	50	3	1
10	**PC363CE**	Hydraulics Laboratory	-	-	2	2	25	50	3	1
			21	**-**	**06**	**27**	**285**	**640**		**24**

Professional Elective – 1			**Professional Elective –3**		
S. No.	**Course code**	**Course title**	**S. No.**	**Course code**	**Course title**
1	**PE301CE**	Design of Hydraulic Structures	1	**PE309CE**	Steel Structures
2	**PE302CE**	Structural Analysis –II	2	**PE310CE**	Ground Water Engineering
3	**PE303CE**	Foundation Engineering	3	**PE311CE**	Geotechnical Design
4	**PE304CE**	Railway and Airport Engineering	4	**PE312CE**	Environmental Impact Assessment of Transportation Projects

Professional Elective – 2

S. No.	Course code	Course title			
1	**PE305CE**	Design of Concrete Structures-I			
2	**PE306CE**	Traffic Engineering and Management			
3	**PE307CE**	Sustainable Construction Methods			
4	**PE308CE**	Open Channel Flow & River Engineering			

Open Elective – 1			**Open Elective – 2**		
S. No.	**Course code**	**Course title**	**S. No**	**Course code**	**Course title**
1	**OE350CE**	Remote Sensing & Geographical Information	3	**OE353CE**	Principles of Green Building Practices
2	**OE351CE**	Road Safety Engineering	4	**OE354CE**	Disaster Mitigation & Management

PC: Professional Course **PE**: Professional Elective **OE**: Open Elective
L: Lectures T: Tutorials Pr : Practical Drg: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note: 1) Each contact hour is a Clock Hour
*2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Course Code	Course Title						Core / Elective
PC 302 CE	**STRUCTURAL ANALYSIS - I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mechanics of Materials & Structures	**3**	**1**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Understand the advantage of statically indeterminate structure over the statically determinate structure.
2) Understand basic methods for the analysis of statically indeterminate beams and frames and know the difference between different methods.
3) Evaluate the displacements and redundant forces using energy principles.
4) Understand the analysis of structural elements subjected to moving loads & the analysis of road/railway bridges and gantry girders, arches.
5) Explain the concepts involved in the analysis of suspension cable bridges.

Course Outcomes

After Completion of this course, the student will be able to

1) Solve statically indeterminate beams and portal frames using classical methods
2) Sketch the shear force and bending moment diagrams for different loading condition for indeterminate structures.
3) Sketch ILD for bending moment and shear force, for determinate girders for different position of loading system and for different sections of girder
4) Analyze cable suspension bridges along with three hinged stiffening girder for static loads.
5) Analyze the three hinged arches for moving loads.

UNIT - I

Slope deflection method: Application of the method to continuous beams with and without sinking of supports, single bay - portal frames (Degree of freedom 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

Curves of maximum bending moment and shear force: for simply supported girders traversed by (l) single point load, (2) two point loads, (3) uniformly distributed-load longer/shorter than span, enveloping parabola and EUDL (4) several point loads not exceeding four.

Moving loads: Influence line for support reaction, bending moment and shear force at any location for simple beams. Determination of maximum bending moment and shear force for moving load systems on simply supported girders.

UNIT – V

Moving loads on trusses / girders: Influence lines for forces in members of statically determinate plane framed structures under moving loads for Warren girder, Pratt truss, and Curved flange truss.

Suspension bridges: Influence lines for horizontal and vertical components of tension in the cable, tension in the cable, bending moment and shear force.

Arches: Influence lines for horizontal thrust, bending moment, normal thrust and radial shear for three hinged arches.

Suggested readings:

1. *D.S. Prakash Rao, "Structural Analysis - A Unified Approach", University Press,1996*
2. *Kinney, J. Sterling," Indeterminate Structural Analysis", Oxford Book Company,*
3. *B.C. Punmia, Er.A.K.Jain and Dr.A.K. Jain, "Theory of structures", Laxmi Publications, New Delhi,2018.*
4. *G .S, Pandit, S. P. Gupta and R. Gupta, "Structural Analysis, A Matrix Approach", Tata McGraw Hill, New Delhi,2008.*
5. *C.S.Reddy,"Basic Structural Analysis", Tata McGraw-Hill Publishing Co. Ltd., 3rd Edition, New Delhi,2010.*
6. *S.S.Bhavikatti,"Structural Analysis" – Vol. I & II, Vikas publication House Pvt. Ltd., 4thEdition, 2011.*
7. *Ramamrutham. S., "Theory of Structures", Dhanpath Rai& Sons, New Delhi,2014.*

Course Code	Course Title						Core / Elective
PC322CE	**HYDRAULIC ENGINEERING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Fluid Mechanics	3	0	0	0	**30**	**70**	**3**

Course Objectives

1) To introduce the students to various hydraulic engineering problems in open channel flows
2) Ability to understand energy loss principles
3) Ability to relate the theory and practice problems in hydraulic engineering

Course Outcomes

After Completion of this course, the student will be able to

1) Categorize various types of flows.
2) Solve various Engineering problems in Open Channels
3) Understand the hydraulic jump and its uses
4) Understand the Dimensional analysis.
5) Apply their knowledge of fluid mechanics in addressing problems in hydraulic machinery

UNIT -I:

Flow though pipes – Reynolds experiment, Laminar flow and Turbulent flow, Lower critical Reynolds number, characteristics of laminar and turbulent flows.

Velocity and shear stress distribution in laminar flow through circular pipes – Hagen Poiseuille equation, head loss in laminar flow.

Loss of head through pipes - Darcy Weisbach equation, Darcy friction factor for laminar flow, Velocity profile of Turbulent flow, empirical relations for turbulent flows, hydro dynamically smooth and rough boundaries, Moody's diagram.

Minor losses, hydraulic gradient line, Pipe flow systems - Pipes in series, equivalent pipes, pipes in parallel

UNIT-II:

Introduction to 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.

Uniform Flow: Characteristics and development of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n". Most economical section of channel. Computation of 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**.**

Steady RVF - Hydraulic Jump- Theory of hydraulic jump, Elements and 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:

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

UNIT -V

Turbines and pumps – classification of turbines, work done and efficiency in Pelton Wheel, Francis Turbine and Kaplan Turbine. Unit quantities and specific speed. Performance characteristics of turbines.
Centrifugal Pump: Components and functioning of centrifugal pump – manometric head and efficiency, work done by the impeller, Priming of pump and minimum starting speed, specific speed and performance of centrifugal pumps.

Suggested readings:

1. *Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House, 2017*
2. *Fluid Mechanics And Hydraulic Machines, K. Subramanya, Tata McGrawHill, 2018*
3. *Flow in Open channel, K. Subramanya, Tata McGrawHill, 2019*
4. *Open Channel Hydraulics, Ven Te Chow, The Blackburn Press, 2009*

Course Code	Course Title						Core/ Elective
PC323CE	**STRUCTURAL ENGINEERING DESIGN AND DETAILING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**0**	**0**	**30**	**70**	**3**

Course Objectives

The Objective of This Course is to

1) Provide a solid background of principles of structural design of Reinforced Concrete Members.
2) Provide Hands- on- experience and skill to design structural Reinforced Concrete elements.
3) Develop an understanding of real-world design problems.

Course Outcomes

After Completion of this course, the student will be able to

1) Adopt the design philosophies of Limit State method of Design and design a singly reinforced section.
2) Design of Doubly reinforced and T- Beams for flexure,
3) Design a Reinforced Concrete Beam for shear and torsion.
4) Design a Reinforced concrete one way and two-way slabs.
5) Design of Short axially loaded columns and isolated rectangular Reinforced concrete footing.

UNIT- I

Introduction: Safety and sustainable development in performance. 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 RCC beams - 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.

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

UNIT- II

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

Design of T- Beams: Analysis and Design of Singly and doubly reinforced T Beams for flexure.

UNIT- III

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 beam 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**,** Solid slab, Ribbed and Hollow slabs, Introduction to Flat slab.

One Way Slabs: Analysis and design and detailing of simply supported and continuous one way slabs**.** Check for deflection of simply supported one way slab.

Two Way Slabs: Analysis of two way slab, yield line theory. Design and detailing of simply supported and restrained two way slabs using IS code coefficients.

UNIT- V

Limit State of Collapse – Compression: Assumptions made in Limit state of Collapse-Compression.

Design of Columns: Analysis and Design and detailing of Short axially loaded rectangular and circular column. Analysis and design of short Uni-axial and Bi-axial columns using Interaction Diagrams. Design of lateral ties.

Design of Footings: Introduction and types of Footings, Isolated footing, combined footing and Raft foundation.

Design of Isolated rectangular footing of uniform and varying depth.

Suggested readings:

1. *David Darwin, Charles W. Dolan, Arthur H. Nilson, "Design of Concrete Structures" , 15th Edition, McGraw Hill, 2016.*
2. *S.U.Pillai and D.Menon. "Reinforced concrete Design" Third Edition. McGraw Hill, 2009.*
3. *H. J. Shah, "Reinforced Concrete (Elementary reinforced concrete)", 11th Edition, Volume I, Charotar Publications, 2016.*
4. *B. C. Punmia, "Reinforced concrete structures", 7th Edition, Laxmi Publications, 1992.*
5. *A.K Jain, "Reinforced Concrete- Limit State Design", 7th edition, Nem Chand and Bros publications,2012.*
6. *N.V. Ramana Rao and P Sreenivas Sharma, " Design of Reinforced Concrete Structures", Academic Publishing Company, 2012*

Course Code	Course Title						Core / Elective
PC324CE	**GEOTECHNICAL ENGINEERING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Geology	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Introduction of Particulate Mechanics further to the solid and fluid mechanics
2) Characterization and classification of soils based on laboratory and field experiments
3) Understand Seepage, Strength and Compressibility characteristics of soils and learn the analysis of applications involving them

Course Outcomes

1) Competence in understanding the soil and the mechanisms associated with it.
2) Ability to analyze the systems involving soil mechanics
3) Competence for application of principles of soil mechanics in Foundation Engineering to be learned in the next semester.
4) Ability to analyze Compaction and consolidation Process in soils
5) Ability to analyze Earth Pressure States of earth pressure

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

Soil moisture states: Held and Free moisture

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.

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

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

Quick Sand phenomena: Critical Hydraulic gradient, Remedial measures

UNIT-III

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

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

UNIT – IV

Shear Strength: Significance of Shear strength in soils - Mohr - Coulomb equation - shear parameters - 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.

UNIT - V

Earth Pressure: States of earth pressure - Active, passive, at rest condition; Rankine's theory: computation of active and passive earth pressure in c-less and cohesive soils; Coulomb's Wedge theory: Rehbhan's graphical solution: stability of earth retaining gravity wall.

Slope stability: Definition and classification of slopes -types of slope failure - Factors of safety with respect to cohesion, angle of shearing resistance, Height - Analysis of stability of slope using Swedish slip circle method and Taylor's stability number.

Suggested readings:

1) *Lambe, T.W. and Whitman, R.V., "**Soil Mechanics",** John Wiley &Sons Inc., NY,1969.*
2) *Donald. P. Coduto, "Geotechnical Engineering", Mc Graw HillPublications*
3) *Venkataramaiah, C., **"Geotechnical Engineering",** New Age Publishers,2006.*
4) *Murthy, V.N.S., "**Soil Mechanics and Foundation Engineering".** Dhanpat Rai & Sons,2006.*
5) *Arora, K.R., "**Soil Mechanics and Foundation Engineering",** Standard Publishers Distributors, revised and enlarged sixth edition,2007.*
6) *S.P. Brahma, **"Foundation Engineering",** Tata McGraw Hill Publishing Company Limited, New Delhi,1985.*
7) *Relevant ISCodes*

Course Code	Course Title						Core / Elective
PC325CE	**HYDROLOGY AND WATER RESOURCES ENGINEERING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

The students will have ability to

1) Understand the interaction among various processes in the hydrologic cycle
2) Familiar with basic concepts and assessment of groundwater flows.
3) Description regarding planning and design aspects of different types of distribution systems

Course Outcomes

At the end of the course, students must be in a position to:

1) Find out average rainfall in a catchment area and various losses
2) Develop relationship between Rainfall-Runoff
3) Understand the basic aquifer parameters and estimate ground water resources for different hydro-geological boundary conditions.
4) Determination of crop water requirement
5) Assimilation of the knowledge for various concepts of canal design.

UNIT - I

Introduction - hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data.

Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, Probable Maximum Precipitation (PMP), rainfall data in India.

Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, infiltration, infiltration capacity, measurement of infiltration, infiltration indices.

UNIT - II

Runoff - runoff volume, SCS-CN method of estimating runoff volume, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph, Design flood-m SPF, PMF, flood control, flood frequency studies by Gumble's method

UNIT - III

Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics, steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

UNIT - IV

Water withdrawals and uses – water for energy production, water for agriculture, water for hydroelectric generation; Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta, Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT - V

Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge, Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime cannels. Canal outlets: non-modular, semi-modular and modular outlets. Proportionality, Sensitivity and flexibility, Lining of canals, types of lining, Drainage of irrigated lands: necessity, methods.

Suggested readings:

1. *K Subramanya, "Engineering Hydrology",4th Edition, Mc-GrawHill, 2013*
2. *Kedar Mutreja, "Applied Hydrology", Tata Mc-GrawHill, 1996*
3. *G L Asawa, Irrigation and water resource Engineering, New Age Publishers, 2005.*
4. *Larry W Mays, Water Resources Engineering, John Wiley & Sons, 2000.*
5. *Punmia, B.C., Pande B. and Lal, B., "Irrigation and Water Power Engineering", 16th edition, Laxmi Publications, 2016.*
6. *S.K.Garg, "Irrigation Engineering and Hydraulic Structures", 35th edition, Khanna publishers,2016*

Course Code	Course Title						Core/Elective
PC 326CE	**TRANSPORTATION ENGINEERING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Understand the need of highways and its classification as per IRC codes
2) Design the highway geometrics as per standard code of practice
3) Study various traffic studies including analysis and design
4) Study of Airport & Railway Engineering.

Course Outcomes

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

1) Carry out surveys involved in planning and highway alignment
2) Design the geometric elements of highways and expressways
3) Carry out traffic studies and implement traffic regulation and control measures.
4) Characterize pavement materials, design flexible & rigid pavements as per IRC
5) Understand elements of Railway & Airport Engineering

UNIT-I

Highway development and planning: Classification of roads, road development in India, Current road projects in India, National Transport Policy Recommendations, IRC, CRRI, Vision 2021, NHDP, PMGSY.

Alignment: Engineering Surveys for alignment, horizontal alignment- super elevation, extra widening and transition curves, vertical alignment- gradient, grade compensation, summit and valley curves.

UNIT-II

Geometric design of highways: Introduction, cross sectional elements - camber, sight distance stopping distance and overtaking sight distance.

Traffic engineering & control: Traffic Characteristics, traffic engineering studies, traffic flow, Level of service and capacity, traffic regulation and control, Traffic Signs and road markings, roundabouts, types of traffic signals.

UNIT-III

Pavement materials: Materials used in Highway Construction- Desirable properties of Road aggregates and tests. Types of paving binders – Paving grade bitumen, modified bituminous binders, cut-back bitumen, and Bitumen emulsion, Tests on Bitumen, Grading of bitumen, Bituminous paving mixes.

UNIT-IV

Design of pavements: flexible pavements, factors affecting design and performance; stresses in

flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC, construction joints - expansion joints, contraction joints. Functions of dowel and tie bars.

UNIT–V

Railway Engineering: Different types of gauges, Permanent way component parts and its functions. Rails – various types and functions, creep of rails, coning of wheels, Track fittings and fastenings, Sleepers- various types and functions, merits and demerits, ballast, various types and functions and sub grade preparation, Points and Crossing, Turnouts.

Airport Engineering: Introduction to air transportation, Typical airport layouts, airport classification as per landing & take-off and dimensions. Factors for airport site selection.

Runway Design: Runway orientation, basic runway length, correction for elevation, temperature and gradient.

Suggested readings:

1. *Khanna S.K., Justo C.E.G., Veeraraghavan A., "**Highway Engineering**", 10thEdition, NemChand&Bros,2015*
2. *KadiyaliL.R,"**TrafficEngineeringandTransportationPlanning"**,KhannaPublishers,2016*
3. *ITE Hand Book, Highway Engineering Hand Book, Mc Graw - Hill.*
4. *Srinivasa Kumar R., "Pavement Design", Orient Blackswan Pvt. Ltd., New Delhi, 2013.*
5. *R.Srinivasa Kumar, Transportation Engineering (Railways, Airport, Docks Harbour), Universities Press, 2014.*

Course Code	Course Title						Core / Elective
PC351CE	**FLUID MECHANICS LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**0**	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

1) Students should be able to verify the principles studied in fluid mechanics
2) Ability to perform the experiments in laboratory

Course Outcomes

1) Ability to measure flow in closed conduits and flumes
2) Application of Bernoulli's principle in Hydraulics
3) Computation of various losses in pipes and pipe fittings

List of Experiments

1. Determination of coefficient of discharge of a Rectangular Notch with end contractions
2. Determination of coefficient of discharge of a Circular orifice
3. Determination of coefficient of discharge of a Mouth piece
4. Determination of coefficient of discharge of V- Notch
5. Determination of coefficient of discharge of a Venturimeter
6. Determination of coefficient of discharge of an Orifice meter
7. Classification of flow by Reynold's Experiment
8. Determination of Darcy's friction factor
9. Verification of Bernoulli's theorem
10. Flow visualization by Heleshaw model

e-Resources:

1. *http://nptel.ac.in/*
2. *http://mhrd.gov.in/e-contents*
3. *http://vlab.co.in/*

Course Code	Course Title						Core / Elective
PC352CE	**GEOTECHNICAL ENGINEERING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**0**	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

1) Expose the students to different types of soils
2) Experience the concepts of soil mass, soil solids, and soil structure.
3) Understand the laboratory test procedures and appreciate the suitability of each test.
4) Make the students to relate theoretical concepts in doing lab tests.

Course Outcomes

1) Competence in performing the laboratory experiments on soil specimen, analyse the results, interpret and validate the same
2) Greater insight in to the soil behavior and hence enhanced understanding of soil mechanics
3) Ability to model a field application in the laboratory to take up research
4) Competence in performing, analyze the results of Direct Shear Test
5) Ability to analyze shear parameters in calculation of Bearing capacity of soils

DETERMINATION OF INDEX PROPERTIES:

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 Casgrande's standard LLdevice
5. Determination of Liquid limit using Cone Penetration apparatus
6. Determination of Plastic limit and Shrinkage limit
7. Sieve Analysis for plotting Particle size distribution curve.
8. Determination of Field Density using Sand Replacement Method

DETERMINA TION OF ENGINEERING PROPERTIES:

9. Determination of Compaction Characteristics
10. Determination of Co-efficient of Permeability by Constant Head Permeameter test
11. Determination of Co-efficient of Permeability by Variable Head Permeameter test
12. Determination of shear strength, parameters by Direct Shear Test
13. Determination of shear strength Cohesive soils by Unconfined Compression test
14. Determination of shear strength by conducting Vane Shear Test

DEMONSTRATION OF TEST PROCEDURE:

15. Consolidometer test
16. Tri-axial compression Test
17. Laboratory Plate Load Test
18. Reverse Osmosis Test
19. Quick Sand Model
20. Cyclic Tri-axial Test Facility

Note: *At least ten experiments should be conducted in the Semester*

Suggested readings:

1) *IS: 2720 – Relevant Parts.*
2) *Lambe, T.W., **"Soil Testing for Engineers",** Wiley Eastern Ltd., New Delhi, 1969.*
3) *S.Mittal, "Soil Testing for Engineers", Khanna Publishers, 1992.*

Course Code	Course Title						Core/Elective
PC353CE	**TRANSPORTATION ENGINEERING LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**0**	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

1) Know the properties of various road materials
2) Create the awareness about various traffic studies in the field

Course Outcomes

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

1) Characterize the pavement materials.
2) Perform quality control tests on pavement material and pavements.
3) Conduct traffic studies for estimation of traffic flow characteristics.

List of Experiments:

A) Tests on Bitumen

1) Penetration Test.
2) Ductility Test
3) Softening point test
4) Specific gravity test
5) Viscosity test
6) Flash and fire point test

B) Tests on Road Aggregate

7) Aggregate crushing value test
8) Los Angeles abrasion test
9) Aggregate impact value test
10) Aggregate shape test (flakiness & elongation)
11) Specific gravity
12) Water Absorption
13) Soundness

C) Experiments on Traffic

14) Traffic Volume study (a) at mid-section (b) at intersection
15) Spot speed study
16) Speed and delay study
17) Origin and Destination Study

D) Miscellaneous Tests (Demonstration Only)

18) Marshal stability test
19) Determination of C.B.R.
20) Benkelman beam test
21) Bitumen extraction test
22) Exposure to Latest Software in the field of Transportation Engineering

Note: At least ten experiments should be conducted in the Semester

Suggested readings:

1. Relevant IS and IRC Codes of Practice.
2. Relevant ASTM and AASHTO Codes of Practice
3. Khanna, S. K. and Justo, C.E.G., Highway Material Testing (laboratory manual). Nem Chand & Bros, Roorkee (2000)

SCHEME OF INSTRUCTION& EXAMINATION
B.E. – VII SEMESTER(CIVIL ENGINEERING)
AICTE MODEL CURRICULUM(for 2018-2022 & 2019-2023 Batches)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC401CE**	Construction Engineering and Management	3	-	-	3	30	70	3	3
2	**PC402CE**	Prestressed Concrete	3	-	-	3	30	70	3	3
3	**PE**	Professional Elective - IV	3	-	-	3	30	70	3	3
4	**PE**	Professional Elective - V	3	-	-	3	30	70	3	3
5	**OE**	Open Elective - II	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
6	**PR401CE**	Seminar*	-	-	4	4	25	-	3	2
7	**PW401CE**	Project - I	-	-	4	4	50	-	-	**2**
			15	**-**	**8**	**23**	**225**	**350**		**19**

*Technical Report and Seminar / based on summer industrial Internship/Mini Project

Professional Elective – 4			Professional Elective – 5		
S. No.	**Course Code**	**Course Title**	**S. No.**	**Course Code**	**Course Title**
1	**PE401CE**	Design of Concrete Structures - II	1	**PE405CE**	Advanced Steel Design
2	**PE402CE**	Urban Transportation Planning	2	**PE406CE**	Retrofitting and Rehabilitation of Structures
3	**PE403CE**	Surface Hydrology	3	**PE407CE**	Highway Construction and Management
4	**PE404CE**	Disaster Mitigation and Management	4	**PE408CE**	Geographic Information Systems and Remote sensing

Open Elective – II		
1	**OE421 ME**	Entrepreneurship (Not for Mech/Prod Engg students)
2	**OE402 CE**	Green Building Technologies (Not for Civil Engg students)
3	**OE402 CS**	Data science using R (Not for CS students)
4	**OE403 IT**	Cyber security (Not for IT students)
5	**OE402 EE**	Transducers And Sensors (Not for EEE & EIE Students)

Course Code	Course Title						Core / Elective
PC 401 CE	**CONSTRUCTION ENGINEERING AND MANAGEMENT**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Nil	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Impart knowledge of project management systems and construction scheduling
- Introduce with the techniques involved in the optimization of project resources
- Familiarize with health and safety on project sites and BIM for project managers

Course Outcomes

After completing this course, the student shallbe able to:

- Apply current construction practices in the management of infrastructure projects
- Implement various techniques for scheduling of construction projects
- Apply resource optimization in construction projects using available software
- Implement BIM to improve quality, reduce costs, and time in construction process
- Formulate and apply LP model to optimize time-cost in construction projects

UNIT – I

Introduction: Introduction to Construction projects – objectives and lifecycle, existing construction practices &project management systems, Project scale, Project Team, organization, roles, responsibilities, Management Ethics (human aspects) in construction projects, Labor welfare, applicable labor legislations.

UNIT – II

Construction Management through Network Theory: Definitions and different types of Event, 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, Project up dating, Introduction to Project management software

UNIT – IV

Project Monitoring & Control - Safety, Health and Environment on project sites, accidents their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, basics of modern project management systems such as lean construction, use of Building Information Modelling (BIM) in project management

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, Case studies

Suggested readings

1. Gahlot. P.S. and Dhir. B.M., "Construction Planning and Management", Wiley Eastern Ltd., 2018.
2. Sidney Levy., "Project Management in Construction", Seventh Edition, McGraw-Hill Education, 2017.
3. Seetharaman S., "Construction Engineering and Management", Umesh Publications, 2012.
4. Punmia, B. C., and Khandelwal, K. K., "Project planning and control with PERT and CPM", 2006.
5. Chitkara, K. K. "Construction Project Management: Planning, Scheduling and Controlling", Tata McGraw–Hill Education, 2004.
6. Srinath L.S., "PERT and CPM: Principles and Applications", East-West Press, 2001

Course Code	Course Title						Core/Elective
PC 402 CE	**PRESTRESSED CONCRETE**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Reinforced Cement Concrete	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand the basic concepts of prestressed concrete, materials used and load balancing.
- Study the flexural and shear design of prestressed concrete beam sections and design of beams.
- Learn to evaluate the deflections and design the end blocks of prestressed concrete sections.

Course Outcomes

After completing this course, the student will be able to

- Apply the concept of prestressing and determine the losses of prestress.
- Analyse the prestressed concrete beam and suggest the cable profile for beam.
- Design the prestressed concrete beam for flexure and shear.
- Analyse the prestressed continuous beam and determine the concordant cable profile.
- Estimate the deflection of a prestressed concrete beam and design the end block.

UNIT – I

Introduction to Prestressed Concrete: Historical development, principles of pre stressed concrete. Definition, classification and systems of prestressing. Materials for pre stressed concrete.

Loss of pre stress: Losses of pre stress in pre-tensioned and post-tensioned members.

UNIT – II

Analysis of Pre stress: Basic assumptions, analysis of pre stress, resultant stress, pressure line, kern points, cable profiles, load balancing concept, stress diagrams for pre stress, dead load and live load.

UNIT – III

Simply Supported Continuous Beams: concordant cable profile, analysis of continuous pre stressed concrete beams.

Design of Sections: Flexural strength design of rectangular, I and T sections using IS code provisions.

UNIT – IV

Design for Shear: Basic concept of shear design, shear failure, flexural shear failure, shear compression failure, shear tension failure, shear strength of beams (a) unfrocked in flexure and (b) cracked in flexure.

UNIT – V

Deflections: Necessity of deflection estimation, limitations of deflections. Deflections of pre-stressed concrete beams with uniformly distributed and point loads.

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.

Suggested Readings:

1. T.Y. Lin and N.H. Burns, *Design of prestressed concrete structure*, Jon Wiley and Sons,1982.
2. A.H. Nilson, *Design of Prestressed Concrete*, John Wiley and Sons,1982.
3. N. Krishna Raju, *Design of prestressed concrete structure*, Tata McGraw Hill Book Co.,1996.
4. G.S. Pandit and S.P. Gupta, *Prestressed Concrete*, CBS Publishers,1995.

Course Code	Course Title						Core / Elective
PE 401 CE	**DESIGN OF CONCRETE STRUCTURES - II**						**PE -IV**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
DCS- I	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand the design concepts of concrete structures like deep beams and shear walls.
- Understand the design principles and methods for Bunkers and Silos.
- Learn the various types of R.C.C bridges and their design procedures.

Course Outcomes

After completing this course, the student will be able to

- Analyse and design an Intze water tank, a canonical bottom water tank and a deep beam
- Apply the concepts of shear walls in selection of their design parameters
- Analyse and design square and circular bunkers and cylindrical silos.
- Analyse and Design the R.C.C Deck type bridge.
- Analyse and Design a Tee Beam bridge for IRC Loading

Unit –I

Water Tanks: Analysis and Design of Intze Water Tank, and Circular Water Tank with Canonical bottom.

Deep Beams: Introduction, Analysis and design of Deep Beam for flexure. Shear in deep Beams.

Unit – II

Shear walls: Introduction, classification of shear walls, types of loads, introductory analysis and design concepts

Unit – III

Bunkers and Silos: Introduction - Design principles and theories Code provisions - design ofsquare and circular bunkers - design of cylindrical silos. IS specifications.

Unit – IV

Design of RCC Slab Bridges: IRC loadings, Elastic Design and Detailing of RC bridge deck slab using effective width methods.

Unit – V

Design of RCC T Beam Bridges: Use of Pigaud's curves for the design of slab. Design and detailing of Cross beams and Tee Beam of a Tee beam bridge.

Suggested Reading:

1. David Darwin, Charles W. Dolan, Arthur H. Nilson, “Design of Concrete Structures”, 15th Edition, McGraw Hill, 2016.
2. Krishna Raju, N., “Structural Design and Drawing: Reinforced Concrete”, Universities Press, 2009.
3. Johnson Victor, D., “Essentials of Bridge Engineering”, Oxford & IBH Publishing, 2019.
4. Krishna Raju, N., “Design of Bridges”, Oxford & IBH Publishing; 5th edition, 2019
5. Praveen Nagarajan, “Design of Concrete Bridges: As per latest IRC Codes”, Wiley Publishing, 2020
6. P.C. Vargese, “Advanced Reinforced Concrete Design,” PHI publishing, 2005
7. Pankaj Agarwal and Manish Shrikhande, “Earthquake Resistant Design of Structures,” PHI publishing, 2006

Course Code	Course Title						Core /Elective
PE 402 CE	**URBAN TRANSPORTATION PLANNING**						**PE -IV**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Objectives:

The objectives of this course are to:

- Familiarize with urban transportation systems planning process and its components
- Review various travel surveys and data collection procedures
- Study of various components of travel demand forecasting in transportation planning process

Outcomes:

After completing this course, the student will be able to:

- Classify various urban transportation issues and planning methodologies
- Design, conduct and administer surveys to provide the data required for transportation planning.
- Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
- Develop and calibrate modal split, trip generation rates for specific types of land use developments.
- Adopt the steps that are necessary to complete a long-term transportation plan.

UNIT – I

Urban Transportation Problems and Planning Process: Role of transportation - Transportation problems - Urban travel characteristics – Systems approach to transportation planning - Transportation Survey and Analysis: Definition of study area - Zoning - Types and sources of data - Road side interviews - Home interview surveys.

UNIT – II

Trip Generation Analysis: Concept of travel demand - Demand function - Independent variables - Travel attributes -Trip generation models - Zonal models - Category analysis - Household models - Trip attractions of work centers.

UNIT – III

Trip Distribution Analysis: Introduction – Methods of trip distribution – Uniform factor method – Average factor method - Trip distribution models - Growth factor model - Gravity model –- Opportunity model.

UNIT – IV

Modal Split Analysis: Introduction – Factors affecting modal split – Modal split in transportation planning process- Probit analysis – Logit analysis – Mode choice behaviour.

UNIT – V

Route Assignment Analysis – Introduction – Assignment techniques - All-or-nothing assignment – Multiple route assignment - Capacity restraint assignment - Diversion curves.

Suggested Reading:

1. Papacostas,'Fundamentals of Transportation Planning', PHI Learning Pvt. Ltd., New Delhi, 2009.
2. Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall. New Delhi, 2008
3. Kadiyali, L. R. "Traffic Engineering and Transport Planning", Khanna Publishers, New Delhi, 2006
4. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson and Company (Publishers) Limited, England, 1985.
5. Hutchinson, E.G., "Principles of Urban Transport Systems Planning", McGraw Hill, Inc., USA, 1974.

Course Code	Course Title						Core / Elective
PE 403 CE	**SURFACE HYDROLOGY**						**PE -IV**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Fluid Mechanics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- Understand the formation of water resources, sediment movement in rivers and stream flow measurement.
- Describe the flood routing techniques, mitigation measures and application of statistical methods.
- Explain the concept of urbanization and its impact on the natural water cycle.

Course Outcomes:

- Able to apply the knowledge of soil erosion and sedimentation to estimate the life of the reservoir
- Demonstrate concept of flood routing techniques and suggest suitable flood control measures.
- Estimate stream flows.
- Develop relationship between hydrological variables.
- Able to understand the planning and operation of Urban water management.

UNIT – I

Formation of surface water Resources-Streams, rivers, lakes, swamps, caves, seas and oceans: Definition of river, river basins and water divides, formation of river valleys, fluvial deposits, alluvial fans, meandering of rivers, formation of different types of lakes, deltas and valleys.

Sediment discharge, Sediment transport, Sediment yield of watersheds, suspended load and bed load measurements, reservoir sedimentation-sediment movement and deposition, reduction in reservoir capacity, reservoir sedimentation control.

UNIT – II

Flood Routing- Introduction, basic equation, Hydrologic storage routing, attenuation, Hydrologic channel routing, Hydraulic methods of flood routing.

Flood Control- Structural and non-structural methods, flood control in India, national and state bodies involved for mitigation and management of floods as a natural disaster.

UNIT – III

Stream flow Measurement – Stage and Velocity Measurement – Gauges – Current meter and Doppler flow velocity meter - Discharge measurement – direct methods (Area-Velocity method, Dilution techniques, electromagnetic method, ultrasonic method), indirect methods (Slope-area method, discharge measuring Structures(weirs, flumes and gated structures),Stage-Discharge relationship , Selection of a Stream Gauging Site.

UNIT – IV

Statistics in Hydrology- Introduction, Statistical parameters, central tendency parameters, dispersion characteristics, skewness, probability distribution, discrete and continuous distribution, frequency analysis, log Pearson type III distribution, regression and correlation, standard forms of bivariate equations, multivariate linear regression and correlation, analysis of time series, selection of a design return period, determination of permissible risk.

UNIT – V

Urban Water Management-urban hydrology, major issues in urban storm water management, objectives and limitations, airport drainage design, urban water resource management models, urban storm water management practices, rainwater harvesting.

Suggested Reading:

1. Chow V.T., Maidment D.R., Mays L.W., "*Applied Hydrology*", McGraw Hill Publications, New York, 1995.
2. Subramanya K., "*Hydrology,Tata McGraw Hill Co*., New Delhi, 1994.
3. Patra.K.C, "*Hydrology and Water Resources Engineering*",Narosa Publications, 2008, 2nd Edition, New Delhi.
4. Jay Rami Reddy.P, "*Hydrology*", Laximi Publications, New Delhi, 2004
5. Raghunath H.M., "*Hydrology*", New Age International Publishers, New Delhi, 2014.
6. Martin, P. Wanelista and Yousef, A. Yousef., *Storm Water Management*, John Wiley and sons,1993
7. Jay L.Devore, "*Probability and statistics for Engineering and the Sciences*", 5th Edition, Thomson and Duxbury, Singapore, 2002

Course Code	Course Title						Core / Elective
PE 404 CE	**DISASTER MITIGATION AND MANAGEMENT**						**PE -IV**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
--	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Objectives:

- Learn about the basic principles of disaster management and the types of disasters
- 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

Outcomes:

After completing this course, the student will be able to

- Apply the concepts of disaster management to evaluate a disaster situation.
- Classify the various categories of disasters and their specific characteristics.
- Select appropriate pre-disaster, during disaster and post-disaster measures and framework
- Identify the disaster management acts and frameworks specific to India relevant to a situation
- 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 Microzonation, 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 Disaster Management Act 2005 – 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, GPS and RS) 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.

Suggested Reading:

1. Rajib, S and Krishna Murthy, R. R, *Disaster Management Global Challenges and Local Solutions"* CRC Press, 2009.
2. Navele, P & Raja, C. K, *Earth and Atmospheric Disasters Management, Natural and Manmade. B. S. Publications, 2009*
3. Bhattacharya, T., *Disaster Science and Management*. Tata McGraw hill Company, 2017
4. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5. *An overview on natural & man-made disasters and their reduction*, R K Bhandani, CSIR, New Delhi
6. *Disaster Management Act 2005*, Publisher by Govt. of India

Course Code	Course Title						Core/Elective
PE405CE	**ADVANCED STEEL DESIGN**						**PE - V**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Steel Structures	**3**	**-**	**-**	**-**	**30**	**70**	**3**

CourseObjectives

- Understand the basic concepts of welded plate girder design.
- Learn the basic principles of gantry girder design.
- Study the various types of bridges, bridge bearings and their design procedures.

CourseOutcomes

After completing this course, the student will be able to

- Analyse and design the Welded plate girder.
- Analyse and design of gantry girder.
- Design of Roller and Rocker Bearing for the bridge.
- Design a Deck type Plate girder railwaysteelbridges.
- Analyse and Design a Truss Girder Bridge.

UNIT–I

Plate Girders: Design of welded plate girders for static loads, connections, intermediate and bearing stiffeners, web and flange splices.

UNIT–II

Gantry Girders: Basic principles, codal provisions and detailed design.

UNIT–III

Bearings: Types and materials, detailed design of bearings for bridges.

UNIT–IV

Bridges: Deck and trough type bridges, economical span, bridge rules(Railway Board, Ministry of Railways)

Plate Girder Bridge: Detailed designof plategirderbridges

UNIT–V

Truss Girder Bridge: Detailed design of truss girder bridges

***SuggestedReadings*:**

1. N.Subramanyam, *Design of Steel Structures*,Oxford University Press,2008.
2. B.C.Punmia, *Comprehensive Design of Steel structures*,Laxmi Publishers,2001.
3. P.Dayaratnam, *Design of steel Structures*, S.Chand & Company Ltd, 2003.
4. N.Krishna Raju, *Design of Bridges*,Oxford and IBH Publishers,NewDelhi,1998.
5. Relevant *I.S.Code books* on Design of Steel Structures.

Course Code	Course Title						Core / Elective
PE 405 CE	**RETROFITTING AND REHABILITATION OF STRUCTURES**						**PE -V**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**		**-**	**-**	**30**	**70**	**3**

Course Objectives:

- Understand the basic concepts of building maintenance, the causes, mechanisms and prevention of deterioration in structures.
- Study the methods of condition assessment of structures and associated non-destructive techniques.
- Know the materials, methodology and techniques of repair, and retrofitting of structures.

Course Outcomes:

After completing this course, the student will be able to

- Select an appropriate building repair and maintenance method for a specified deterioration in structures.
- Differentiate the types of defects, damage and explain the various deterioration mechanisms in structures.
- Choose an appropriate non-destructive test and a condition assessment procedure for a given structure.
- Apply the knowledge of repair materials and techniques for choosing a rehabilitation process for a distressed structure.
- Choose a suitable retrofitting and rehabilitation procedure for a deteriorated and distressed structure.

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UNIT –I

Introduction to Building Maintenance*:* Definitions of repair, renovation, remodelling, restoration, retrofitting and rehabilitation. Need for maintenance, types of maintenance, routine maintenance works in buildings.

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 Corrosion: 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, Half-cell potential measurement, Electrical resistivity measurement, Carbonation depth measurements, Petrographic Analysis, Electromagnetic methods for Rebar detection, Ground Penetrating radar, Infrared thermography, Radiography,

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)

Suggested Readings

1. Handbook on *"Repair and Rehabilitation of RCC Buildings"*, Published by Director General, CPWD, Govt. of India, 2002.
2. Varghese P. C. (2015), *Maintenance, Repair & Rehabilitation & Minor Works of Buildings*, PHI Learning Pvt. Ltd, Delhi.
3. Modi P.I. and Patel C.N. (2016), *Repair and Rehabilitation of Concrete Structures*, PHI Learning Pvt. Ltd, Delhi.
4. Peter H. Emmons and Gajanan M. Sabnis (2001), *Concrete Repair and Maintenance Illustrated*, Galgotia Publications, New Delhi.
5. SP: 25-1984, (1999), *Handbook on Causes and Prevention of Cracks in Buildings*, BIS, New Delhi.
6. 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
PE 407 CE	**HIGHWAY CONSTRUCTION AND MANAGEMENT**						**PE -V**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- Understand the material characterization for the use in pavement construction
- Review of various soil stabilized pavement layers
- Study of components of pavement distress evaluation and pavement management systems

Course Outcomes:

After completing this course, the student will be able to:

- Implement the method of construction and field control check for flexible pavement layers.
- Develop QA/QC procedures for monitoring the quality of pavement construction
- Perform mix design to identify the bearing capacity of soil stabilized pavement layers
- Apply modern devices for functional and structural evaluation of pavements
- Develop performance prediction models for pavement management systems

UNIT – I

Flexible Pavement Construction: Earthwork, compaction and construction of embankments, specifications of materials, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers and their choice.

UNIT – II

Cement Concrete Pavement Layers: Specifications and method of cement concrete pavement construction; Construction of interlocking block pavements, Quality control tests; Construction of various types of joints

UNIT – III

Soil Stabilized Pavement Layers: Principles of gradation/proportioning of soil-aggregate mixes and compaction; Design factors, mix design, construction control and quality control checks for mechanical, soil-cement, soil-bitumen and soil-lime stabilization methods. Use of additives, Numerical problems on mix design and applications.

UNIT – IV

Pavement Evaluation - Pavement Distress - Functional and structural condition of pavements, Pavement distress survey, Functional condition evaluation of pavements- Roughness, Skid Resistance. Structural evaluation of pavements - nondestructive testing, Benkelman beam and Falling Weight Deflectometer, Pavement strengthening based on deflection as per IRC, Maintenance and rehabilitation techniques.

UNIT – V

Pavement Management Systems - Pavement Management Systems Components, structure, data requirements, Project level and Network level needs, Pavement performance prediction – concepts, modelling techniques– AASTHO, CRRI and HDM models, Budget forecasting for maintenance and rehabilitation, Ranking and optimization methodologies, lifecycle costing.

Suggested Reading:

1. Yoder E.J, and Witczak M. W., "Principles of Pavement Design", John Wiley & Sons, 1975.
2. Kadiyali and Lal, "Principles of Highway Engineering", Khanna Publishers, New Delhi, 2006
3. Haas and Hudson W.R., "Pavement Management Systems", McGraw Hill Inc., USA, 1978.
4. Frank Harris, "Modern Construction Equipment & Methods", John Wiley & Sons, 2006
5. IRC related Codes for Flexible and Rigid Pavements design.

Course Code	Course Title						Core / Elective
PE 408 CE	**GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING**						**PE -V**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Surveying &Geomatics	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

The objectives of the course are:

- Learn the fundamental concept of Remote Sensing and know about different types of satellite and sensors
- Understand the concepts of GIS and its applications
- Learn to work with GIS software in various application fields

Course Outcomes:

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

- Classify different types of satellites and sensors used in remote sensing
- Illustrate the energy interactions with earth surface features and their spectral properties
- Demonstrate the basic concept of GIS and its applications, know different types of data representation in GIS
- Create the spatial data using various techniques
- Develop models using Spatial & Terrain Analysis

UNIT – I

Basics of Remote Sensing: Definition, History, Advantages, Aerial Photography and Satellite Remote Sensing, Components of Remote Sensing System: Energy Source, Energy-Atmosphere Interaction, Energy Interaction with Atmosphere and Surface Materials, Spectral Signatures

UNIT – II

Remote Sensing Platforms: Aircrafts and Satellites, Orbital Characteristics of Sun-synchronous and Geostationary satellites - Special Purpose 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.

UNIT – III

Introduction to GIS: History of development of GIS- Geo Spatial Data - GIS operations- Standard GIS packages, Applications of GIS;

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

UNIT – IV

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

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

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

UNIT – V

Terrain Modelling & Analysis: Contouring, Vertical profiling, Hill shading, 3D perspectives; Slope & Aspect analysis, Viewshed & watershed analysis. **Software:** Introduction to QGIS or ARCGIS software.

Suggested Reading:

1 Chang, K. T. (2016). Geographic information system. *International Encyclopedia of Geography: People, the Earth, Environment and Technology*, 1-10.

2 Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons.

3 Reddy, M. A., & Reddy, A. (2008). *Textbook of remote sensing and geographical information systems* (pp. 4-4). Hyderabad: BS publications.

OPEN ELECTIVE – II

Course Code	Course Title						Core / Elective
OE421ME	**ENTREPRENEURSHIP**						**OE -II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise & project management
- To understand the design principles of solar energy systems, their utilization and performance evaluation
- To understand the behavioral aspects of entrepreneurs and time management

Course Outcomes:

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

- Understand Indian Industrial Environment, Entrepreneurship and Economic growth, Smal and Large Scale Industries, Types and forms of enterprises.
- Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs Conception and evaluation of ideas and their sources.
- Practice the principles of project formulation, Analysis of market demand, Financial an profitability analysis and Technical analysis.
- Apply the concepts of Project Management during construction phase, project organizatio project planning and control using CPM, PERT techniques
- Understand the Behavioral aspects of entrepreneurs, Time Management,Various approache of time management, their strengths and weakness. The urgency addiction and tim management matrix.

Unit-I

Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.

Unit-II:

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

Unit-III

Project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis, project financing in India.

Unit-IV

Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques. Human aspects of project management. Assessment of

tax burden.

Unit-V

Behavioral aspects of entrepreneurs: Personality - determinants, attributes and models. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behavior. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix.

Suggested Reading:

1.Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House,1997

2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata McGraw-Hill Publishing Company Ltd. 1995.

3. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

4. G.S. Sudha, "Organizational Behaviour",1996.

5. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", Tata Me Graw Hill Publishing Company Ltd., 5lh Ed.,2005.

Course Code	Course Title						Core / Elective
OE402CE	**GREEN BUILDING TECHNOLOGIES**						**OE-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- Learn the principles of green building technologies and rating systems
- Understand the principles of effective energy and resources management in buildings
- Understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes:

After completing this course, the student will be able to

- Classifythevarious features, benefits, and rating systems for a green building
- Outline the criteria used for site selection and water efficiency methods
- Select the energy efficiency techniques in designing a green building
- Select materials for sustainable built environment & adopt waste management methods
- Identifyan appropriate methodfor maintaining indoor environmental quality in a green building

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.

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 (c) use of materials with recycled content such as blended cements 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 Well being: Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.

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

Suggested Readings:

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment
3. 'Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. 'Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004

Course Code	Course Title						Core / Elective
OE402CS	**DATA SCIENCE USING R**						**OE-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- To learn basics of R Programming environment: R language, R- studio and R packages.
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting.
- To learn Decision tree induction, association rule mining and text mining.

Course Outcomes:

Student will be able to

- Use various data structures and packages in R for data visualization and summarization.
- Use linear, non-linear regression models, and classification techniques for data analysis.
- Use clustering methods including K-means and CURE algorithm

UNIT – I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

Getting Started With R: Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using _As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT – II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

UNIT – III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression?, Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT – IV

Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Time Series In R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT – V

Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.
Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.
Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.
Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.
Frequent Itemset, Closed Itemset And Association Rules.
Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis**.**

Suggested Readings:

1. Data Analytics using R by Seema Acharya. McGraw Hill education.
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. 'The R book, Crawley, Michael J. John Wiley & Sons, Ltd

Course Code	Course Title						Core / Elective
OE403-IT	**CYBER SECURITY**						**OE-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Outcomes:

Student will be able to

- Understand different types of cyber-attacks
- Understand the types of cybercrimes and cyber laws
- To protect them self and ultimately the entire Internet community from such attacks

UNIT – I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance –Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT – II

Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial.

UNIT – III

Logical Design: Blue print for security. Security Policy, standards and Practices, Design of Security Architecture.

Physical Design: Security Technology, Physical Design of Security SDLC Firewalls, Dialup Protection, Intrusion Detection Systems, Scanning and analysis tools, and Content filters.

UNIT – IV

Cryptography: The basic elements of cryptography: symmetric (Symmetric Key-DES, IDEA, and AES), and public key cryptography (Public Key Encryptions-RSA).

UNIT – V

Message digest (MD-5, SHA), and digital signatures.

SSL and SET: SSL and SET protocols, Internet transactions using both SSL and SET.

Suggested Readings:

1. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security", Thomson, 2003.
2. William Stallings, "Cryptography and Network Security", Pearson Education, 2000.
3. Nina Godbole, "Information System Security", John Wiley & Sons, 2008.

Course Code	Course Title						Core / Elective
OE402EE	**TRANSDUCERS AND SENSORS**						**OE-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- To expose the students to various sensors and transducers for measuring mechanical quantities.
- To understand the specifications of sensors and transducers.
- To learn the basic conditioning circuits for various sensors and transducers.
- To introduce advances in sensor technology

Course Outcomes:

At the end of the course students will be able to

- Familiar with the basics of measurement system and its input, output configuration of measurement system.
- Familiar with both static and dynamic characteristics of measurement system.
- Familiar with the principle and working of various sensors and transducers

UNIT-I

Introduction to measurement system (MS) static characteristics of MS: linearity, Hysteresis, Threshold, Repeatability, Reliability and maintainability, Span, Calibration. Sensor Fundamentals: Basic sensor technology and sensor system Sensor characteristics, system characteristics, instrument selection, data acquisition and readout, and installation.

UNIT-II

Resistive Transducer: Classification of transducers, Basic requirements of transducers, Variable resistance transducers; Potentiometers, Strain gauge (SG), types of Strain Guage.

UNIT-III

Variable capacitive transducers: Capacitance, Principles, Capacitance displacement transducers, Capacitive hygrometer, and capacitive proximity transducers. Variable inductive transducers: Linear variable differential transformer, Rotary variable differential transformer.

UNIT - IV

Measurement of temperature: Standards for calibration of temp. Temperature measuring devices, types of filled in system thermometers — liquid in glass, vapour pressure, bimetallic on solid rod thermometer Resistance temperature detectors, thermostat thermocouple.

UNIT – V

Advance Sensors: Piezoelectric transducers and their signal conditioning, Seismic transducer and its dynamic response, photoelectric transducers, Hall effect sensors, Digital displacement sensors, Fibre optic sensor, Semiconductor sensor and Smart sensors.

Suggested Readings:

1. C.S.Rangan, G R Sarma& V S N Mani, Instrumentation Devices and Systems-TMH, 2nd Edition2004.
2. B.Nakra&Chowdhari, Instrumentation Measurement and Analysis, TMH, 2nd Edition 2003

3. D.V.S.Murthy, Transducers and Instrumentation, PHI, 1995 4. John P. Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education,2000.
4. Doebelin E.O, Measurement Systems - Application and Design, 4th Edition, McGrawHill, New Delhi.
5. PatranabisD, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill, New Delhi,1997.
6. Jon Wilson Sensor Technology Handbook, Newness PublicationElsevier.

Course Code	Course Title						Core / Elective
PR 401 CE	**SEMINAR (Based upon Summer Internship/ Mini Project)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	**-**	**-**	**2**	**25**	**-**	**2**

Course Objectives:

- Analyze a current topic of professional interest by conducting literature survey.
- Summarize and present the topic before an audience.
- Acquire skills in technical report writing

Course Outcomes:

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

- Understand the current needs of the industry.
- Understand techniques, processes and tools used in the industry.
- Prepare technical report on an industrial project
- Realize the importance of self-learning
- Present the technical experience at an industry or through the mini-project to a peer audience.

Course Plan

Seminar

Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and presenting the class.

Evaluation

(Evaluation of Technical Report should be based on the progress reported by the student and certified by the supervisor)

Seminar:25marks	Activity	**Weightage**
Distribution of marks	Presentation	**10**
	Ability to answer questions	**8**
	Report	**7**

Note: Two progress evaluations, mid semester and end semester, are mandatory
Allevaluationsaremandatoryforcoursecompletionandforawardingthefinalgrade.

Internship Guidelines (S*election of Summer Internships)*

1. Students should opt for summer internship 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. Summer internship can also involve data collection from different sources including generating experimental data, collection of data from field etc. Later on the student is required to analyze the data collected and arrive at meaningful conclusions.
3. Summer internship shall be aimed at solving some of the problems of the society/ local region that should have practical applications and benefit the society.

4. Students should devote full 3-4 weeks for summer internship. If any student undergoes internship duration is less than 3-4 weeks, such interns shall not be considered. If any credits are given to the internship program then student must register as per the course registration process.
5. Different central and state government organizations, CSIR labs, premier institutions like IITs and IIMs, DRDO, public sector undertaking organizations, top IT companies, skill enhancement centers recognized by state or central governments, research labs and Industries (small scale to large scale) can be considered for summer internships.
6. Students of individual institutions/colleges are permitted to undertake internships in their own campuses. However, in house (own campuses) internships are permitted with the prescribed guidelines.
7. Head of the department should allocate faculty members as advisors for all VI students at the end of V semester for advising the students in selecting proper summer internship. Entire process should complete by 31st March of every year.
8. Head of the department should depute faculty members for monitoring the student summer internship by communicating to the company guide.
9. The internship done by the student is assessed in two stages. i) External evaluation for 30 marks and internal evaluation for remaining 20 marks. HoD should constitute summer internship evaluation committee consisting of 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 summer internship if it doesn't meet the requirements of summer internships. Such students have to repeat the summer internship.
10. Individual department should send the recommended student list to the academic section/training and placement cell of the individual institution/college by second week of March for further proceedings. The list should contain the student basic details, concern faculty details, research areas, expected outcome of the internships. For this to happen, the students should submit the request letter through single window application processing system for further proceedings from the department and academic section/ training and placement cell.
11. 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 summer internships (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.
12. Maximum number of students allowed per faculty shall be decided by the individual department in consultation with Academic section.

Course Code	Course Title						Core / Elective
PW 401 CE	**PROJECT WORK - I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	**-**	**-**	**-**	**50**	**-**	**2**

Course Objectives:

- To develop skills in doing literature survey.
- To encourage students to work with innovative and entrepreneurial ideas.
- To enable project identification and execution of preliminary works on final semester project.

Course Outcomes:

- Analyze a current topic of professional interest and present it before an audience
- Identify an engineering problem, analyze it and propose a work plan to solve it
- Develop awareness of design methodologies & its implementation
- Acquire skills in technical report writing
- Prepare a preliminary report and present it before an audience.

Project preliminary:

Identify suitable project relevant to the branch of study. Form project team (not exceeding four students). The students can do the project individually also. Identify a project supervisor. Present the project proposal before the internal departmental committee comprising of Head of the Department, faculty coordinator, faculty supervisor(s) and at least two faculty members (excluding the external expert) and get it approved by the committee.

The preliminary work to be completed:

(1) Literature survey
(2) Formulation of objectives
(3) Formulation of hypothesis/design/methodology
(4) Formulation of work plan (5) Seeking funds
(6) Preparation of preliminary report

Note: The same project initiated in Project Work-I should be continued and completed in the VIII semester as Project Work –II by the same project team.

Evaluation

Evaluation of Project-1 should be based on the progress reported by the student and certified by the supervisor. Evaluation is done based on the students presentation, twice in the semester ie. mid semester evaluation and end semester evaluation. Sessional marks are awarded by the evaluation committee comprising of two faculty members and the supervisor. Marks are allotted based on the students presentation, Report preparation and students ability to answer the questions raised by the examiners.

Distribution of marks	Activity	Weightage
Mid semester evaluation (25)	Supervisor	**10**
	Examiners	**15**
End semester evaluation (25)	Supervisor	**10**
	Examiners	**15**

Note: Two progress evaluations, mid semester and end semester, are mandatory. All evaluations are mandatory for course completion and for awarding the final grade.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI – Semester (CIVIL ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC331CE**	Environmental Engineering	3	-	-	3	30	70	3	3
2	**PC332CE**	Estimation and Specifications	3	-	-	3	30	70	3	3
3		Professional Elective – 1	3	-	-	3	30	70	3	3
4		Professional Elective – 2	3	-	-	3	30	70	3	3
5		Professional Elective – 3	3	-	-	3	30	70	3	3
6	**OE**	Open Elective – 1	3	-	-	3	30	70	3	3
7		Open Elective – 2	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	**PC361CE**	Environmental Engineering Lab	-	-	2	2	25	50	3	1
9	**PC362CE**	Computer Aided Civil Engineering Drafting, Analysis & Design Lab	-	-	2	2	25	50	3	1
10	**PC363CE**	Hydraulics Laboratory	-	-	2	2	25	50	3	1
			21	**-**	**06**	**27**	**285**	**640**		**24**

Professional Elective – 1			**Professional Elective –3**		
S. No.	**Course code**	**Course title**	**S. No.**	**Course code**	**Course title**
1	**PE301CE**	Design of Hydraulic Structures	1	**PE309CE**	Steel Structures
2	**PE302CE**	Structural Analysis –II	2	**PE310CE**	Ground Water Engineering
3	**PE303CE**	Foundation Engineering	3	**PE311CE**	Geotechnical Design
4	**PE304CE**	Railway And Airport Engineering	4	**PE312CE**	Environmental Impact Assessment of Transportation Projects

Professional Elective – 2

S. No.	Course code	Course title
1	**PE305CE**	Design of Concrete Structures-I
2	**PE306CE**	Traffic Engineering and Management
3	**PE307CE**	Sustainable Construction Methods
4	**PE308CE**	Open Channel Flow & River Engineering

Open Elective – 1			Open Elective – 2		
S. No.	**Course code**	**Course title**	**S. No**	**Course code**	**Course title**
1	**OE350CE**	Remote Sensing & Geographical Information	3	**OE352CE**	Principles of Green Building Practices
2	**OE351CE**	Road Safety Engineering	4	**OE353CE**	Disaster Mitigation & Management

PC: Professional Course **PE**: Professional Elective **OE**: Open Elective
L: Lectures T: Tutorials Pr : Practical Drg: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note: 1) Each contact hour is a Clock Hour
*2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Course Code	Course Title						Core / Elective
PC331 CE	**ENVIRONMENTAL ENGINEERING**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Fill the gap between general introductory environmental science and the more advanced environmental engineering
2) Explain the different sequential unit operations of water and wastewater treatment processes
3) Provide necessary engineering principles for analyzing the environmental issues
4) Motivate the present and future generations to take suitable care of sustainability of all existing resources

Course Outcomes

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

1) Forecast water demands for water supply in the societal context.
2) Design environmental engineering systems including the considerations of risk and environmental impacts.
3) Characterize sewage systems and design sewers and appurtenances
4) Understand and design sludge disposal systems and septic tanks
5) Categorize air and noise pollution impacts and standards

UNIT -I

Water supply: Objectives of protected water supplies, rate of demand, population forecasts, surface and ground water sources of water, analysis of water, Classification, description, and design of Coagulation, flocculation, and sedimentation processes.

UNIT –II

Classification, description, and design of filtration, disinfection, and softening processes, Methods of layout of distribution pipes, Design of distribution by Hardy Cross method for simple net works.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/recycle, energy recovery, treatment and disposal)

UNIT-III

Wastewater engineering: Definitions, system of sewerage, shapes of sewers, hydraulic formulae for design of sewers, sewer appurtenances, traps, B.O.D. and C.O.D., self purification of stream methods of disposal of sewage.

UNIT-IV

Treatment of Sewage: Principles and design of screens. grit chambers. Detritus tanks. Sedimentation tanks. Contact beds. Trickling filters. and activated sludge process. Methods of sludge disposal. Sludge digestion tanks. Principles and design of septic tanks

UNIT – V

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

Noise Pollution: Impacts of noise. Permissible limits of noise pollution. Measurement of noise

and control of noise pollution.

Suggested readings:

1. *Fair. G. M. and Geyer. J. C. 'Water and Wastewater Engineering', vol. I and II, John Wiley & ,Sons Inc., New York, 2010.*
2. *White. J.B .. 'Wastewater Engineering', Edward Arnold. London, 1978*
3. *Hammer. M. J. and Hammer. M. J. Jr., 'Water and Wastewater Technology', Prentice-Hall of India Pvt. Ltd., New Delhi, 1998*
4. *Metcalf & Eddy. 'Wastewater Engg; treatment, disposal reuse', Tata McGraw- Hill Publishing Company Limited, New Delhi,1995*
5. *Sasi Kumar, K & Sanoop Gopi Krishna., 'Solid waste Management', PHI Publishers, 2013*
6. *Gilbert, M. Masters , 'Introduction to Environmental Engineering and Science', Prentice-Hall of India Pvt. Ltd., New Delhi, 1995*

Course Code	Course Title						Core / Elective
PC307 CE	**ESTIMATION COSTING AND SPECIFICATIONS**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**2**	**30**	**70**	**3**

Course Objectives

1) Understand the basic principles and specifications for estimations
2) Know the basic procedures for Tenders and Tender documents
3) Understand the detailed estimation of buildings, roads and Irrigation structures

Course Outcomes

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

1) Prepare and document for detailed specification of Civil works
2) Prepare tender documents
3) Prepare estimates for various Civil Engineering structures
4) Finalize Estimates for Irrigation structures
5) Perform valuation of Civil Engineering structures.

UNIT -I

Basic principles and specifications: General and detailed specifications of works. Departmental procedures to the construction works. Types of estimates, various types of contract, turnkey projects, essentials of contracts and conditions of contracts, Schedule of rates, standard data, rate analysis, Bill of quantities.

UNIT –II

Tenders and Documentation: Tenders, preparation of tenders, tender documentation, Tender notice, work order, Earnest money deposit, and security money deposits, comparative statements, additional conditions mentioned by tender, and those implications. Measurement book and muster roll, advances in tender procedures. National bidding/International bidding/Shopping. BOT, BOOT and PPP projects. Role of IT in tenders and construction industry.

Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management

UNIT-III

Estimation of Buildings and roads: Traditional residential buildings. advanced buildings (earth work. footings, columns, beams and slabs etc) by long wall and short wall method and centre line method, bar bending schedules, estimation of reinforcement quantities, Estimation of road works using levels (Cross sections and longitudinal sections). Preparation of estimates using computer software/excel sheets/available software's, Introduction to MS project.

UNIT-IV

Estimation of Irrigation Structures: Pipe culvert, Slab culvert. Irrigation canal including

earth work (cutting and banking), Retaining walls, overhead Water tank

UNIT-V

Valuation: Basic – Principles of valuation – Value and Cost – value engineering – value analysis – phases in value engineering – information – function – escalation – evaluation – recommendation implementation

Settlement of disputes, R.A. Bill & Final Bill, Payment, Introduction to Acts pertaining to- Minimum wages, Workman's compensation, Arbitration, Easement rights.

Suggested readings:

1. *Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016*
2. *Chakraborthi, M. (2010). "Estimating, Costing, Specification and Valuation in Civil Engineering 24th Edition, M. C. Chakraborthi, Kolkata.*
3. *Jagjit Singh. (1996). "Estimating and Costing in Civil Engineering." Galgotia publications, New Delhi.*
4. *Relevant Indian Standard Specifications.*
5. *World Bank Approved Contract Documents.*
6. *FIDIC Contract Conditions.*
7. *Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration*
8. *Typical PWD Rate Analysis documents.*

Course Code	Course Title						Core / Elective
PE301CE	**DESIGN OF HYDRAULIC STRUCTURES**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Hydrology and Water Resources Engineering	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Develop the understanding of basic principles and concepts of analysis and design of hydraulic structures
2) Understand design of weirs and barrage, regulation works, dams, canals and various river training works.
3) Provide the detailed insight into the theories of diversion works

Course Outcomes

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

1) Assimilation of the various concepts of reservoirs and design of gravity dams
2) Design the main sections of earth dams.
3) Determine Energy dissipation through spill ways
4) Application of design aspects of different types of weirs and regulatory systems
5) Usefulness of cross drainage works; canal falls and its design.

UNIT-I

Types of reservoirs: Selection of site, Storage capacity analysis, Reservoir sedimentation, Flood routing through retarding basin.

Gravity dams: Types of dams, advantages & disadvantages, selection criteria, forces acting on gravity dam, failures of gravity dam, Stability of gravity dams, principal and shear stresses, elementary and practical profiles of a gravity dam, economical height of dam, high and low gravity dams, functions, and types of galleries in gravity dams

UNIT-II

Earth Dams: Types, methods of construction, failures of earth dam, Criteria for the safe design of an earth dam, computation of seepage from flow net, phreatic line in an earth dam (for homogeneous sections with and without filter cases), design of earth dams to suit available materials, embankment and foundation seepage control measures, drainage in embankment, various types of filters

UNIT-III

Spill ways & Energy Dissipation: Types of Spill ways, ogee spill ways, design of Ogee profile, fixation of levels, siphon spill way & chutes spill way. Energy Dissipaters, Hydraulic jump & Bucket type dissipaters, Tail water rating curve & jump height curve.

UNIT-IV

Diversion Headworks: component parts of diversion headworks, types of weirs, causes of failures of weirs, remedial measures, Bligh's and Khosla's theories, design of vertical drop weir, and sloping glaciers weir.

UNIT-V

Canal Falls: Definition, location, types of falls, design of trapezoidal notch fall, cylinder fall, vertical drop fall and glacis fall.

Regulators and Modules: Head regulator and cross regulators, canal escapes

Cross drainage works: Definition, classification, design of aqueducts, siphon aqueducts, super passages, and canal siphons, inlets and outlets-selection of cross drainage works.

Suggested readings:

1. *Punmia Punmia, B.C., Pande B. and Lal, B., "Irrigation and Water Power Engineering", 16th edition, Laxmi Publications, 2016.*
2. *S.K.Garg, "Irrigation Engineering and Hydraulic Structures", 35th edition, Khanna publishers,2016*
3. *Modi P.N., "Irrigation and Water Resources and Water Power Engineering", Standard Book House, 2014*
4. *S.K.Sharma, "Irrigation Engineering & Hydraulic Structures" S.Chand Publishers, New Delhi 2016.*
5. *U.S.Bureau of Reclamation, "Design Manual for Concrete Gravity Dams", Denver, 1976.*
6. *U.S.Army Corps of Engineers, "Engineering and Design", CECW-ED Publications, 1995*
7. *Wurbs, R A. and James, W.P., "Water Resources Engineering", Prentice-Hall of India, New Delhi, 2002.*

Course Code	Course Title						Core / Elective
PE361CE	**STRUCTURAL ANALYSIS –II**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Structural Analysis	**3**	**1**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Illustrate the matrix methods of structural analysis for computer applications.
2) Analyze and evaluate Beams, Trusses and structural frames through stiffness matrices an Flexibility matrices.
3) Able to understand basics of FEM & development of structural engineering software.
4) 2D frames analysis by approximate methods

Course Outcomes

1) Develop flexibility matrix to calculate the Redundant forces and sketch the BMD and SFD.
2) Develop Stiffness matrix to calculate the displacement of joints and sketch the BMD and SFD.
3) Develop Direct Stiffness matrix for different elements and obtain member displacements and member end forces.
4) Analyze the frames using approximate methods of Analysis.
5) Understand the Basic concept of Finite Element Method.

UNIT – I

Flexibility Matrix Method: Determination of Static and kinematic indeterminacy – Equilibrium and compatibility conditions-Principles of superposition, Application of Flexibility Matrix Method to continuous beams, plane trusses, plane frames and ortho grid structures (Static indeterminacy not exceeding three) subjected to Concentrated forces, Uniform forces and Concentrated Moments - Effect of temperature, Lack of fit.

UNIT – II

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

UNIT – III

Direct Element Method: Application of direct element method to problems of axially loaded bars, continuous beams, plane trusses and plane frames (Degree of freedom not exceeding three). Introduction to Structural Analysis software packages.

UNIT – IV

Approximate methods of Analysis:

Substitute Frame Method: Substitute frame, Application of Substitute frame method of analysis of frames subjected to transverse loading. Arrangement of Live loads as per IS 456 – 2000.

Analysis of Frames subjected to Lateral loads: Analysis of Building frames subjected to Lateral loads, Portal method and Cantilever method.

UNIT-V

Introduction to Finite Element Method: Types of Problems, Types of Materials, Types of Forces, Equations of equilibrium for 3-D Continua. Variational approach, Rayleigh-Ritz method, FEM application to one dimensional element, shape function. Introduction to FEM structural engineering softwares.

Suggested readings:

1. *J. M. Gere & William Weaver, "Matrix Analysis of Framed Structures", 2nd Ed., D Van Nostand, New Jersey,1980.*
2. *D.S. Prakash Rao, "Structural Analysis - A Unified Approach", University Press,1996*
3. *G .S, Pandit, S. P. Gupta and R. Gupta, "Theory of Structures", – Vol. I & II, Tata McGraw Hill, New Delhi,1999.*
4. *C.S.Reddy,"Basic Structural Analysis", Tata McGraw-Hill Publishing Co. Ltd., 3rd Edition, New Delhi,2010.*
5. *C.S. Krishna Moorthy, Finite Element Analysis, McGraw Hill,1991.*
6. *S.S.Bhavikatti,"Structural Analysis" – Vol. I & II, Vikas publication House Pvt. Ltd., 4thEdition, 2011.*
7. *Ramamrutham. S., "Theory of Structures", Dhanpath Rai& Sons, New Delhi,2014.*
8. *S.S. Bhavakatti, Finite Element Analysis, New Age International Publishers,2005.*

Course Code	Course Title						Core / Elective
PE303CE	**FOUNDATION ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Learn the definition, necessity, types and suitability of different foundation systems.
2) Understand the procedures of geotechnical design of foundations.
3) Understand the necessity and usage of different foundation construction related aspects.
4) Learn about different methods of geotechnical investigations and its role in selection and design of foundations.

Course Outcomes

After Completion of this course, the student will be able to

1) Understand the stress distribution in soils.
2) Calculate bearing capacity of shallow foundation.
3) Design pile foundation and machine foundation.
4) Understand soil explorations
5) To learn various aspects of foundation.

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 construction period) – Permissible uniform & differential settlements – Proportioning of footings.

UNIT- III

Pile Foundations: Necessity – types based on load transfer mechanism / material / method of installation / functional use – 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 Principles of Pile Foundations- Concept of Piled raft foundation.

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

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

UNIT- V

Foundation construction related aspects.

Timbered / braced excavations: Necessity - methods – suitability – distribution of pressure – reaction of struts.

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

Coffer dams: necessity – types – suitability

Underpinning: Necessity – methods (pin / pile) - suitability

Geosynthetics: Classification – functions – applications.

Suggested readings:

1. *Joseph E.Bowles,"Foundation analysis and Design", McGraw-Hill Publications, 2001.*
2. *Das, Braja M. "Principles of Foundation Engineering", cengage Publications, 2013*
3. *Arora, K.R., "Soil Mechanics & Foundation Engineering" Standard Publications, 2009.*
4. *Varghese, P.C,. "Foundation Engineering", PHI Publications, 2005.*

Course Code	Course Title						Core / Elective
PE304CE	**RAILWAY AND AIRPORT ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Impart knowledge on railway engineering.
2) Understand Geometry and layout concepts of Railway systems
3) Understand Airport Planning concepts

Course Outcomes

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

1) Understand element of permanent way and application of principles of geometric design railway track
2) To perform Engineering Surveys and geometric design of railway track.
3) Understand basic elements of turnarounds and signal in railways
4) Understand basic element of airport engineering and application of basic design concepts of runway alignment
5) Make preliminary design of Runways for airports including surface and subsurface drainage.

A: RAILWAY ENGINEERING

UNIT – I

Components of Railway Engineering: Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings

Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT – II

Geometric Design of Railway Track: Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

UNIT-III

Turnouts & Controllers: Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing. Signal Objectives – Classification – Fixed signals – Stop signals – Signaling systems – Mechanical signaling system – Electrical signaling system – System for Controlling Train Movement – Interlocking – Modern signaling Installations.

B.AIRPORT ENGINEERING

UNIT-IV

Airport Planning & Design: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids

and Air traffic control.

UNIT – V

Runway Design: Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

Suggested readings:

1. *R. Srinivasa Kumar, Transportation Engineering (Railways, Airport, Docks Harbour), Universities Press, 2014.*
2. *Chandra, S. and Agarwal, M.M., Railway Engineering, Oxford Higher Education,2nd Edition, University Press New Delhi, 2007*

Course Code	Course Title						Core/ Elective
PE305 CE	**DESIGN OF CONCRETE STRUCTURES-I**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	**T**	**L**	**T**			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

The Objective of This Course is to

1) Provide a good understanding of advanced concrete design.
2) Provide Hands- on- experience and skills to designing structural elements.
3) Develop an understanding of real-world design problems.

Course Outcomes

After Completion of this course, the student will be able to

1) Design and detailing Reinforced concrete flat slab.
2) Design and detailing of combined footings and retaining walls.
3) Design and detailing of Beams Curved in plan and deep Beams
4) Design and detailing of Ground level and overhead Water Tank.
5) Design and detailing of Portal Frame and Building frame.

UNIT- I

Design of Solid Slab: Design of Simply Supported and Restrained Two way Slabs using IS code method.

Design of Flat Slab: Types of Flat Slab, IS code Provision, Analysis and design of Flat Slab (Without and with Drop in Slab), Using Direct Design Method and Equivalent frame method.

UNIT- II

Design of Footing: Types of Footings, Introduction of Isolated footing, Combined Footing, Raft Foundation and Pile Foundation.

Design and Detailing of Isolated Rectangular, Square and Circular Footings, Design of Combined Rectangular and Trapezoidal Footings.

UNIT- III

Retaining Walls: Design and Detailing of Cantilever and Counter fort Retaining Walls.

Beams Curved in Plan: Introduction, design Principle, design of beams curved in plan of circular and semicircular.

UNIT – IV

Water Tanks: Introduction, Types of water tanks, Elastic Design and Detailing of R.C.C. Circular and Rectangular Ground level and overhead water tanks using IS code method.

UNIT- V

Portal Frames: Introduction, Analysis and design of rectangular portal frames including hinges at the base.

Building Frames: Substitute frame method of Analysis for building frames, Analysis and Design of frames with single bay two storeyed and two bay single storeyed.

Suggested readings:

1. *N. Krishna Raju, "Advanced Reinforced Concrete Design", CBS Publisher*
2. *H. J. Shah, "Reinforced Concrete" Volume II, Charotar Publications*
3. *B. C. Punmia, "RCC Design", Laxmi Publications*.

Course Code	Course Title						Core / Elective
PE306CE	**TRAFFIC ENGINEERING AND MANAGEMENT**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) To set a solid and firm foundation in traffic engineering management,
2) Provide concepts of traffic regulation and highway capacity,
3) Teach principles of design and introduction of traffic flow theory.

Course Outcomes

This course will enable students will be able to

1) Learn advanced topics in traffic engineering and management
2) Design hourly traffic volume including mixed traffic conditions
3) Understand the concept of highway capacity
4) Perform Accident analysis
5) Apply Queuing theory for traffic flow and understand traffic management systems

UNIT – I

Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection.

UNIT – II

Design Hourly Volume For Varying Demand Conditions: Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, and demand functions. Determination of design hourly volume; critical hour concept.

UNIT-III

Highway Capacity: Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalized intersections. Problems in Mixed Traffic flow; Case studies.

UNIT-IV

Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions.

UNIT – V

Traffic Flow Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications.

Traffic Management: Traffic System Management (TSM) and Travel Demand Management(TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes.

Suggested readings:

1. *Kadiyali L.R,. Traffic Engineering and Transport planning, 9th Edition, Khanna Tech Publishers, 2013.*
2. *C.E.G.Justo, A. Veeraragavan and S.K.Khanna, Highway Engineering, 10th Edition, Nem Chand Publishers, 2017.*
3. *Donald Drew, Traffic Flow Theory Chapter 14 in Differential Equation Models, Springer, 1983*
4. *Martin Whol, Brian V Martin , Traffic system Analysis for Engineers and Planners, McGraw Hill, 1967*
5. *Highway Capacity Manual, TRB Publications.*

Course Code	Course Title				Core / Elective		
PE307CE	**SUSTAINABLE CONSTRUCTION METHODS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) To be able to understand the significance of modular construction methods.
2) To study and understand the properties of sustainable building materials used in construction
3) To get a complete overview of various kinds of sustainable building rating systems and how they are used in the construction industry.
4) To be able to analyze productivity and economics in construction techniques.

Course Outcomes

On completion of this course, students are able to:

1) Understand the role of project management strategies in sustainable construction.
2) Understand the limitations of construction techniques.
3) Implement modular construction practices.
4) Understand reliable proportioning concepts in construction techniques
5) Understand and document building rating system based on Green building concept

UNIT – I

Modular Construction Practices - Introduction to formwork - requirements of formwork, loads carried by formwork, types of formwork -timber, steel, slip forms, scaffolding. Modular construction - modular coordination, modular standardization, modular system building, modular shuttering, limitation and advantages of modular construction

Unit-II

Basic Construction Methods – Construction of foundation and super structure - buildings - precast concrete structures, bridges - steel bridges, arch bridges, cantilever bridges segmental construction, box girders. Construction of special type of bridges such as cable stayed bridge, suspension and pre-stressed bridge.

UNIT – III

Sustainable Construction Materials – Overview of cutting-edge sustainable energy -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

Innovative Methods of Construction – Slip form technology, jump form technology, aluminum form technology, tunnel form technology, dry wall technology, plastering machines.

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.

Suggested Reading

1. *Roy Chudley, Construction Technology - Vol. 1, 1st Edition, Pearson Education, 2014.*
2. *Robert Peurifoy, Clifford J. Schexnayder and Aviad Shapira, Construction Planning, Equipment and Methods, McGraw Hill Publication, 2010.*
3. *Relevant books on Construction Engineering, NICMAR Publications*
4. *Manuals, brochures, publications from construction companies, firms etc.*
5. *Reports of actual works executed.*
6. *Kumar Niraj Jha, Formwork for Concrete Structures, McGraw Hill Publication, 2017.*
7. *Allen Edward and Iano Joseph, Fundamentals of Building Construction: Material and Method, 6th Edition, John Wiley and Sons, 2013.*
8. *Sustainable Engineering Practice ASCE Publication 2010.*

Course Code	Course Title						Core / Elective
PE308CE	**OPEN CHANNEL FLOW & RIVER ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Hydraulic Engineering	3	0	0	0	**30**	**70**	3

Course Objectives

1) To develop a basic knowledge of open channel flow relationships by applying fluid properties, hydrostatics, and the conservation equations for mass, momentum, and energy
2) To gain proficiency in applying the conservation equations to open channel flow problems.
3) Knowledge about River Morphology, river protection and river restoration.

Course Outcomes

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

1) Ability to develop the open channel flow equations from the basic conservation equations.
2) Have knowledge basics of numerical methods and fluid mechanics.
3) Competent in understanding flood routing in Channel networks.
4) Knowledge about physical river models
5) Design of river training works and flood protection structures.

UNIT-I

This course should discuss how to analyze for unsteady flows in open channels; Derivation of 1-D and 2-D shallow water flow equations; Consideration for non- hydrostatic pressure distribution

UNIT-II

Basics of numerical methods Finite-Difference methods Latest shock capturing Finite Volume methods for solving 1-D and 2-D shallow water flow equations

UNIT-III

Dam break flow, Flood routing in large channel networks

UNIT-IV

Knowledge about river behavior is essential for practicing hydraulic and water resources engineers. River Morphology (Bars; Bends and Meanders, Thalweg; Braiding; Bifurcations etc.); Sediment Transport Mechanics (Bed forms, Bed Load transport, Transport of suspended sediment, Critical Shear stress, Sediment Transport Equations); Aggradation and Degradation; Local Scour at Bridge Piers and other Hydraulic Structures.

UNIT-V

Measurements in Rivers (Stage measurements, Channel geometry, Discharge, Sediment samplers and suspended and bed load measurement), Physical river Models (fixed and movable bed models; sectional models, distorted Models), Mathematical models for aggradations, degradation and local scour, River Protection and Training Works (Revetments, Dikes, Gabions, Spurs, Bank Protective measures and Bed control structures), river training works and flood protection structures, Diversion and Cofferdams; River regulations systems; Dredging and Disposal, River restoration.

Suggested readings:

1. *K. Subramanya, Open channel Flow, Tata McGraw Hill, 2015.*
2. *Ven Te Chow, Open Channel Hydraulics, Tata McGraw Hill, 2009.*
3. *Bansal, R. K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2018.*
4. *Modi P. N. & Seth S. M., Hydraulics & Fluid Mechanics, Standard Book House. 2018.*
5. *S K Garg, River Engineering, 1st Edition, Khanna Publications, 2018.*
6. K D Gupta, *River* Engineering, 1st Edition, Vayu Education of India, 2014.

Course Code	Course Title						Core/ Elective
PE309 CE	**STEEL STRUCTURES**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

The Objective of This Course is to

1) Know the IS code provisions as applicable for the designs.
2) Understand the material behavior and basics of design of steel structures.
3) Learn the design of various members along with the connections.
4) Explain the design principles of roof trusses

Course Outcomes

After Completion of this course, the student will be able to

1) Learn IS code provisions and basics of design of steel structures.
2) Design the different types of bolted and welded connections.
3) Design tension members of an steel structure.
4) Design a laterally supported and unsupported steel beam.
5) Design a compression members and roof trusses

UNIT- I

Materials and Specifications: Chemical composition of steel, types of Structural Steel, Residual stresses, Stress Concentration.

Basis of Structural Design: Codes and Specifications, Design Philosophies, working Stress Method, Limit State Method.

Loading and Load Combinations: Characteristic Loads, Dead Loads, Imposed Loads, Earthquake Loads, Wind Loads and Load Combinations. Partial safety factors for materials and loads.

Bolted Connections (Limit state method): Bolted Connections, Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, Design Strength of High Strength Friction Grip Bolts, Pin Connections, Simple Connections and Eccentric Connections.

Welded Connections (Limit State Method): Advantages of Welding, Types of Welds and Joints, Simple Connections and Eccentric Connections.

UNIT- II

Working Stress Method: Permissible Stresses, Slenderness Ratio, Net Area of Cross Section, Design of tension members, Design of Simple Compression Members.

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 Beams (Limit State Method): Types of Beams, Section Classification, Lateral Stability of Beams, Buckling of Real Beams, Behavior 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, Biaxial Bending and Unsymmetrical Bending.

UNIT – IV

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 Colum

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)

Suggested readings:

1) *Subramanian. N, Design of Steel Structures, Oxford University Press, 2008.*
2) *Duggal S.K., Design of Steel Structures, 3rd Edition, Tata McGraw Hill Publishing, 2017.*
3) *Shiyekar M.R.,Limit State Design in Structural Steel, 2nd Edition, PHI Learning Pvt. Ltd., 2013.*
4) *Bhavikatti, S.S., Design of Steel Structures, 5th Edition, I.K. International Publishing House Pvt. Ltd. 2017.*
5) *P. Dayaratnam, Design of Steel Structures, S. Chand & Co. New Delhi, 2012.*
6) *Indian Standard Code – IS : 800-2007*

Course Code	Course Title						Core / Elective
PE310CE	**GROUND WATER ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Hydrology & WR Engineering	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Introduction to well hydraulics problems and perspectives of ground water
2) Knowledge about various investigations related to ground water
3) Quality and management of ground water

Course Outcomes

After Completion of this course, the student will be able to

1) Understand the porous medium properties that control groundwater flow and transport, including porosity, hydraulic conductivity and compressibility.
2) Apply groundwater flow equations to confined and unconfined aquifers.
3) Understand Surface and Subsurface investigations for ground water
4) Derive effective hydraulic conductivity for various cases of heterogeneous subsurface formations.
5) Understand about groundwater quality recharge and salt water intrusion

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

Suggested readings:

1. *D.K.Todd, Ground Water Hydrology, John Wiley & Sons, Inc., USA.*
2. *H.M.Ragunath, Ground Water, Wiley Eastern Limited, New Delhi.*
3. *K.P.Karnath, Ground Water Ananment, Development and Management, Tata McGraw Hill Publishing Company New Delhi.*
4. *Walton, Ground Evaluation and Management, McGraw Hill.*
5. *Bouwer, Ground Water Hydrology McGraw Hill.*

Course Code	Course Title						Core / Elective
PE311CE	**GEOTECHNICAL DESIGN**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) To understand the objectives, necessity and scope of ground improvement techniques
2) To learn different methods of in situ densification of cohesive, cohesion less soils
3) To learn the classification, functions and applications of Geosynthetics in ground improveme
4) To appreciate different types of geosynthetic products and the functions served by each.
5) To understand the applications of geosynthetics in various civil engineering fields

Course Outcomes

After Completion of this course, the student will be able to

1) Ability to understand the necessity of ground improvement and potential of a ground for improvement.
2) To gain comprehensive understanding about the improvement of in situ cohesive soils as well as Cohesion less soils.
3) Comprehend different properties and test methods of geotextile & manufacturing process and design process of geosynthetic
4) Describe the different properties and test methods of geogrid and geonet.
5) Design geo-composites for basic functions like separation, reinforcement and so on.

UNIT- I

Introduction: Need for ground improvement, applications, and factors affecting - different mechanical, chemical, static and dynamic techniques - mechanical stabilization - blending of aggregate - Rothfunt's - Testing.

Chemical Stabilization: Lime, cement, bitumen, factors influencing -Design approach, construction procedure, laboratory testing, and additives. Suspension and solution grouts, principles, methods, equipment, applications, compaction grouting, jet grouting.

UNIT- II

Cohesionless Soils: In situ densification, vibro techniques -Mechanisms. Factors affecting, suitability number, compacting piles. Vibro replacement process.

Cohesive Soils: In situ densification, Pre-loading - Dewatering - sand drains. Sandwicks, geodrains, ropedrains, band drains-stone columns, lime piles - thermal and vacuum methods.

UNIT- III

An Overview of Geosynthetics: Introduction – Classification & basic description of Geosynthetics – manufacturing process – Over view of Geotextiles, Geogrids, Geonets, Geomembranes and Geocomposites.

Design Methods: Design by cost & availability – Design by specification – Design by function.

UNIT – IV

Geotextile Properties and Test Methods: Physical, Mechanical, Hydraulic, Endurance and Degradation properties.

Designing with Geotextiles: Geotextile functions and mechanisms – Designing for separation – Designing for reinforcement – Designing for stabilization – Designing for filtration – Designing for drainage – designing for multi functions.

UNIT- V

Designing with Geogrids: Designing for geogrid reinforcement, Geonets Properties and Test methods: Physical, Mechanical, Hydraulic, Endurance and Environmental properties.

Designing with Geonets and Geocomposites: Designing for geonet drainage- Geocomposites for separation – reinforcement – filtration – drainage – liquid/ vapour barriers, Construction Methods & Techniques Using Geosynthetics.

Suggested readings:

1. *J.E. Bowles, Foundation Design & Analysis,5th Edition, McGraw-Hill Edition, 2001.*
2. *P. Purushottam Raj, Ground Improvement Techniques, 2nd Edition, Laxmi Publications.2016*
3. *F. S. Fang, "Handbook of Foundation Engineereing",2nd Edition, Springer, 1991.*
4. *Rao, G.V. and Raju, G.V.S.S., Engineering with Geosynthesis, Tata McGraw-Hill Pub. Co., 1998*
5. *Robert M. Koerner, Designing with Geosynthetics, 6th Edition, Prentice Hall, 2012.*
6. *Manoj Datta and Gulati, S.K., "Geotechnical Engineering" 1st Edition, McGraw Hill Education (India), Pvt. Ltd., 2017.*

Course Code	Course Title						Core / Elective
PE312CE	**ENVIRONMENTAL IMPACT ASSESSMENT OF TRANSPORTATION PROJECTS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Explain the concepts of environmental impact assessment and apply in the projects.
2) List and define various indicators such as terrestrial subsystems, Indicators aquatic subsystems, Socio-economic and able to Select various indicators for EIA studies.
3) Explain the impacts of transportation related components on environment
4) Explain and illustrate the methodologies for environmental impact assessment

Course Outcomes

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

1) Describe the environmental imbalances, indicators and explain the concept of EIA
2) Identify and describe elements to be affected by the proposed developments and/or likely to cause adverse impacts to the proposed project, including natural and man-made environment;
3) Identify the negative impacts and propose the provision of infrastructure or mitigation measures
4) Assess the impacts of various development on environment
5) Summarize the methodologies for carrying out environmental impact assessment

UNIT - I

Introduction: Environment and its interaction with human activities - Environmental imbalances - Attributes, Impacts, Indicators and Measurements - Concept of Environmental Impact Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitations of EIA

The Environmental Protection Act, Pollution Act, Motor Act.

UNIT – II

Environmental Indicators: Indicators for climate - Indicators for terrestrial subsystems - Indicators for aquatic subsystems - Selection of indicators - Socio-economic indicators - Basic information - Indicators for economy - Social indicators - Indicators for health and nutrition - Cultural indicators - Selection of indicators.

UNIT-III

Environmental Impact Assessment for Transportation Projects: Basic Concepts, Objectives, Transportation Related Environmental Impacts – Vehicular Impacts – Safety & Capacity Impacts – Roadway Impacts – Construction Impacts, Environmental Impact Assessment – Environmental Impact Statement, Environment Audit, Typical case studies

UNIT-IV

Environmental Issues in Industrial Development: On-site and Off-site impacts during various stages of industrial development, Long term climatic changes, Green house effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways, Mining and Energy development

UNIT – V

Methodologies for Carrying Environmental Impact Assessment: Overview of Methodologies, Adhoc Checklist, Matrix, Network, Overlays, Benefit Cost Analysis, Choosing a Methodology.

Environmental Audit & Environmental legislation: objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

Suggested readings:

1. *Jain, R.K., Urban, L.V., Stracy, G.S., (1991), "Environmental Impact Analysis", Van Nostrand Reinhold Co., New York*
2. *Rau, J.G. and Wooten, D.C., (1996), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York*
3. *Canter, L.W., (1997), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York*
4. *Grand Jean, E. Gilgen A., "Environmental Fact ors in Urban Planning", Taylor and Francis Limited, London, 1976.*
5. *UNESCO, (1987), "Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development", UNESCO/UNEP, Paris.*

Course Code	Course Title						Core / Elective
PC361CE	**ENVIRONMENTAL ENGINEERING LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**0**	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

1) Characterization of water and wastewater to ensure security and well-being of humanity
2) Verify the efficiency of certain water treatment processes
3) Understand the importance of coagulation

Course Outcomes

1) Students will have the ability to: compile and use of experimental information
2) Ability to perform experiments on water sample for physical and chemical tests
3) Ability to critically analyze and interpret data and present results on water samples

List of Experiments:

1. a) Determination of total dissolved solids
   a) Determination of total suspended solids
   b) Determination of fluorides
2. Determination of pH and EC
3. Determination of total hardness
4. Determination of alkalinity
5. Determination of chlorides
6. Determination of sulphates
7. Determination of MPN
8. Determination of residual chlorine
9. Determination of optimum alum dosage
10. Determination of BOD
11. Determination of COD

Suggested readings:

1. *Fair.G.M. and Geyer. J.C.* ***"Water and Wastewater Engineering"****, Vol. I & II. John Wiley & Sons Inc., New York, 2010.*
2. *White. J.B****."Wastewater Engineering",*** *2nd Edition, Edward Arnold. London, 1978*
3. *Hammer. M.J. and Hammer. M.J.Jr.,* ***"Water and Wastewater Technology",*** *Prentice-Hall of India Pvt.Ltd., New Delhi, 1998.,*

Course Code	Course Title						Core / Elective
PC362CE	**COMPUTER AIDED CIVIL ENGINEERING DRAFTING, ANALYSIS & DESIGN LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	0	0	0	2	**25**	**50**	1

Course Objectives

1) To develop skill to use STAAD III, ANSYS etc
2) To develop skill to use software to create 2D and 3D models.

Course Outcomes

1) Able to write C program for civil engineering problems.
2) Able to analyze certain structural elements using Excel
3) Able to analyze various structural elements using STAAD

List of Experiments:

A) Introduction:

Main frame - Mini and Micro computers - system configuration - Functions – Hardware, Software, Operating System Basics - File Processing Techniques - High level languages – packages.

B) Development and Implementation of Programs for the following in C Language:

1. Solution of simultaneous equations by Gauss – Jordan method.
2. Solution of non-linear equations using Newton-Raphson technique.
3. Drawing the S.F and B.M. diagrams for simply supported beams and cantilever beams subject to point, udl and uniformly varying loads
4. Analysis of plane, pin jointed frames.
5. Deflection of cantilever and simply supported beams.
6. Limit state Design of R. C. Rectangular and T – beams.
7. Design of tension and Compression Steel Members.
8. Expert Systems for Classification of soil.
9. Water surface profiles.
10. Determination of friction factor
11. Stability of slopes

C) Development and Implementation of Programs for the following using Excel:

12. Design of R.C. Retaining Walls
13. Design Profile of masonry dams
14. Design of Two-way slab and flat slab.

D) Miscellaneous:

15. Analysis of 2D Truss using STAAD-III
16. Analysis of 2D and 3D Rigid Frames using STAAD-III
17. Analysis of 3D pin jointed frames using ANSYS

18. Analysis of suspension cables using ANSYS
19. Design of Footings and Retaining Walls using STAAD-III
20. Structural Design of the following, using STAAD-III and detailing of the same using AUTO CAD
    a. R.C. Beams
    b. R.C. Slabs
    c. R.C. Columns and Footings
    d. Steel beams
    e. Steel columns
21. Design of circular water tanks using STAAD-III
22. Deflection and Stresses in beams using FEAST
23. Building Drawing, including perspective view using Floor Plan 3D
24. Concrete mix design and mathematical calculations using MATHCAD

Note: At least **twelve** experiments should be conducted in the Semester

Suggested readings:

1. *Balaguruswamy. E, Object – Oriented Programming In C, Tata Mc Graw Hill.*
2. *STAAD Package Manual*
3. *ANSYS Package Manual.*

Course Code	Course Title						Core / Elective
PC363CE	**HYDRAULICS LABORATORY**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**0**	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

1) Provide understanding of practical applications of open and curved channels
2) Application of force concepts on jets and hydraulic machines
3) Determination of characteristic curves of turbines and pumps

Course Outcomes

1) Competence in understanding flow phenomenon in open channels
2) Ability to analyze the force acting due to jets concept and its application in hydraulic machines
3) Competence in working principles of hydraulic pumps and turbines

List of Experiments:

1. Determination of roughness coefficient in an open channel
2. Determination of a vane coefficient
3. Study of universal characteristic curves of a Pelton Wheel
4. Study of universal characteristic curves of a Francis turbine
5. Determination of super elevation in an open channel
6. Determination of basic characteristics of a hydraulic jump
7. Verification of Froude's Model law in an open channel
8. Determination of flow around an Aerofoil / circular cylinder
9. Study of main characteristic curves of a Centrifugal pump
10. Determination of Minor losses in pipe

Suggested readings:

1. *S. K. Som, and Biswas, G, 'Fluid Mechanics and Fluid Machines', Tata McGraw-Hill Publishing Co., New Delhi, 1998*
2. *Yuan, S. W., 'Foundation of Fluid Mechanics', Prentice-Hall India Pvt. Ltd., New Delhi, 1976*
3. *C.S.P. Ojha, R.Berndtsson, P.N. Chandramouli, 'Fluid Mechanics and Machinery', Oxford University Press, New Delhi, 2010*
4. *A.K.Mohanty, 'Fluid Mechnics', Prentice-Hall India Pvt. Ltd., New Delhi, 1994*
5. *P.N. Modi, 'Hydraulics and Fluid Mechanics Including Hydraulics Machines', Standard Book House, New Delhi, 2013.*

OPEN ELECTIVES OFFERED BY CIVIL ENGINEERING DEPARTMENT

Open Elective-I	Open Elective-II
Remote Sensing & Geographical Information	Principles of Green Building Practices
Road Safety Engineering	Disaster Mitigation & Management

Course Code	Course Title						Core / Elective
OE____ CE	**REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives: The objectives of the course is to provide

1) Basic concept of Remote Sensing and know about different types of satellite and sensors.
2) Comprehend concepts of GIS and its applications
3) knowledge of GIS software and able to work with GIS software in various application fields

Course Outcomes

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

1) Procure knowledge on Remote Sensing, different types of satellite and sensors
2) Understand the principles of satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies
3) Understand the basic concept of GIS and its applications, know different types of data representation in GIS
4) Understand data types apply the principles of filters
5) Understand and Develop models for GIS spatial Analysis

UNIT-I

Basics of Remote Sensing: Definition, History, Advantages, Aerial Photography and Satellite Remote Sensing, Components of Remote Sensing System: Energy Source, Energy-Atmosphere Interaction, Energy Interaction with Atmosphere and Surface Materials, Spectral Signatures.

UNIT- II:

Remote Sensing Platforms: Aircrafts and Satellites, Orbital Characteristics of Sun-synchronous Earth Resource Satellites and Geostationary Communication - Special Purpose 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.

UNIT-III

Introduction to GIS: Map, definitions, representations-Point, line, polygon, common coordinate systems, map projections-Transformations-Coordinate system - Map analysis. History of development of GIS -Standard GIS packages, Applications of GIS

UNIT-IV

Data Entry, Storage and Maintenance: Data types - spatial, non spatial (attribute data) Data structure, data format - Point line vector-Raster - Polygon - Object structural model - Filters and files data in computer, Digital elevation data, data compression.

UNIT-V

GIS Analysis Functions for Integrated Analysis of Spatial and Attribute Data : Retrieval and classification functions : Overlay operations, neighborhood operations, connectivity functions, output formatting, map annotations text pattern and line styles, graphic symbols,

cartographic molding by GIS analysis procedure with an example.

Presentation of Geo-data and Analysis: Types of output data - Types of errors elimination and accuracies-sampling-Components of data quality.

Suggested Reading:

1. *Kang-Tsung Chang, Introduction to GIS, Tata McGraw Hill Edition.*
2. *Burrough P.A., Principles of GIS for Land resource Assessment, Oxford Publication.*
3. *Lilly and John weily, Remote Sensing and Image Interpretation.*
4. *Stan, Geographic Information Systems A management Perspective.*

Course Code	Course Title						Core / Elective
OE ___ CE	**ROAD SAFETY ENGINEERING & MANAGEMENT**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) Introduction to various factors considered for road safety and management
2) Explain the road safety appurtenances and design elements
3) Discuss the various traffic management techniques

Course Outcomes

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

1) Understand the fundamentals of traffic safety analysis
2) Analyze Accident data
3) Remember the concepts of road safety in urban transport
4) Apply crash reduction techniques
5) Design of urban Infrastructure considering safety aspects.

UNIT – I

Introduction: Road Safety scenario in India and World, Road Accident Characteristics.

Traffic Safety Analysis: Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT – II

Accident Analysis: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction. Application of computer analysis of accident data.

UNIT – III

Road Safety in planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

UNIT – IV

Traffic Signals & Road signs: Traffic Signals, Factors affecting signal design, street lighting, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

Safety at Construction Site: Safety provisions for workers at construction site, Construction Zone markings, signs.

UNIT – V

Traffic Management safety audit: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

Suggested Readings:

1. *Kadiyali L.R,. Traffic Engineering and Transport planning, 9th Edition, Khanna Tech Publishers, 2013.*
2. *C.E.G.Justo, A. Veeraragavan and S.K.Khanna, Highway Engineering, 10th Edition, Nem Chand Publishers, 2017.*
3. *Donald Drew, Traffic Flow Theory Chapter 14 in Differential Equation Models, Springer, 1983*
4. *C.Jotinkhisty and B. Kent Lall, Transportation Engineering – An Introduction, 3rd Edition, Pearson publications, 2017*
5. *Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson, Handbook of Road Safety measures, second Edition, Emerald Publishing, 2009.*
6. *Highway Research Programme (NCHRP) Synthesis 336.A synthesis of Highway Research Board, Washington D.C, 2016.*

Course Code	Course Title						Core / Elective
OE ___CE	**PRINCIPLES OF GREEN BUILDING PRACTICES**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	L			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) To impart knowledge of the principles and practices of the green buildings.
2) To know the importance of sustainable use of natural resources and energy.
3) To understand the principles of effective energy and resources management in buildings.
4) To bring awareness of the basic criteria in the green building rating systems.
5) To understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes

After completing this course, the student will be able to

1) Define sustainability and a green building, along with its features and benefits.
2) Describe the criteria used for site selection and water efficiency methods.
3) Explain the energy efficiency terms and methods used in green building practices.
4) Select materials for sustainable built environment & adopt waste management methods.
5) Describe the methods used to maintain indoor environmental quality.

UNIT-I

Introduction to Green Buildings: Definition of green buildings, definition of sustainability, 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, and so on.

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, Solar Heat Gain Coefficient, U-Values for facade materials, efficient lighting technologies, energy efficient and BEE rated 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) Local building materials.(b) Natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks. (c) Materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) Reuse of waste and salvaged materials.

Waste Management: Handling of construction & demolition waste materials, separation of household waste, handling e-waste, on-site and off-site organic waste management.

UNIT-V

Indoor Environmental Quality: Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.

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

Suggested Readings:

1. *IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.*
2. *GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.*
3. *K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, Alternative building materials and technologies, New Age International Private Limited, 2017*
4. *G. D. Rai, Non-Conventional Energy Resource, Khanna Publishers, 2004.*
5. *Energy and Resource Institute, Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi, 2009.*
6. *Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.*
7. *Charles J. Kibert, Sustainable Construction - Green Building Design and Delivery, 4th Edition, John Wiley & Sons, New York, 2016.*
8. *Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.*

Course Code	Course Title						Core / Elective
OE ___CE	**DISASTER MITIGATION AND MANAGEMENT**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	L			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

1) To impart knowledge of the principles and practices of the green buildings.
2) To know the importance of sustainable use of natural resources and energy.
3) To understand the principles of effective energy and resources management in buildings.
4) To bring awareness of the basic criteria in the green building rating systems.
5) To understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes

After completing this course, the student will be able to

1) Define sustainability and a green building, along with its features and benefits.
2) Describe the criteria used for site selection and water efficiency methods.
3) Explain the energy efficiency terms and methods used in green building practices.
4) Select materials for sustainable built environment & adopt waste management methods.
5) Describe the methods used to maintain indoor environmental quality.

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 Microzonation, 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 Disaster Management Act 2005 – 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, GPS and RS) 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.

Suggested Reading:

1. *Rajib, S and Krishna Murthy, R. R, Disaster Management Global Challenges and Local Solutions" CRC Press, 2009.*
2. *Navele, P & Raja, C. K, Earth and Atmospheric Disasters Management, Natural and Manmade. B. S. Publications.2009*
3. *Battacharya, T., Disaster Science and Management. Tata McGraw hill Company, 2017*
4. *Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi*
5. *An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi*
6. *Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006*
7. *Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur*
8. *Disaster Management Act 2005, Publisher by Govt. of India*
9. *Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management*
10. *National Disaster Management Policy, 2009, Govt. of India*
11. *Jagbir singh, Disaster management–Future challenges and opportunities, I.K. International publishing house, 1st edition, 2007.*
12. *Coppala P Damon, Introduction to International Disaster management, Butterworth-Heinemann, 2015.*

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Civil Engineering) VIII– SEMESTER
AICTE MODEL CURRICULUM (for 2018-2022 & 2019-2023 Batches)

S. No.	Course Code	Course Title	Scheme of Instruction			Scheme of Examination		Credits
			L	T	Pro/ Drg	CIE	SEE	
Theory Courses								
1	MC	Gender Sensitization	2	-	-	30	70	-
2	PE	Professional Elective – VI	3	-	-	30	70	3
3	PE	Professional Elective - VII	3	-	-	30	70	3
4	OE	Open Elective -III	3	-	-	30	70	3
Practical/ Laboratory Courses								
5	PW 704 CE	Project Work - II	-	-	12	50	100	**6**
			8	**-**	**12**	**170**	**380**	**15**

Open Elective – III		
1	OE605 EE	Smart Building Systems (Not for EEE & EIE Students)
2	OE606 EE	Programmable Logic Controllers (Not for EEE & EIE Students)
3	OE631 AE	Automotive Maintenance (Not for Mech./Prod./Automobile Engg. students)
4	OE631 ME	Mechatronics (Not for Mech./Prod./Automobile Engg. students)
5	OE603 CE	Road Safety Engineering (Not for Civil Engg. Students)
6	OE604 IT	Software Engineering (Not for IT Students)

Professional Elective – 6			**Professional Elective – 7**		
S.No	**Course code**	**Course title**	**S.No**	**Course code**	**Course title**
1	**PE409CE**	Finite Element Techniques	1	**PE413CE**	Concrete Technology
2	**PE410CE**	Principles of Climate Change	2	**PE414CE**	Water and Air quality
3	**PE411CE**	Principle of green buildings	3	**PE415CE**	Intelligent transportation systems
4	**PE412CE**	Construction Equipment and Automation	4	**PE416CE**	Infrastructure Engineering

Course Code	Course Title						Core/Elective
MC901 CE	**GENDER SENSITIZATION**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**-**

Course Objectives

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- Information about some key biological aspects of genders.
- Reflect critically on gender violence.
- Exposure on egalitarian interactions between men and women.

Course Outcomes

After completing this course, the student will be able to

- Developabetterunderstandingofimportantissuesrelatedtogenderincontemporary India.
- Sensitize to basic dimensions of the biological, sociological, psychological and legal aspects ofgenderthroughdiscussionofmaterialsderivedfromresearch,facts,everydaylife,literatureandfilm.
- Getafinergraspofhowgenderdiscriminationworksinoursocietyandhowtocounterit.
- Better equipped to work and live together as equals.
- Develop a sense of appreciation of women in all walks of life.

UNIT–I

Understanding Gender: Why should we study it? Socialization: making women, making men. Introduction, preparing for womanhood, growing up male, first lessons in caste, different masculinities, just relationships, being together as equals, Mary Kom and Onler, Love and acid just do not mix, love letters, mothers and fathers, Further reading: RosaParks- the brave heart.

UNIT–II

Gender and Biology: Missing women, sex selection and its consequences, declining sex ratio, demographic consequence, gender spectrum, beyond the binary, two or many, struggles with discrimination, our bodies, our health.

UNIT–III

Gender and Labor: Housework, the invisible labor, my mother doesn't work, share the Load, women's work, its politics and economics, fact and fiction, unrecognized and unaccounted work, wages and conditions of work.

UNIT–IV

Issues of Violence: Sexual harassment - Say No!: Sexual harassment, no eve teasing, coping with everydayharassment,"Chupulu"domesticviolence,speakingout,ishomeasafeplace?Whenwomenunite,rebuilding lives, new forums for justice, thinking about sexual violence, blaming the victim, I fought for my life, the caste face of violence.

UNIT–V

Gender Studies Knowledge: Through the lens of gender, point of view, gender and the structure of knowledge. Unacknowledged women artists of Telangana: Whose history? Questions for historians and others :reclaiming a past, writing other histories, missing pages from modern Telangana history.

Suggested Readings:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, Towards a World of Equals: A Bilingual Text book on Gender, Telugu Akademi, Hyderabad, 1st Edition, 2015

PROFESSIONAL ELECTIVES

Course Code	Course Title						Core / Elective
PE 409 CE	**FINITE ELEMENT TECHNIQUES**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Structural Analysis I&II	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course are:

- Understand the numerical finite element modelling of 3D structural problemswith linear and non-linear models.
- Understand the analysis of various loads and displacements relations both for a local element and the global assembly of a structure.
- Perform the numerical analysis for simple problems the procedure for which is same in solving complex problems using high-end computer oriented numerical analysis tools.

Course Outcomes

After completing this course, the student will be able to:

- Formulate the matrix equations for constitutive relationships for 2D and 3D structural elements in plane stress and plane strain problems.
- Formulate the stiffness matrices for various structural elements.
- Formulate global stiffness matrix and load matrix along with assigning appropriate boundary conditions using suitable domain discretization
- Solve for the unknown nodal parameters using Gauss quadrature techniques and interpolating shape functions for Iso-parametric finite elements
- Formulate the Stiffness Matrix, Stress-Strain relationships and boundary conditions for axisymmetric problems.

UNIT - I

Introduction to Finite Element Method: Introduction**,** Stress and Equilibrium. Boundary conditions. Strain – Displacement relations. Stress – strain relations. One Dimensional Problems: Finite element modeling coordinates and shape functions. Plane stress and plane strain problems.

Unit – II

Stiffness Matrix: Stiffness matrix for two noded bar, truss, and beam elements, problems with three degrees of freedom. Transformation, generation of stiffness matrix for frames

Variational approach, Rayleigh-Ritz and Galerkin's methods.

UNIT – III

***Formulation of Finite Element Method*:** Using principle of virtual displacement. Determination of stiffness matrix for three noded triangular element (constant strain triangle), and four noded rectangular element for plane stress and plane strain problems. Convergence criteria for selection of displacement models. Discretisation of continuum. Assembly of global stiffness and load matrices. Displacement boundary conditions.

UNIT – IV

***Isoparametric Finite Elements*:** Direct construction of shape functions for higher order

elements using natural co-ordinate system. Shape functions for eight noded parabolic curved iso-parametric element. Determination of element stiffness matrix for four noded quadrilateral element. Use of Jacobian, and Gauss quadrature techniques. Load matrix for eight noded rectangular isoparametric element (for body forces and surface traction).

UNIT – V

***Strain Displacement*:** Stress – strain relation for axisymmetric problems. Stiffness matrix for three noded ring element, Volume co-ordinates and stiffness matrix for four noded tetrahedron element. Exposure to FEM based softwares.

Suggested Readings:

1. O.C. Zienkiewicz and R.L. Taylor, *The Finite Element Method*, Vol. I, McGraw Hill,1989.
2. K.J. Bathe, *Finite Element Procedures*, Pearson Education,2006.
3. S. M. Jalaludeen, *Finite Element Analysis*, Anuradha Publications,2016.
4. T.R. Chandrupatla, *Finite Element Analysis for Engineering and Technology*, Universities Press, 2004.
5. C.S.Krishnamoorthy, *Finite Element Analysis, Tata Mcgraw Hill publishing Company.2014*

Course Code	Course Title						Core / Elective
PE 410 CE	**PRINCIPLES OF CLIMATE CHANGE**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Understand basic concepts of general circulation Models and their importance.
- Know the features of Indian Summer Monsoon Rainfall (ISMR) and their characteristics.
- Understand the downscaling principles of statistical downscaling and dynamical downscaling.

Course Outcomes:

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

- Classify and illustrate the various elements of the climate system.
- Identify the various elements of global water balance and causes of instability.
- Analyze the indicators that affect the monsoon and drought conditions
- Make use ofmodels of climate change using various causative parameters and statistical tools.
- Apply the statistical tools for bias correction and data downscaling on general circulation models of climate change.

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, Vapour Pressure atmospheric stability-causes of instability-classification of clouds-precipitation process

UNIT – III

Monsoon: 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)- CMIP5 data downloading procedure- Reanalysis data products.

UNIT – V

General Circulation Models: Bias correction methods -Downscaling – Types of downscaling- Dynamical downscaling- Regional Climate Models - concepts of statistical downscaling- data reduction techniques - principal component analysis-application of Regression methods.

Suggested Reading:

1. Bonon G B (2008) - *Ecological Climatology*- Cambridge University Press Edition- II
2. RL Wilby, SP Charles, E Zoritaa, B Timbal, PW Hetton, LO Mearns (2004) -*Guide lines for use of climate science from Statistical Modeling models*.
3. *Physical science basis of AR 5 report of IPCC (2013)*- working group I contribution to Assessment Report- https://ipcc.ch/report/ar5/wg1/
4. Rasmus E Benestad, Inger Hanson Baver, Delinag Chen (2008) *Empirical Downscaling World*, Scientific Publishing Co. Ltd.
5. Vente Chow (1964)- *Hand Book of Applied Hydrology*- - Mc Graw Hill Co.

Course Code	Course Title						Core / Elective
PE 411 CE	**PRINCIPLES OF GREEN BUILDINGS**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Learn the principles of green buildings and the available green rating systems for buildings in India and abroad.
- Understand the principles of sustainable development adopted in green buildings through reduce, recycle and reuse strategy in conserving natural resources and energy.
- Understand the principles of landscape preservation, water conservation, energy efficiency, building resources management and indoor air quality in green buildings

Course Outcomes:

After completing this course, the student will be able to

- Outline the various features and benefits of a green building and classify the various parameters used in green rating systems
- Evaluate a building using the green rating criteria for site selection and water efficiency
- Identify the energy efficiency parameters and methods used in green building practices
- Select materials for sustainable built environment & adopt waste management methods
- Apply the various methods for maintaining indoor environmental quality in green buildings

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,Design principles of ground recharge type and storage type rainwater harvesting methods,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 Well being: Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.
Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Suggested Readings:

1. *IGBC Green Homes Rating System*, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers
2. GRIHA version 2015, GRIHA rating system, *Green Rating for Integrated Habitat Assessment*
3. '*Alternative building materials and technologies*' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. '*Non-Conventional Energy Resources*' by G. D. Rai, Khanna Publishers.
5. *Sustainable Building Design Manual*, Vol.1 and 2, TERI, New Delhi 2004

Course Code	Course Title						Core/Elective
PE 412 CE	**CONSTRUCTION EQUIPMENT AND AUTOMATION**						**PE -VI**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

•Introduce construction equipment and its effective utilization using scientific principles
•Identify construction equipment and its association with different construction works
•Attain knowledge in equipment selection for various activities involved in construction.

Course Outcomes:

- Apply the working procedures of various excavating and earth moving equipment
- Apply various equipment needed for compaction, erection, drilling and demolition
- Understand working procedures of material handling and production equipment.
- Identify and apply automation systems and fire safety equipment in construction sites
- Analyze the various processes of HVAC & Security

UNIT – I

Equipment for Earthwork: Fundamentals of Earth Work Operations- Earth Moving Operations - Types of Earth Work Equipment –Excavation equipment- Power Shovels, Back Hoe, Drag line, Clamshell – Excavating and Earth Moving Equipment – Scrapers, Bull Dozers, Tractors, Hauling Equipment– Dump trucks, Dumpers Loaders, trucks.

UNIT – II

Equipment for Earth Compaction-Tamping Rollers, Smooth Wheel Rollers, Sheeps foot Roller, Pneumatic- tyred Roller, Vibrating Compactors, Vibro compaction methods.

Other construction equipment: Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting-Equipment for Compaction- Erection Equipment- Types of pumps used in Construction-Equipment for Dewatering and Grouting– Foundation and Pile Driving Equipment – Equipment for Demolition, Road making equipment.

UNIT – III

Equipment for material handling - Crushers – Feeders - Screening Equipment – Material handling equipment - Cranes, Hoists, Forklifts and related equipment - Portable Material Bins –Conveyors – Hauling Equipment.

Equipment for aggregate production and concreting- Batching and Aggregate Mixing Equipment-Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment–Ready mix concrete equipment, Concrete mixers, Concrete batching and mixing plant, Transportation of concrete mix, Concrete Pouring and Pumping Equipment, Concrete compaction equipment.

UNIT – IV

Introduction to building automation systems (BAS) - Concept and application of Building Automation System, requirements and design considerations and its effect on functional efficiency, architecture and components of BAS.

Fire alarmsystem (FAS) standards- Fundamentals: Fire modes, Components, and Principles of Operation. FAS Components: Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. FAS Architectures, loop, Examples. Fire Standards: IS Concept of fire &alarm system..

UNIT – V

Access control security systems-Access Control System: Components, Design. CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, Network design, Storage design. Components.Security Systems, Concepts, Components, Technology, Advanced Applications, Security system design.

Heating, ventilation & air conditioning system- HVAC basic processes, Air Properties, Psychometric Chart, Heat Transfer mechanisms, Human comfort zones, Effect of Heat, Humidity, Heat loss. Heating Process & Applications, Cooling Process & Applications, Ventilation Process & Applications. Instrumentation Basics, Field components & use. Air conditioning Components.

Suggested Reading:

1. R.L.Peurifoy, "Construction Planning and Equipment" Tata McGraw-Hill Education; 9th Edition, 2018.
2. Mahesh Varma .Dr., "Construction Equipment And Its Planning And Application", Metropolitan Book Company, New Delhi, 2003
3. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, Delhi, 2008
4. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers Delhi, 2008
5. Gagnon. R. "Design of Special Hazards and Fire Alarm Systems", Thomson Delmar, NY, US, 2007
6. Levenhagen, Spethmann. J.I, Donald . "HVAC Controls and Systems", McGraw-Hill, SG, 1994

Course Code	Course Title						Core / Elective
PE 413 CE	**CONCRETE TECHNOLOGY**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Objectives:

- Understand the behavior of fresh and hardened concrete.
- Learn the design of concrete mixes as per IS, ACI and British Standards
- Know about the precast technology and its uses.

Outcomes:

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

- Evaluate concrete quality based on its properties at fresh stage and hardened stage
- Interpret the effects of creep and shrinkage on concrete durability and illustrate the microstructure of concrete with all its phases.
- Design the concrete mix using IS code method, British code and ACI code method.
- Identify the use of special concretes based on their properties in different situations.
- Classify the various components of precast technology and the various types of prefabricated components.

UNIT – I

Properties of Fresh Concrete and Hardened Concrete: Review of the physical properties of Concrete, Workability- Factors affecting workability- workability tests. Water/Cement ratio, Segregation and Bleeding of concrete. Mixing and vibration of Concrete. Strength of concrete, Factor effecting strength of concrete. Abram's Law, Gel space ratio. Compressive strength, Flexural Tensile strength, Split tensile strength, Pull out strength , Modulus of Elasticity and Poisson's ratio of Concrete. Method of determining these strength and relevant IS code Provisions.

UNIT –II

Durability of concrete – Factors affecting durability. Creep of concrete- Factors influencing creep- Relation between creep & time- Nature of creep-Effects of creep-Shrinkage-types of shrinkage.

Microstructure of concrete – significance- complexities- Aggregate phase – Hydrated cement phase – Interfacial transition zone – Dimensional stability

UNIT – III

Mix Design: Factors in the choice of mix proportions- Quality Control of concrete- Statistical Quality control- Acceptance criteria- Proportioning of concrete mix – IS method of mix design – British and ACI method of mix design

UNIT - IV

Special Concretes: High strength concrete, Ferro cement mass concrete, light weight concrete, high density concrete, polymer concrete self-compacting concrete, nano concrete recycled aggregate concrete, geo-polymer concrete fiber reinforced concrete shotcrete, reactive powder concrete.

UNIT – V

Introduction To Precast Technology

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

Prefabricated Components

Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

Suggested Reading:

1. A. M. Neville , "PropertiesofConcrete,"5th edition, Pearson, 2011
2. M. S. Shetty and A. K. Jain, "Concrete Technology: Theory and Practice," S.Chand& Co., 2018
3. M. L. Gambir, "Concrete Technology: Theory and Practice" Tata Mc Graw Hill Publishers, New Delhi, 2017
4. P. K. Metha and J. M. Monteiro, "Concrete: Microstructure, Properties and Materials," Tata Mc-Graw Hill Education, 2017
5. CBRI, Building materials and components, India, 1990
6. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
7. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009
8. "Handbook on precast concrete buildings," Indian Concrete Institute (ICI), Chennai, 2016.

Course Code	Course Title						Core / Elective
PE 414 CE	**WATER AND AIR QUALITY MODELING**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Understand modelling concepts.
- Describe air quality and water quality models.
- Explain computer-based simulation and various software's.

Course Outcomes:

- Classify modelling techniques, models based on mass conservation and mass balance
- Classify and describe the parameters involved in various air quality models
- Formulate the various water quality models.
- Develop linear programming models and other optimization techniques to estimate the air and water quality.
- Gain knowledge of and explain the features of various software related to air and water quality modelling.

UNIT – I

Modeling Concepts: Casual and statistical models-characteristics-steps in model development-importance of model building conservation of mass and mass balance-calibration and verification of models.

UNIT – II

Air Quality Modeling

Modelling for nonreactive pollutants, single source, short term impact, multiple sources and area sources, Metrological Modelling – Diagnostic Models -Prognostic Models – diffusion models, modifications of Gaussian plume equation -long term average- receptor oriented and source oriented air pollution models ,Numerical Models, model performance, accuracy and utilization.

UNIT – III

Water Quality Models

Mass balance equation -Mathematics of Pollutant Transport – Advection- dispersion-In-Water Transformation- Waste load allocations – Basic mechanisms of river self-purification, Dissolved Oxygen dynamics Streeter-Phelps and Dobbins models, Pollutant and nutrient dynamics, Temperature dependence and transport, Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants – Ground Water Quality Modelling – Contaminant solute transport equation, Numerical methods.

UNIT – IV

Computer Based Simulation

Formulation of linear optimization models. Linear programming. Sensitivity testing and duality. Solutions techniques and computer programming, Formulation of linear optimization models. Finite difference finite element method of pollutant dispersion- Optimization river pollutant and management models finite element method of pollutant dispersion-optimization river pollutant and management models-Application of models- simulation, parameters estimation of

experiment design. Model uncertainty reliability.

UNIT – V

Software

Air quality Model -ARMOD, CALPUFF. – UNAMAP- BLP-RAM-ISCMPTER-CRSTER- Surface water quality models -HSPF, QUAL2K,.

Suggested Reading:

1.Deaton, M.L and Winebrake, J.J., Dynamic Modelling of Environmental Systems, Verlag, 2000.

2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, 2008.

3.Arthur C. Stern., Air Pollution (Third Ed.) Volume I – Air Pollutants, their transformation and Transport, (Ed.), Academic Press, 2006.

4.Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley and Sons Inc., New York, 2013

5.Dykes, A.P., Mulligan, M., and Wainwright, J, Monitoring and Modelling dynamic environment, Wiley – Blackwell 2015.

6.Paolo Zanetti, Air Pollution Modelling – Theories, computation Methods and available Software Springer. New York, 1990

7.Benedini G. Tsakiris Water Quality Modelling for Rivers and streams Springer , New York , 2013

Course Code	Course Title						Core / Elective
PE 415 CE	**INTELLIGENT TRANSPORTATION SYSTEMS**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	**3**	**-**		**-**	**30**	**70**	**3**

Course Objectives:

The objectives of this course is to

- Understand ITS & ATIS
- Know the functional areas of ITS such as ATMS, CVO, AVCS and APTS, ARTS
- Study of ITS architecture and its applications

Course Outcomes:

After completing this course, the student will be able to:

- Plan and specify the requirements using ITS
- Plan and management aspects for ITS
- Prepare architecture and application for ITS
- Illustrate the functional areas of ITS and their user needs and services
- Explain the overview of ITS in highway incident management systems

UNIT – I

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

UNIT – II

Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System.

UNIT – III

ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

UNIT – IV

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT – V

Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.Traffic and incident management systems – ITS and sustainable mobility, travel demand management, electronic toll collection.

Suggested Reading:

1. Ghosh, S., Lee, T.S., “Intelligent Transportation Systems: New Principles and Architectures”, CRC Press, 2000
2. Chowdhury, M. A., Sadek, A. and Boston, M.A., “Fundamentals of Intelligent Transportation Systems Planning”, Artech House, Inc., USA, 2003
3. Joseph, S.S., “Perspectives on Intelligent Transportation Systems”, Springer publishers, USA, 2008
4. Sussman, J. M., “Perspective on ITS”, Artech House, Inc., USA, 2005

Course Code	Course Title						Core / Elective
PE 416 CE	**INFRASTRUCTURE ENGINEERING**						**PE -VII**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Transportation Engineering	**3**	**-**		**-**	**30**	**70**	**3**

Course Objectives

- Examine the power sector infrastructure requirements including maintenance issues.
- Review various infrastructures needs of roads, railways, water ways and airports
- Discuss various communication systems and postal services infrastructure requirements.

Course Outcomes

- Demonstrate the understanding of the power sector infrastructure needs and maintenance strategies.
- Evaluate the public & private sector role in infrastructure development
- Develop strategies for Infrastructure Planning and its Implementation
- Implementation of environmental laws and regulations

  Demonstrate the understanding of the strategies for successful implementation of infrastructure projects

UNIT-I

An Overview of Infrastructure Engineering: Urban Infrastructure and Rural Infrastructure in general. An Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages in an 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 and Telecommunications.

UNIT-II

Public and Private Sector Role in Infrastructure Development: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization , Challenges in Privatization Water Supply, Power, Infrastructure, Road Transportation Infrastructure in India, BOOT, BOT, DBFOT, PPP,HAM -Case studies preferable.

UNIT-III

Infrastructure Planning and Implementation: 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 preferable.

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

UNIT-V

Strategies for Successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects, 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.

Suggested readings:

1. Grigg, Neil, "*Infrastructure Engineering and Management*", Wiley, 1988.
2. Hudson, Hasnuddin, *"Infrastructure Management: Integrating Design, Construction,Maintenance, Rehabilitation and Renovation",* McGraw Hill, 1997.
3. Anjaneyulu, Y &Manickam, V, *"Environmental Impact Assessment Methodology"*. B.S.Publications, Hyderabad, 2012.
4. P. Chandra, *"Projects: Planning, Analysis, Selection, Financing, Implementation andReview"*, Tata McGraw-Hill, New Delhi, 2009.
5. A. S. Goodman and M. Hastak, *"Infrastructure Planning Handbook: Planning, Engineeringand Economics",* McGraw-Hill, New York, 2006.

OPEN ELECTIVE III

Course Code	Course Title						Core / Elective
OE405EE	**SMART BUILDING SYSTEMS**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To understand the basic blocks of Building Management System.
- To design various sub systems (or modular system) of building automation
- To integrate all the sub systems

Course Outcomes:

Student will be able to

- Describe the basic blocks and systems for building automation
- Use different subsystems for building automation and integrate them
- Understand basic blocks and systems for building automation
- Design different systems for building automation and integrate those systems

UNIT – I

Introduction: Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

UNIT – II

Fire Alarm (FA) System: concept of fire, Fire modes, History, Components, and Principles of Operation. Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. Types of FAS Architectures, Examples. Classification of FAS loops, Examples. FAS Design procedure in brief, NFPA 72A, BS 5839, IS, Concept of IP enabled fire & alarm system, design aspects and components of PA system.

UNIT – III

Access Control System: Access Components, Access control system Design.

CCTV: Camera Operation & types, Camera Selection Criteria, Camera Applications, DVR Based system, DVM, Network design, Storage design. Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system. CCTV Applications.

UNIT – IV

Security Systems Fundamentals: Introduction to Security Systems, Concepts.

Perimeter Intrusion: Concept, Components, Technology, Advanced Applications. Security system design for verticals. concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components, Computer system access control –DAC, MAC, RBAC.

EPBX System & BMS subsystem integration: Design consideration of EPBX system and its components, integration of all the above systems to design BMS.

UNIT – V

Energy Management: Energy Savings concept & methods, Lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples.

Building Management System: IBMS (HVAC, Fire &Securi-ty) project cycle, Project steps BMS, Advantages & Applications of BMS, IBMS Architecture, Normal & Emergency operation, Advantages of BMS.

Suggested Readings:

1. Jim Sinopoli, *Smart Buildings*, Butterworth-Heinemann imprint of Elsevier,2nd ed., 2010.
2. Reinhold A. Carlson, Robert A. Di Giandomenico, *Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs),* R.S. Means Company Publishing, 1991.
3. Albert Ting-Pat So, WaiLok Chan, Kluwer, *Intelligent Building Systems*, Academic publisher,3rd ed., 2012.
4. Robert Gagnon, *Design of Special Hazards and Fire Alarm Systems*, Thomson Delmar Learning; 2nd edition, 2007.
5. Levenhagen, John I.Spethmann, Donald H, *HVAC Controls and Systems*, McGraw-Hill Pub.
6. Hordeski, Michael F, *HVAC Control in the New Millennium*, Fairmont press, 2001.
7. Bela G. Liptak, *Process Control-Instrument Engineers Handbook*, Chilton book co.

Course Code	Course Title						Core / Elective
OE406EE	**PROGRAMMABLE LOGIC CONTROLLERS**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To be able to understand basics of Programmable logic controllers, basic programming of PLC.
- To make the students to understand the Functions and applications of PLC

Course Outcomes:

Student will be able to

- Develop PLC programs for industrial applications.
- Acquire the knowledge of PLC counter functions and PLC Arithmetic functions and data handling functions.

UNIT – I

PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programmer Monitors - PLC input and output models - Printing PLC Information- Programming Procedures - Programming Equipment - Programming Formats- Proper Construction of PLC Diagrams - Devices to which PLC input and output modules are connected - Input on/off switching devices - Input analog devices - Output analog on/off devices and output analog devices.

UNIT – II

Basic PLC Programming: Programming on/off inputs to produce on/off outputs - PLC input instructions - Outputs - Operational procedures - Contact and coil input/output programming examples - Relation of digital gate logic contact / coil logic - PLC programming and conversion examples - Creating ladder diagrams from process control descriptions - Sequence listings - Large process ladder diagram constructions.

UNIT – III

Basic PLC Functions: General Characteristics of Registers - Module addressing - Holding registers - Input registers - output registers - PLC timer functions - examples of timer functions. Industrial applications - PLC counter functions.

UNIT – IV

Intermediate Functions: PLC Arithmetic functions - PLC additions and subtractions - The PLC repetitive clock - PLC Multiplications, Division and Square Root - PLC trigonometric and log functions - Other PLC arithmetic functions - PLC number comparison functions. PLC basic comparison functions and applications - Numbering systems and number conversion functions - PLC conversion between decimal and BCD-Hexadecimals numbering systems.

UNIT – V

Data Handling Functions: The PLC skip and master control relay functions - Jump functions - Jump with non return - Jump with return. PLC data move Systems - The PLC functions and applications. PLC functions working with bits - PLC digital bit functions and applications - PLC sequence functions - PLC matrix functions.

Suggested Readings:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India Private Limited, Fifth edition, 2003.
2. Frank D. Petruzella, *Programmable Logic Controllers*, 5th Edition, Mc-Graw Hill, 2019.

Course Code	Course Title						Core / Elective
OE431AE	**AUTOMOTIVE MAINTENANCE**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To study basic types of vehicle maintenance along with its importance
- To understand the trouble diagnosis procedure for electrical and electronic systems in automobiles
- To acquaint with various Trouble shooting, fault tracing practices available in automobile industry
- To understand the maintenance procedure for air-conditioning in automobiles.

Course Outcomes:

Student will be able to

- Demonstrate the maintenance procedure for automotive Engine.
- Illustrate the trouble diagnosis procedure for electrical systems like Battery, Starting Systems
- Identify the trouble diagnosis procedure for steering and suspension system
- Illustrate trouble diagnosis procedure for lubrication and fuel delivery system etc.
- Explain trouble diagnosis procedure for heating system of automobile.

UNIT – I

Maintenance, Workshop Practices, Safety and Tools: Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis.

vehicles, fire safety - First aid. Basic tools –Scheduled maintenance services – service intervals - Towing and recovering.

UNIT – II

Engine and Engine Subsystem Maintenance: introduction engine IC Engine General Engine service- cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management. **S**ervice - fault diagnosis- servicing emission controls.

UNIT – III

Transmission and Driveline Maintenance: Clutch- general checks, adjustment and service- road testing, Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT – IV

Steering, Brake, Suspension and Wheel Maintenance: Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage.

UNIT – V

Auto Electrical and Air Conditioning Maintenance: Maintenance of batteries, starting system,

charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

Suggested Readings:

1. Ed May, "*Automotive Mechanics Volume One*", McGraw Hill Publications, 2003.
2. Ed May, "*Automotive Mechanics Volume Two*", McGraw Hill Publications, 2003
3. *Vehicle Service Manuals of reputed manufacturers*
4. *Bosch Automotive Handbook*, Sixth Edition, 2004

Course Code	Course Title						Core / Elective
OE431ME	**MECHATRONICS**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

Student has to understand the

- How to identify, formulate, and solve engineering problems
- The design a system, component, or process to meet desired needs within realistic constraints
- The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
- The use of drive mechanisms and fluid power systems
- The use of industrial electronic devices
- The demonstrate the design of modern CNC machines, and Mechatronics elements

Course Outcomes:

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

- Model and analyse electrical and mechanical systems and their inter connection
- Integrate mechanical, electronics, control and computer engineering in the design of Mechatronics systems
- Do the complete design, building, interfacing and actuation of a Mechatronics system for a set of specifications
- Be proficient in the use of fluid power systems in various Mechatronics applications
- Demonstrate the use of industrial electronic devices
- Demonstrate the design of modern CNC machines, and Mechatronics elements

Unit-I

Introduction to mechanization & automation: Need of interface of electrical & electronic devices with mechanical elements, the concept of Mechatronics, Flow chart of Mechatronics system, elements of Mechatronics system, drive mechanisms, actuators, feedback devices and control system, application in industries and systems development

Unit-II:

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems Introduction to electrical actuators: A.C. servomotors, D.C. servomotors, stepper motors

Unit-III

Introduction to fluid power systems: Industrial Pneumatics and hydraulics, merits of fluid power, pneumatic & hydraulic elements symbols, study of hydraulic control valves, pumps & accessories, hydraulic circuits & mechanical servo control circuits, Electro-hydraulic and Hydro pneumatic circuits

Unit-IV

Introduction to industrial electronic devices: Diodes, Transistors, Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits, Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion, signal processing using operational amplifiers, introduction to microprocessor & micro controller, Temperature measurement interface and LVDT interface, Systems response

Unit-V

Design of modern CNC machines and Mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems, Flexible manufacturing systems, Multipurpose control machines, PLCprogramming

Suggested Reading:

1. William Bolton, Mechatronics: Electronic control systems in mechanical and electrical engineering, 6th edition, PearsonEducation
2. HMT Ltd, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi,1998
3. Michaels Histand& David G, Alciatore, Introduction to Mechatronics and Measurement Systems, Tata McGraw-Hill InternationalEdition
4. Devdas Shetty, Richard A. Kolk, Mechatronics System Design, CengageLearning
5. S.R. Majumdar, Oil Hydraulic Systems – Principles & Maintenance, McGraw-Hill Publishing Company Limited, NewDelhi
6. Godfrey Onwubolu, Mechatronics: Principles and Applications,Butterworth-Heinemann

Course Code	Course Title						Core / Elective
OE403CE	**ROAD SAFETY ENGINEERING**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- Introduce various factors considered for road safety and management
- Explain the road safety appurtenances and design elements
- Discuss the various traffic management techniques

Course Outcomes:

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

- Prepare accident investigation reports and database
- Apply design principles for roadway geometrics improvement with various types of traffic safety appurtenances/tools
- Manage traffic including incident management
- Apply crash reduction techniques
- Design of urban Infrastructure considering safety aspects

UNIT – I

Introduction: Road Safety scenario in India and World, Road Accident Characteristics.

Traffic Safety Analysis: Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT – II

Accident Analysis: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction. Application of computer analysis of accident data.

UNIT – III

Road Safety in planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipment's, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

UNIT – IV

Traffic Signals & Road signs: Traffic Signals, Factors affecting signal design, street lighting, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

Safety at Construction Site: Safety provisions for workers at construction site, Construction Zone markings, signs.

UNIT – V

Traffic Management safety audit: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

References:

1. L.R. Kadiyali and N.B. Lal, “Principles and Practice of Highway Engineering”, New Delhi, 2006
2. Myer Kutz, “Hand Book of Transportation Engineering”, Editor McGraw Hill, 2004.
3. Kadiyali, L. R. "Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi, 2006
4. Guidelines on Design and Installation of Road Traffic Signals, IRC: 93.
5. Specification for Road Traffic Signals IS: 7537-1974.

Course Code	Course Title						Core / Elective
OE404IT	**SOFTWARE ENGINEERING**						**OE -III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	**-**		**-**	**30**	**70**	**3**

Course Objectives:

- To introduce the basic concepts of software development processes from defining a product to shipping and maintaining
- To impart knowledge on various phases, methodologies and practices of software development
- To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics

Course Outcomes:

Student will be able to

- Acquired working knowledge of alternative approaches and techniques for each phase of software development
- Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS.
- Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles.
- 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 knowledge on patterns.

UNIT – I

Introduction to Software Engineering:

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models

UNIT – II

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

System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT – III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

Suggested Readings:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw Hill, 2009

2. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, OxfordUniversity Press, 1996

3. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House, 2008

Course Code	Course Title						Core / Elective
PW402CE	**PROJECT WORK - II**						**CORE - PROJECT**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	**-**		**12**	**50**	**100**	**6**

Objectives

- To apply engineering knowledge in practical problem solving
- To foster innovation in design of products, processes or systems
- To develop creative thinking in finding viable solutions to engineering problems

Outcomes:

- Analyse the specific problem using engineering knowledge to arrive at a solution methodology
- Formulate an investigation procedure and analyze, interpret, and synthesize the obtained data using a laboratory procedure and/or modern engineering software and tools.
- Draw valid conclusions and engineering solutions including design, recommendations, or estimations, keeping in view the safety norms and regulations in codes of practice.
- Discuss and communicate in oral and written forms, the technical contents of the project, observing professional ethical principles of documentation.
- Demonstrate individual and teamwork skills in carrying out and managing the project work

CoursePlan

1. In depth study of the topic assigned in the light of the preliminary report prepared in the VII semester
2. Review and finalization of the approach to the problem relating to the assigned topic
3. Preparing a detailed action plan for conducting the investigation, including team work
4. DetailedAnalysis/Modelling/Simulation/Design/ProblemSolving/Experimentasneeded
5. Final development of product / process, testing, results, conclusions and future directions Preparing a paper for Conference presentation/Publication in Journals, if possible
6. Preparing a report in the standard format for being evaluated by the Internal Departmental Committee
7. Final project presentation and viva voce by the faculty coordinator including external expert

Internal Evaluation

Maximum Marks: 50

Evaluation of Project-1 should be based on the progress reported by the student and certified by the supervisor. Evaluation is done based on the students presentation, twice in the semester ie. mid semester evaluation and end semester evaluation. Sessional marks are awarded by the evaluation committee comprising of two faculty members and the supervisor. Marks are allotted based on the students presentation, Report preparation and students ability to answer the questions raised by the examiners.

Distribution of marks	Activity	Weightage
Mid semester evaluation (25)	Supervisor	**10**
	Examiners	**15**
End semester evaluation (25)	Supervisor	**10**
	Examiners	**15**

Distribution of marks for the Project final is as follows:
(i) Two progress assessments:**20 marks** by the faculty supervisor(s)
(ii) Assessmentsandfinalprojectreport:**30marks**bytheinternalfacultycoordinator/reviewcommittee

ExternalEvaluationbyUniversityappointedexternalexaminerMax imumMarks: 100

Distribution of marks for the Project final is as follows:

(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 forwarding the final grade.