Course Structure & Syllabus

of

B.Tech Programme

in

Civil Engineering

(From the Session 2015-16)

VSSUT, BURLA

COURSE STRUCTURE

FIRST YEAR
(COMMON TO ALL BRANCHES)

FIRST SEMESTER				SECOND SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	Subject	L .T .P		Course Code	Subject	L. T. P	
	Mathematics - I	3 - 1 - 0	4		Mathematics - II	3 - 1 - 0	4
	Physics/Chemistry	3 - 1 - 0	4		Chemistry/ Physics	3 - 1 - 0	4
	Engineering Mechanics/ Computer Programming	3 - 1 - 0	4		Computer Programming/ Engineering Mechanics	3 - 1 - 0	4
	Basic Electrical Engineering/ Basic Electronics	3 - 1 - 0	4		Basic Electronics/ Basic Electrical Engineering	3 - 1 - 0	4
	English/ Environmental Science	3 - 1 - 0	4		Environmental Science/ English	3 - 1 - 0	4
Sessionals				**Sessionals**			
	Applied Physics Laboratory/Chemistry Lab	0 - 0 - 3	2		Chemistry Lab/Applied Physics Laboratory	0 - 0 - 3	2
	Workshop-I/ Engineering Drawing	0 - 0 - 3	2		Engineering Drawing/ Workshop-I	0 - 0 - 3	2
	Basic Electrical Engg. Lab/ Basic Electronics Lab	0 - 0 - 3	2		Basic Electronics Lab/ Basic Electrical Engg. Lab	0 - 0 - 3	2
	Business Communication and Presentation Skill/ Programming Lab	0 - 0 - 3	2		Programming Lab/ Business Communication and Presentation Skill	0 - 0 - 3	2
	Total	**15-5-15**	**28**		**Total**	**15-5-15**	**28**

THIRD SEMESTER

THEORY

Sl No.	Course Code	Subject	Contact Hrs. L-T-P	CR
1		Mathematics-III	3-1-0	4
2		Object Oriented Programming	3-1-0	4
3	CE 15003	Mechanics of Materials	3-1-0	4
4	CE 15004	Civil Engineering Materials and Construction	3-1-0	4
5		Engineering Economics	3-1-0	4
		SESSIONAL		
1	CE 15005	Building Drawing	0-0-3	2
2	CE 15006	Concrete Lab	0-0-3	2
3		Material testing lab	0-0-3	2
4		OOP Lab	0-0-3	2
Total			**15-5-12**	**28**

FOURTH SEMESTER

THEORY

1		Mathematics-IV	3-1-0	4
2	CE 15007	Engineering Surveying	3-1-0	4
3	CE 15008	Fluid Mechanics	3-1-0	4
4	CE 15009	Structural analysis-I	3-1-0	4
5		Organizational Behaviour		
			3-1-0	4
		SESSIONAL		
1	CE 15010	Hydraulics Lab	0-0-3	2
2	CE 15011	Survey Practice-I	0-0-3	2
3	CE 15012	Computer application in Civil Engineering	0-0-3	2
4	CE 15013	Environmental Engineering Lab.	0-0-3	2
Total			**15-5-12**	**28**

FIFTH SEMESTER THEORY				
Sl No.	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**CR**
1	CE 15014	Structural Design	3-1-0	4
2	CE 15015	Water Resources Engineering	3-1-0	4
3	CE 15016	Geotechnical Engineering-I	3-1-0	4
4	CE 15017	Environmental Engineering	3-1-0	4
5	CE 15018	Structural Analysis -II	3-1-0	4
SESSIONAL				
1	CE 15019	Fluid Flow Lab	0-0-3	2
2	CE 15020	Geotechnical Engineering Lab	0-0-3	2
3	CE 15021	Environmental Engineering Design	0-0-3	2
4	CE 15022	Design of Concrete Structure	0-0-3	2
Total			**15-5-12**	**28**
SIXTH SEMESTER THEORY				
1	CE 15023	Fluid Dynamics	3-1-0	4
2	CE 15024	Transportation Engineering-I	3-1-0	4
3	CE 15025	Geotechnical Engineering-II	3-1-0	4
4	CE 15026	Steel Structures	3-1-0	4
5		Core Elective-I	3-1-0	4
SESSIONAL				
1	CE 15027	Design of Steel Structures	0-0-3	2
2	CE 15028	Transportation & Geotechnical Engineering Design	0-0-3	2
3	CE 15029	Transportation Engineering Lab	0-0-3	2
4	CE 15030	Survey Practice-II	0-0-3	2
Total			**15-5-12**	**28**

SEVENTH SEMESTER THEORY				
Sl No.	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**CR**
1	CE 15031	Advanced Concrete Structures	3-1-0	4
2	CE 15032	Hydraulic Structures	3-1-0	4
3	CE 15033	Transportation Engineering-II	3-1-0	4
4		Core Elective-II	3-1-0	4
5		Open Elective-I	3-1-0	4
SESSIONAL				
1	CE 15034	Structural Engineering lab	0-0-3	2
2	CE 15035	Minor Project	0-0-3	2
Total			**15-5-6**	**24**
EIGHTH SEMESTER THEORY				
1	CE 15036	Construction Management	3-1-0	4
2	CE 15037	Estimation and Professional Practices	3-1-0	4
3		Open Elective-II	3-1-0	4
SESSIONAL				
1	CE 15038	Comprehensive VivaVoce	0-0-0	2
2	CE 15039	Seminar	0-0-3	2
3	CE 15040	Major Project	0-0-6	8
Total			**9-3-6**	**24**

Electives

Open Elective-I & Open Elective-II			
CE 15066	Numerical Methods in engineering	CE 15051	Mechanics of Composite Materials
CE 15067	Traffic Engg & Management	CE 15052	Remote Sensing and GIS
CE 15068	Theory of Elasticity & Plasticity	CE 15053	Water Power Engg
CE 15069	Finite Element Method	CE 15054	Green Building
CE 15070	Project Management	CE 15055	Waste Management
CE 15071	Environmental Management	CE 15072	Structural Dynamics

Core Elective-I & Core Elective-II			
CE 15041	Advance Surveying	CE 15056	Pavement Design
CE 15042	Town Planning & Architecture	CE 15057	Rock mech and Tunnel Engg
CE 15043	Economic evaluation and analysis of transport project	CE 15058	Machine foundation
CE 15044	Pavement management system	CE 15059	Soil Dynamics & Earthquake Engineering
CE 15045	Environmental Geotechnique	CE 15060	Advanced Structural Analysis
CE 15046	Ground Improvement Technique	CE 15061	River Engineering
CE 15047	Concrete technology	CE 15062	Computational Hydraulics
CE 15048	Pre-stressed Concrete	CE 15063	Water Resources Planning & Management
CE 15049	Bridge Engineering	CE 15064	Open Channel Flow
CE 15050	Ground Water Engineering	CE 15065	Watershed Management
CE 15051	Mechanics of Composite Materials	CE 15066	Numerical Methods in engineering
CE 15052	Remote Sensing and GIS	CE 15067	Project Management
CE 15053	Water Power Engg	CE 15068	Finite Element Method
CE 15054	Green Building	CE 15069	Theory of Elasticity & Plasticity
CE 15055	Waste Management	CE 15070	Traffic Engg & Management
		CE 15071	Environmental Management

SYLLABUS

FIRST & SECOND SEMESTER

(COMMON TO ALL BRANCHES)

PHYSICS – I (3 – 1 – 0)

Module I

Interference

Superposition of waves - coherent and incoherent superposition, Intensity distribution.

Two source interference theory, Interference in thin films. Newton's Rings, Determination of wavelength of light and refractive index of liquid.

Diffraction

Diffraction: Introduction, Types of diffraction ,Fraunhofer diffraction at a single slit,Plane Diffraction grating, Diffraction spectra, Determination of wavelength of light, angular dispersion, resolving power.

Polarization

Polarization: Introduction, Types of Polarization, Production of polarized light(elementary idea) Brewster's law, Malu's law, Double refraction(only statement, explanation), Construction and working of :Nicol prism, Half wave plate and Quarter wave plate, Application of polarization(Polrimeter: Construction, Principle, Working).

Module II

Electromagnetism

Vector Calculus : Gradient, Divergence, Curl of vector field, Gauss divergence theorem. Stoke's theorem, Green's theorem,Maxwell's electromagnetic equation in differential form and in integral form , Electromagnetic wave equation: in vacuum and in conducting medium. Pyonting vector ,Pyonting theorem, preliminary ideas about waveguides.

Module III

Quantum mechanics

Need for Quantum Physics, wave particle duality,Davisson Germer experiment, Schroedinger wave equation (time dependent and time independent), properties of wave function, Operators , eigen value , eigen function, expectation value, probability current, Simple applications: particle in a box, finite well, step potential and tunneling

Module IV

Lasers

Introduction, Characteristics of lasers, Einstein's coefficients & Relation between them, Lasing action, Population inversion, Different types of Lasers (Ruby Laser,He-Ne Laser), Three and Four level pumping schemes, Applications of LASER(elementary ideas)

Fiber optics

Introduction, Principle of wave propagation in Optical Fiber, Structure of Optical Fiber,Types of Optical Fibers, Acceptance angle and acceptance cone, Numerical aperture, Applications of optical fibers in communications

Nanomaterials

Introduction, Classification, Physical characteristics and applications (fundamental)

Text books:

1. Optics – A.K.Ghatak
2. Concepts of Modern Physics – A. Beiser

Reference Books:

1. Electricity & Magnetism – D. Griffiths
2. Quantum Mechanics – Gascirowicz
3. Lasers, theory and applications - K. Thyagarajan and A.K. Ghatak, New York : Plenum Press.
4. Quantum Mechanics – M. Das and P.K Jena
5. An Introduction to Fiber Optics - A.Ghatak, K.Thyagarajan: Cambridge University Press.
6. .Nano Materials by B.Viswanathan,Narosa Book Distributer

List of Experiments

1. To Determine the Young's Modulus (Y) of the material of a Wire by Searle's Method.
2. Determination of Surface Tension of water by Capillary rise method.
3. Determination of Acceleration due to gravity by using a Bar Pendulum.
4. To determine thermal conductivity of a bad conductor by using Lee's Apparatus.
5. Determination of Wavelength of monochromatic light with the help of a Newton's Ring Apparatus.
6. Determination of Grating element of a Diffraction grating using spectrometer.
7. To verify the laws of transverse vibration of string by using sonometer.
8. To determine the Rigidity modulus of the material of a wire by using Barton's apparatus.
9. To draw the characteristics of a Bipolar Junction Transistor.
10. To draw the V-I characteristics of a P. N Junction diode.

CHEMISTRY – I **(3 – 1 – 0)**

Module–I 10 Hours

Failure of Classical Mechanics, Schrodinger's Wave Equation (Need not be Derived), Energy for 1-D Potential Box, Interaction of Wave with Matter
Fundamental of Microwave, IR, UV-Vis Spectroscopy:
Basic Concept of Spectroscopy, Selection Rule, Numericals, Frank-Condon Principle,

Module – II 10 Hours

Thermodynamics of Chemical Processes: 05 Hours
Concept of Entropy, Chemical Potential, Equilibrium Conditions for Closed Systems, Phase and Reaction Equilibria, Maxwell Relations

Module – III 10 Hours

Definition of Terms: Phase, Components, Degree of Freedom, Phase Rule Equation. Phase Diagrams: One Component Systems – Water and Sulphur, Two Component System – Lead-Silver, Cooling Curves, Iron-Carbon Phase Diagram

Module–IV 10 Hours

Electrode Potentials and its Relevance to Oxidation and Reduction, Measurement of EMF, Determination of pH, Hydrogen, Glass, Quinhydrone Electrodes, Dry Cells, Fuel Cells and Corrosion: Concept, Galvanic Corrosion
Kinetics of Chemical Reactions: 05 Hours
Reversible, Consecutive and Parallel Reactions, Steady State Approximation, Chain
Engineering application of materials: 05 Hours
Organometallics and Nanomaterials

1) P. W. Atkins, Elements of Physical Chemistry, 4th Edition, Oxford University Press
2) C. N. Banwell and E. M. MacCash, Fundamentals of Molecular Spectroscopy, 5th Edition,
3) P. K. Kar, S. Dash and B. Mishra, B.Tech. Chemistry Vol. I, Kalyani Publications

Chemistry Laboratory

(Any ten Experiments)

1. Determination of amount of sodium hydroxide and sodium carbonate in a Mixture.
2. Determination of Total hardness of water by EDTA method.
3. Estimation of calcium present in the limestone.
4. Preparation of aspirin.
5. Standardization of $KMnO_4$ using sodium oxalate.
6. Determination of ferrous iron in Mohr's salt by potassium permanganate.
7. Determination of Rate constant of acid catalyzed hydrolysis of ester.
8. Determination of dissolved oxygen in a sample of water.
9. Determination of Viscosity of lubricating oil by red wood Viscometer.
10. Determination of Flash point of given oil by Pensky Marten's Flash point Apparatus.
11. Determination of available chlorine in bleaching powder.

Reference Book: B.Tech practical Chemistry-Kalyani publisher

MATHEMATICS - I

Subject – Mathematics I (Calculus, Linear Algebra and Numerical Method) (3-1-0)

Module 1: (10 Lectures)

Open sets, Closed sets, Limit points of a set, Limits, Continuous functions, Functions continuous on closed intervals, The derivative, Increasing and decreasing functions, Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Extremum values; Riemann integral: Definition and existence of the integral, Integral as a limit of sums, some integrable functions, Fundamental theorem of calculus, Mean value theorems for integral calculus.

Module 2: (10 Lectures)

Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Gauss Elimination, Linear Independence, Rank of a Matrix, Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Gauss-Jordan Elimination, Vector Spaces, Inner Product Spaces,

Module 3: (10 Lectures)

Eigenvalues, Eigenvectors, Some Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices, Eigenbases, Diagonalization, Quadratic Forms, Complex Matrices and Forms, IncIusion of Matrix Eigenvalues, Power Method for Eigenvalues

Module 4: (10 Lectures)

Numerical methods in general, Introduction, Solution of Equations by Iteration, Interpolation, Numerical Integration and Differentiation

Text Books:

1) S.C. Malik and S. Arora, Mathematical Analysis, New Age International
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: S.C. Malik - 2(2.1- 2.3), 5(5.1-5.3), 6(6.1, 6.3-6.7), 7(7.1), 9(9.1, 9.6, 9.7, 9.9,9.10)
E. Kreyszig - 7(7.1-7.5, 7.7, 7.8,7.9), 8, 20 (20.7, 20.8), 19(19.1, 19.2, 19.3, 19.5)

Reference Books:

1) George B. Thomas , Jr. and Ross L. Finney, Calculus and Analytic Geometry, Addison Wesley Publishing Company
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

MATHEMATICS - II

Differential Equations (3-1-0)

Module 1: (10 Lectures)

Basic Concepts, Modeling, Separable ODEs, Modeling, Exact ODEs, Integrating Factors, Linear ODEs, Bernoulli Equation, Population Dynamics, Existence and Uniqueness of Solutions. Homogeneous Linear ODEs of Second Order, Homogeneous Linear ODEs with Constant Coefficients, Euler-Cauchy Equations, Existence and Uniqueness of Solutions, Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters.

Module 2: (10 Lectures)

General linear differential equations of order n, Differential Operators, Homogeneous Linear ODEs, Homogeneous Linear ODEs with Constant Coefficients, Nonhomogeneous Linear ODEs, Conversion of an nth-Order ODE to a System, Basic Theory of Systems of ODEs.

Power Series Method, Theory of the Power Series Method, Frobenius Method, Sturm-Liouville Problems, Orthogonal Functions.

Module 3: (10 Lectures)

Laplace Transforms, Laplace Transform, Inverse Transform, Linearity. s-Shifting, Transforms of Derivatives and Integrals, ODEs, Unit Step Function, t-Shifting, Short Impulses, Dirac's Delta Function, Partial Fractions, Convolution, Integral Equations, Differentiation and Integration of Transforms.

Module 4: (10 Lectures)

Partial differential equations, Basic Concepts, Modeling: Vibrating String, Wave Equation Solution by Separating Variables, Use of Fourier Series, D' Alembert's Solution of the Wave Equation. Characteristics, Heat Equation: Solution by Fourier Series, Solution of PDEs by Laplace Transforms.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition.

Chapters: 1(1.1-1.5, 1.7), 2(except 2.4, 2.8, 2.9), 3, 4(4.1, 4.2), 5(5.1, 5.2, 5.4), 6(6.1-6.5), 12(12.1-12.5, 12.11)

Reference Books:

1) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
2) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press
3) J. Sinha Roy and S. Padhy, Ordinary and Partial Differential Equation, Kalyani Publisher.
4) Richard Bronsan and Gabriel Costa, Scahum's Outline of Differential Equations, McGraw Hill
5) Paul Duchateau and D.W. Zachmann, Scahum's Outline of Partial Differential Equations, McGraw Hill
6) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill

English for Communication

(Credit: 4-0-0)

Objective- For developing the ability to communicate effectively in professional environment by enhancing their skills in communication.

Module 1:Fundamentals of Communication (10 Hours)

- Communication: Process, pattern and stages of communication, channels and types of communication and Barriers to Communication.
- Functions of language: Descriptive, Expressive and Social Functions.
- Formal and Informal English
- Plain English
- Bias free language

Module 2: Communicative Grammar (10 Hours)

- Time, Tense and Aspects
- Verbs of State and Events
- Use of Modal Verbs
- Phrasal Verbs
- Passive and Active Voice
- Conditionals

Module 3: Sounds of English (10 Hours)

- The Speech Mechanism and Organs of Speech
- ConsonantSounds of English
- Vowel Sounds of English
- Stress Pattern: Syllable, Stress and Intonation.
- Problem sounds for Indian Speakers

Module 4: Business and Official Writing (10 Hours)

- Paragraph writing and Sentence Linker
- Business and Official Letters
- Report and Proposal writing,
- Notice, Circular and Memo writing
- Résumé (CV) Writing.

Text Books:

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Better English Pronunciations By J. D.O Conner (Cambridge University Press)
3. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)

Reference Books: "Business communication" by Ramachandran, Lakshmi and Krishna (Macmillan)

ENGLISH COMMUNICATION SKILLS (Credit :0-0-2)

Objective: For enhancing corporate readiness among students by inculcating several skills of communication through activities.

Laboratory Activities:

1. **Giving Introduction (Self and others)**
2. **Group Discussion**
3. **Interviews**
4. **Role Play**
5. **Listening skill Development**
6. **Reading skill Development**
7. **Writing skill Development**
8. **Speaking skill Development**
9. **Meeting**
10. **Presenatation**

Books Recommended:

1. Soft Skills – By Dr K Alex (S Chand)

ENGINEERING MECHANICS

Module - I

1. **Concurrent forces on a plane**: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment, friction (chapter 1). (7)

2. **Parallel forces on a plane**: General case of parallel forces, center of parallel forces and center of gravity, centroid of composite plane figure and curves(chapter 2.1 to 2.4) (4)

Module - II

3. **General case of forces on a plane**: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections, plane frame, principle of virtual work, equilibrium of ideal systems.(8)
4. **Moments of inertia**: Plane figure with respect to an axis in its plane and perpendicular to the plane, parallel axis theorem(chapter 3.1 to3.4, 5.1, appendix A.1 to A.3) (3)

Module - III

5. **Rectilinear Translation:** Kinematics, principle of dynamics, D Alembert's Principle, momentum and impulse, work and energy, impact (chapter 6). (11)

Module – IV

6. **Curvilinear translation:** Kinematics, equation of motion, projectile, D Alembert's principle of curvilinear motion. (4)
7. **Kinematics** of rotation of rigid body (Chapter 9.1) (3)

Text book:

1. Engineering mechanics: S Timoshenko & Young; 4th Edition (international edition) MC Graw Hill.

Reference books:

1. Fundamental of Engineering mechanics (2nd Edition):
   S Rajesekharan & G Shankara Subramanium; Vikas Pub. House Pvt ltd.

2. Engineering mechanics: K.L. Kumar; Tata MC Graw Hill.

SESSIONAL

Workshop Practice-I

(Consists of 3 sections) **:**

1. Carpentry Section: Wooden rack/bench/chair/stool (any one)

2. Fitting Section: Paper Wt. Square or Rectangular joint (male and female joint) (any one)

3. Black Smith **Section** : Weeding hook/Hexagonal headed bolt blank (any one)

COMPUTER PROGRAMMING

L-T-P: 3-1-0 **Cr.-4**

Module I:

Introduction to computing- Block architecture of a computer, bit, bytes, memory, representation of numbers in memory. Introduction to problem solving- Basic concepts of an algorithm, program design methods, flowcharts.C Language Fundamentals- Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements.Input &Output - Input & Output Assignments, Formatted Outputs. Operatorsand Expressions-Operators, Precedence of operators.

Module II:

Decision Control Structure, Loop Control Structure and Case Control Structure.Functions- Monolithic vs Modular programs, User defined vs standard functions, formal vs Actualarguments, Functions category, function prototypes, parameter passing, Recursion.Arrays- 1D Array, 2D Array & Multi-Dimensional Array. Strings- Declaration &Initialization,String Handling Functions.

Module III:

Pointers- Pointer variable and its importance, Pointer Arithmetic, Passing parameters, pointer to pointer, pointer to function.Dynamic Memory Allocation.Structure- Nested Structure, Array of Structures, Pointer to Structure, Structure & Functions, typedef, Enumerated Data Type, Bit Fields. Union- Array of Union Variables, Union inside Structure.Storage Class.

Module IV:

Preprocessor Directives- Types, Pragma Directives, Conditional Directives.Files- Reading data from Files, Reading data from Files, Writing data to Files, Error Handling during File Operations.Advanced Issues in Input & Output – using *argc*&*argv*.Operation on Bits.

Text Books:

1. C: The Complete Reference: Herbert Schildt
2. Computer Fundamentals &Programming in C: ReemaThareja, Oxford University Press.

Reference Books:

1. Let us C- Y.Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A.N. Pearson Education
3. C How to Program- Deitel and Deitel, Pearson Education.
4. The C programming Language- Brian W. Kernighan and Dennis M. Ritchie,Prentice-Hall.

PROGRAMMING LAB (CS15-984)

L-T-P: (0-0-3) **Cr:** 2

Introduction to OS : Linux/Unix, Dos, Windows, Vi editor, File Handling, Directory Structure, File Permissions, Creating and editing simple c programs, Compilation and Execution

C programming on variables and expression assignment, simple arithmetic loops, If-else, Case statements, Break, Continue, Go to

Single and Multidimensional arrays

Functions, Recursion, File handling in C

Pointers, address operator, Declaring pointers and operators on pointers, Address of an array, Structures, Pointer to structure, Dynamic memory allocation

Fundamental Programs on Data Structures (Stack, Queue, Linked lists, Trees, Graphs)

(EL15-002) BASIC ELECTRICAL ENGINEERING (3-1-0)

MODULE-I (10 HOURS)

DC Networks: Kirchhoff's laws, node and mesh analysis, Delta-star and star-delta transformations. Superposition, Thevenin's and Norton's theorem. Transients, in R-L, R-C and R-L-C circuits with DC. Excitation.

Single Phase AC Circuits: Single phase EMF generation, average and effective values of sinusoids, j-operations, complex representation of impedances, phasor diagrams, power factor, power in complex notation, solution of series and parallel circuits. Introduction to resonance in series RLC circuit.

Three Phase AC Circuit: Three phase EMF generation, delta and star connection, Line and Phase quantities. Solutions of 3-phase circuits with balanced load. Power in 3-phase balanced circuits.

MODULE-II (10 HOURS)

Magnetic Circuits: B-H Curve, Hysteresis, Permeability and reluctance, solution of simple magnetic circuits, Hysteresis and Eddy current losses.

DC Generator: Different types, Principle of Operation of DC generator, EMF equation, methods of excitation.

DC Motor: Back e.m.f., speed and torque of a DC Motor, Conditions for maximum Power. Speed control of DC shunt motor.

Transformers: Construction and Principle of operation of single-phase transformer, EMF equation, Single-phase autotransformer.

MODULE-III (10 HOURS)

Three phase Induction Motor: Construction and principle of operation, types; Slip-torque characteristics.

Synchronous Machines: Construction & principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor.

Introduction to single-phase induction Motor.

MODULE-IV (10 HOURS)

Measuring Instruments: DC PMMC instruments, Extension of range by shunts and multipliers. Moving iron

ammeters and voltmeters, Dynamometer type Watt meters, Induction type Energy Meter.

Power supply systems: Principle of generation - thermal, hydel and nuclear. Transmission and distribution of electric energy. Introduction to Electric Heating & Welding.

TEXT BOOKS

[1]. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.

[2]. D.Kulshreshtha, " Basic Electrical Engineering" TMH, 1st Edition.

REFERENCE BOOKS

[3]. H.Cotton, "Advanced Electrical Technology", CBS Publishers, New Delhi, 7th Edition.

[4]. C.L. Wadhwa, "Electrical Engineering", New Age International Publishers, 2nd Edition.

[5]. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.

(EL15-003) BASIC ELECTRICAL ENGINEERING LAB (0-0-3)

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, To study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules as per ISS
2. Measurement of the armature & field resistance of D.C. Machine by volt-amp method. & Starting and speed control of a D.C. shunt motor
3. Study of BH Curve
4. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds.
5. Measurement of earth resistance and insulation resistance
6. Starting of Induction motor and measurement of three phase power & power factor by 2-wattmeter method.
7. Calibration of a single phase Energy Meter by directed loading & Phantom loading

BASIC ELECTRONICS (3-1-0)

UNIT-1 **(10 Hours)**

Introduction to Electronics: Signals, Frequency Spectrum of Signals, Analog and Digital Signals,
Linear Wave Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator.
Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors,
Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes- LED, Photo diode, Zener Diode.

UNIT-II **(14 Hours)**

Bipolar junction Transistor (BJTs): Device Structure and Operation, Current-Voltage Characteristics, BJT as an Amplifier and as a Switch, Introduction to Power Amplifiers, A,B and C types.

JFET: Physical Structure, Operation and Characteristics MOSFET: Physical Structure, Operation and Characteristics, Feedback Amplifiers & Oscillators: General Feedback Structure, Properties of Negative Feedback, Four Basic Feedback Topologies (block diagram only), Basic Principles of Sinusoidal Oscillators(Crystal, Hartley & Collpit).

Operational Amplifiers (OP-AMPs): The Ideal OP-AMP, Inverting Configuration, Non-Inverting Configuration. OP-AMP Applications (Adder, Subtractor, Integrator, Differentiator).

UNIT-III **(10 Hours)**

Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, RS Flip flop, JK Flip flop.

UNIT-IV **(10 Hours)**

Introduction to Electronic Instruments: CRO: CRT, Waveform Display, Applications of CRO, Electronic Multimeter, Audio Signal Generator: Block diagram, Front Panel Controls.

Principles of Communication: Fundamentals of AM & FM, Block diagram of Transmitters & Receivers.

TEXT BOOKS:

1. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press. Selected portions from chapters 1 to 3, 5, 8, 13.

2. Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications. Selected portions from chapters 4 to 12,14, 16 to 18,20,21.

REFERENCE BOOKS:

1. Integrated Electronics, Millman and Halkias, TMH Publications.

2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

BASIC ELECTRONICS LAB

LIST OF EXPERIMENTS

1. Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital multimeter should be used.
2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3. V-I Characteristics of a Semiconductor Diode. Determining DC and AC resistance.
4. Clipper and Clamper Circuit.
5. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
6. V-I (Output) Characteristics of N-P-N Transistor in CE Configuration.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)

CE 15001: ENVIRONMENTAL SCIENCE & ENGINEERING (3-1-0) CR-04

Module – I **(6 Hours)**

Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space.

Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor.

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).

Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.

Module – II **(15 Hours)**

Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards

Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print

National Ambient Air quality Standards, Noise standards, Vehicle emission standards

Module – III **(12 Hours)**

Drinking water standard (IS 10500), Water Quality Criteria and wastewater effluent standards

Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination

Working principles of ready-made water filter/purification system commercially available

Lay out of a wastewater treatment plant and working of each unit.

Module – IV **(7 Hours)**

Solid waste management: Source, classification and composition of Municipal Solid Waste (MSW), Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill

Biomedical Waste management – sources, treatment (principles only) and disposal

Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only)

Introduction to e-waste management.

Environmental impact Assessment: Project screening for EIA, Scoping studies

Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).

Text Book:

1 Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

1 Environmental Engineering, H.S. Peavy, D.R.Rowe and G. Tchobanoglous, McGraw Hill, 1985.

2 Introduction to Environmental Engineering, M. L. Davis and D. A Cornwell, McGraw Hill International, 2005.

CE 15002: ENGINEERING DRAWING (0-0-3) CR-02

(Minimum 8 sheets and 2 Auto Cad classes)

Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.

Scales: Plain, Diagonal and Vernier Scales.

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids.

Sections of solids; Development of surfaces

Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids,

Introduction to Auto-Cad:

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Text Book:

1 Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.

Reference Books:

1. Engineering Drawing by Venugopal, New Age publisher.

THIRD SEMESTER

MATHEMATICS - III

(Multivariable Calculus and Special Functions) (3-1-0)

Module 1: (10 Lectures)

Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field; Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Divergence Theorem of Gauss, Further Applications of the Divergence Theorem, Stokes's Theorem.

Module 2: (10 Lectures)

Fourier series and integral, Dirichlet criterion, Parseval's identity, the convolution theorem.

Module 3: (10 Lectures)

Orthogonal curvilinear coordinates, Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates, Special curvilinear coordinates.

Module 4: (10 Lectures)

Gama function, The Beta function – Dirichlet integral; Other special functions– Error function, exponential integral, sine and cosine integrals, Bessel's Equation, Bessel Functions $J_{\square}(x)$, Bessel Functions of the Second Kind $Y_{\square}(x)$, Legendre's Equation, Legendre Polynomials $P_n(x)$.

Text Books:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. - 9th Edition
   Chapters: 5(5.3, 5.5, 5.6), 9(9.4, 9.7, 9.8, 9.9), 10, 11(11.1-11.3, 11.6, 11.7), A3.4, A3.1

Reference Books:

1) S.C. Mallik and S. Arora, Mathematical Analysis, New Age International
2) Milton Abramowitz and Irene A. Stegun, *Handbook of Mathematical Functions*, National Bureau of Standards, Applied Mathematics Series - 55
3) Yury A. Brychkov, Handbook of Special Functions: Derivatives, Integrals, Series and Other Formulas, CRC Press
4) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
5) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

CE 15003: MECHANICS OF MATERIALS (3-1-0) CR-04

Module – I **(10 Hours)**

Direct Stress: Load, Stress, Principle of St. Venant, Strain, Hooke's Law, Modulus of Elasticity, Composite bars in tension and compression, temperature stresses in composite rods, statically indeterminate problems

Shear Stress: Shear stress, Complementary shear stress, shear strain, modulus of rigidity

Module – II **(10 Hours)**

Two dimensional stress and strain systems: Principal stresses, Maximum shear stresses, Analysis of stresses, Mohr's stress circle.

Principal strains and principal axes of strain measurement, calculation of principal stresses from principal strains, Analysis of strains, Mohr's strain circle.

Module – III **(12 Hours)**

Shear force and Bending moment: Types of supports, shear force and bending moment diagrams for concentrated load and uniformly distributed load on simple supported and cantilever beam.

Simple bending of beams: Theory of pure bending of initially straight beams, Distribution of normal and shear stresses, Composite beams.

Torsion in solid and hollow circular shafts, Twisting moment, strength of solid and hollow circular shafts, strength of shafts in combined bending and twisting, closed coil helical spring.

Introduction to theories of failure: Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain energy theory, maximum distortion energy theory, maximum octahedral shearing stress theory

Module – IV **(8 Hours)**

Thin cylinders and spheres: Stresses in thin cylinders and spherical shells under internal pressure, wire winding of thin cylinders.

Buckling of Columns: Short and long columns, eccentric loading of columns, core of the section, Euler's theory of initially straight columns with various end conditions, Columns with initial curvature.

Combined bending and direct stress

Text Book:

1. Strength of Materials by S. P. Timoshenko and D. H. Young, East West Press

Reference Books:

1. Strength of Materials by G.H. Ryder, Macmillan India Ltd.

2. Mechanics of Materials by E. Popov

CE 15004: CIVIL ENGG. MATERIALS & CONSTRUCTION (3-1-0) CR-04

Module I **(11 Hours)**

Bricks: Methods of bricks manufacture, testing of bricks

Cement: Classification, chemical composition, hydration, tests for cement.

Concrete: Composition, water- cement ratio, workability.

Module – II **(9 Hours)**

Stairs: Terms used, types of stairs, essential requirements, wooden stairs, concrete stairs, and metal stairs.

Doors and Windows: Types, materials used.

Masonry arches: Terms used types of arches, stability, line of thrust, depth of arch at the crown.

Cavity walls: Purpose, method of construction.

Module – III **(10 Hours)**

Fire resistive construction: Fire resistive construction, fire resistance of common building materials, protection for girders and columns, firefighting appliances.

Plastering: Materials for plastering, methods of plastering, defects in plastering and remedy.

Painting and decoration: Oil painting and Varnishing, enamel painting, Washes and distemper, defects in painting.

Damp prevention: causes, effects, different methods of prevention of dampness.

Module – IV **(10 Hours)**

Stone: Indian building stones, their properties and uses, methods of querying

Glass: Varieties of glass, decorative glass, door and window glazing.

Timber: Preservation and seasoning of timber

Foundation: Brief idea on various types of foundation.

Repair of building: Annual and special repair of buildings, Maintenance of buildings, Types of cracks in Building, Types of building Joint.

Text Book

1. A Text book of Building Construction, A.P. Arora & S.P. Bindra, Dhanpat Rai & Sons.

Reference Books

1. A Text Book of Building Materials, C.J. Kulkarrni
2. Building Materials, Varghese, PHI, Pvt. Ltd.
3. Building Construction, Varghese, PHI, Pvt. Ltd.

CE 15005: BUILIDING DRAWING (0-0-3) CR-02

1. Plan, elevation, side view of residential/office building
2. Detailing of doors/windows
3. Drawing of several types of footing, brick work, floor staircase, masonry, arches and lintels.
4. Types of steel roof trusses
5. Drawing of 2 bedroom/3 bedroom houses (single and two storied), ground and first floor plans, elevation and section for load bearing and framed structures
6. Project on establishment like Bank building/Post.
7. Office/Hostel/Library/Auditorium/Factory building etc.
8. Introduction to Auto-CAD: Use of Auto-CAD in building drawing.

Text Book:

1. Civil Engineering Drawing by: M. Chakraborti,

Reference Book:

1. Building Planning and Drawing by N. Kumara Swamy and A. Kameswara Rao, Charotar Publisher.

CE 15006: CONCRETE LAB. (0-0-3) CR-02

1. Fineness of Cement by Sieve analysis and by air permeability method.
2. Standard consistency & Setting times of cement
3. Specific gravity & Soundness of cement
4. Compressive strength of cement
5. Shape size test, Water absorption & Compressive strength of Brick
6. Grain size distribution, Specific gravity and water absorption of fine and coarse aggregates.
7. Unit mass and Voids of concrete aggregates and Bulking of fine aggregates
8. Slump test & Compaction factor test of wet concrete.
9. Stress-strain curve, modulus of elasticity, and poisson’s ratio of concrete.
10. Modulus of Rupture of concrete
11. Flexural strength and split tensile strength tests of concrete.

HUM01 ENGINEERING ECONOMICS (4-0-0)

MODULE- 1

Theory of Demand- Modern Utility Theory, The Neumann- Morgenstern approach, The Friedman-Savage Hypothesis, Uncertainty and Consumer Behaviour, Expected value of Perfect Information, Revealed Preference Theory, Intertemporal Choice- Slutsky equation, Annual Economic Worth, Present Value, Discount rate IRR and NPV

MODULE- 2

Profit Maximisation: Theory of Production- Laws of Production, Returns to scale and variable proportions, Equilibrium of firm, and Choice of optimal combination of factors, Cost Minimisation- Calculus analysis of cost minimisation, Algebric approach to cost minimisation, average and marginal costs- the short run Cobb-Douglas cost function, constant returns to scale and cost functions, Long run and short run curves- factor prices and cost functions , The envelop theorem for constrained optimisation , Cost control techniques, Critique of the principle of profit maximisation and Modern theories of firms- Baumol's sales maximisation hypothesis, Morris Model of Managerial Enterprise, Hall and Hitch Report and the full cost pricing principle, Bain's limit pricing theory

MODULE- 3

Analysis of Public Projects: Benefit cost analysis, Public goods, Common Property, Free Rider Problem, market failure and externalities, private and social cost, Social Welfare Functions- Welfare maximisation and pare to optimality, market responses to externalities- Mergers, social conventions, property right and bargaining case theorem

MODULE- 4

Linear models: simple regression model -the problem and estimation, classical normal linear regression model, Two- Variable regression- Internal estimation and hypothesis testing, Multiple Regression analysis- The problem of estimation, Dummy Variable Regression Models, Multiple parameter sensitivity analysis, linear Programming- graphic and simplex method; Game theory- the pay off matrix of game, Nash Equilibrium, the mixed strategies and the prisoner's dilemma

READING LIST

1. Varian, H.R. (1992). Introduction to Micro Economic Analysis, Norton and company, New York
2. Woolridge, J.M. (2009). Introductory Econometrics- A Modern Approach, South Western CENGAGE learning
3. Pearce, D.W. and Turner.(1990). Economics of Environment and Natural Resources, Harvester Wheatsheaf. New York
4. Koutsoyiannis, A.(1979). Modern Micro Economics, Macmillan, London
5. Damodaran, S. (2012). Managerial Economics, second Edition, OUP
6. Gujrati and Sangeeta. (2007). Basic Econometrics, TMH, New Delhi
7. Kolstad, C.D. (2000). Environmental Economics, OUP

FOURTH SEMESTER

MATHEMATICS - IV

(Complex Analysis, and Probability and Statistics) (3-1-0)

Module 1: (10 Lectures)

Complex Numbers, Complex Plane, Polar Form of Complex Numbers, Powers and Roots Derivative, Analytic Function, Cauchy-Riemann Equations, Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions, Logarithm, General Power; Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions

Module 2: (10 Lectures)

Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Laurent Series, Singularities and Zeros, Infinity, Residue Integration Method, Residue Integration of Real Integrals; Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations, Special Linear Fractional Transformations, Conformal Mapping by Other Functions.

Module 3: (10 Lectures)

Random Variables, Probability Distributions, Mean and Variance of a Distribution, Binomial. Poisson, and Hypergeometric Distributions, Normal Distribution

Module 4: (10 Lectures)

Introduction. Random Sampling, Point Estimation of Parameters, Confidence Intervals, Testing Hypotheses, Decisions, Regression, Fitting Straight Lines, Correlation.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd

Chapters: 13, 14, 15(except 15.5), 16, 17(except 17.5), 24(24.5-24.8), 25(25.1-25.4, 25.9)

Reference Books:

1) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill
2) R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Taylor & Francis
3) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

CE 15007: ENGINEERING SURVEYING (3-1-0) CR-04

Module I **(9 Hours)**

Concept of surveying: Definition of surveying, classification, principle, accuracy

Linear measurement: Different methods of direct measurement instrument for chaining, ranging, chaining on uneven sloping ground, errors in chaining, corrections.

Chain surveying: Chain triangulation, survey station, lines, locating ground features, field work, instruments for setting out basic problems in chaining, obstacles in chaining

Module II **(11 Hours)**

Compass surveying: Principles use of prismatic compass, measurement of bearings, conversion of bearings, local attraction, correction of compass traverse

Plane table survey: Principles, advantages and disadvantages, equipment, accessories and their uses, Methods of plane table survey, two point and three point problems

Levelling: Types of levelling and their uses, permanent adjustment, curvature and refraction effects

Module III **(10 Hours)**

Contouring: Characteristics and uses of contours, methods of contouring

Theodolite survey: application in height and distance measurements, permanent adjustment of transit theodolite, methods of repetitions and reiterations

Module IV **(10 Hours)**

Curve setting: Simple circular curve setting by chain, tape & theodolite

Introduction to total station

Minor survey instruments: box-sextant, planimeter, pantagraph, their working principles and uses

Text Book:

1 Surveying & Levelling – Kanetkar & Kulkarni, Vol.-I, Pune Vidyarthi Griha Prakashan.

Reference Books:

1 Surveying – Punmia, Vol. – I, Laxmi Publication.

2 Surveying – S.K. Duggal, Tata McGraw Hill

CE 15008: FLUID MECHANICS (3-1-0) CR-04

Module-I **(12Hours)**

Introduction: Physical properties of fluids; Density; specific weight; Specific volume; Specific gravity; Compressibility; Elasticity; Surface tension; Capillarity; Vapour pressure; Viscosity; Ideal and real fluids; Concept of shear stress; Newtonian and non-Newtonian fluids.

Fluid statics: Pressure-density-height relationship; Manometers; Pressure on plane and curved surface;; Centre of pressure; Buoyancy; Stability of immersed and floating bodies; Fluid masses subjected to uniform accelerations.

Module – II **(8 Hours)**

Fluid kinematics: Steady and unsteady, uniform and non-uniform, laminar and turbulent flows and enclosed flows; Definition of one-, two- and three-dimensional flows, Stream-lines, streak-lines, and path-lines; Stream-tubes; elementary explanation of stream-function and velocity potential; Basic idea of flow nets.

Module – III **(12 Hours)**

Fluid dynamics: Basic equations: Equation of continuity; One-dimensional Euler's equation of motion and its integration to obtain Bernoulli's equation and momentum equation.

Flow through pipes: Laminar and turbulent flow in pipes; Hydraulic mean radius; Concept of losses; Darcy-Weisbach equation; Moody's (Stanton) diagram; Flow in sudden expansion and contraction; Minor losses in fittings; Branched pipes in parallel and series, Transmission of power; Water hammer in pipes (Sudden closure condition).

Module-IV **(8 Hours)**

Open channel flow
Definition; Uniform flow; Chezy's, Kutter's and Manning's equations; Channels of efficient cross section.
Flow in Open Channels: Specific energy, Critical flow, Discharge curve, Application of specific energy, Specific force, Classification of Surface profiles, Back water & draw down curves, Flow transition in open channels.

Measurements: Hook gauge; Point gauge; Pitot tube; Current meter; Venturi meter; Orifice meter; Orifices and mouthpieces; Notches and weirs.

Text Books:

1. Fluid mechanics by A.K. Jain, Khanna Publishers.

Reference Books:

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N.Modi and S.M. Seth, Standard Book House.
2. Engineering Fluid Mechanics by K.L. Kumar, S. Chand & Co.
3. Fluid Mechanics by V.L. Streeter, MGH

CE 15009: STRUCTURAL ANALYSIS-I (3-1-0) CR-04

Module – I **(10 Hours)**

Introduction to statically determinate/ indeterminate structure with reference to 2D and 3D structures, free body diagram of structure, introduction to kinematically determinate/indeterminate structures with reference to 2D and 3D structures, degree of freedom.

B.M. and S.F. diagrams for different loading on simply supported beam, cantilever and overhanging beams.

B.M. shear and normal thrust of three hinged arches.

Suspension Cables: Three hinged stiffening girders

Module – II **(12 Hours)**

Deflection of statically determinate beams: Integration method, Moment area method, Conjugate beam method.

Deflection of statically determinate beams by energy methods- strain energy method, castiglianos theorems, reciprocal theorem, unit load method, Deflection of pin-jointed trusses, Williot-Mohr diagram.

Module – III **(06 Hours)**

B.M. and S.F. diagrams for statically indeterminate beams – propped cantilever and fixed beams.

Application of three moment theorem to continuous and other indeterminate beams.

Module – IV **(12 Hours)**

ILD for determinate structures for reactions at supports, S.F. at given section, B.M. at a given section, Maximum shear and maximum bending moment at given section, Problems relating to beams, three hinged arch, suspension cables and roof truss

Text Books

1. Structural Analysis – Norris & Wilber
2. Indeterminate Structures – J.S. Kenney

Reference Book:

Structural Analysis – C.S. Reddy, TMH Publication

CE 15010: HYDRAULICS LAB -I (0-30-0) CR-02

1. Study of flow measuring equipment
2. Determination of head loss in pipes
3. Determination of C_c, C_v and C_d of an circular orifice
4. Determination of discharge coefficient (C_d) of Venturimeter
5. Determination of discharge coefficient (C_d) of orifice meters
6. Flow classification using Raynolds Apparatus
7. Determination of Metacentric height of a pantoon
8. Determination of Manning's and Chezy's coefficients of an open channel
9. Calibration of V-notch
10. Calibration of rectangular weir
11. Measurement of flow using V-notch and rectangular weir
12. Verification of Bernoulli's equation

CE 15010: SURVEY PRACTICE-I (0-0-3) CR-02

1. Study of Chain, Standardization of Chain & Measurement of a line
2. Chain traversing
3. Compass traversing
4. Plane Table : 3 Point problem
5. Study of Dumpy level, its temporary adjustment, Differential Leveling and Fly leveling.
6. Contouring
7. Study of Theodolite, Temporary adjustment of Theodolite & measurement of horizontal and vertical angle.
8. Theodolite Traversing
9. Study on total station

CE 15012: COMPUTER APPLICATIONS IN CIVIL ENGINEERING (0-0-3) CR-02

AIM OF THE COURSE: *Operation of computers and software used in civil engineering; use of instrumentation to conduct laboratory experiments; perform data analysis; create and present technical reports.*

MATLAB: Introduction to MATLAB, Application of MATLAB software for: calculation and plotting SFD and BMD of beam and frame structures. Calculation and Plotting of ILDs, Solution of a few problems related to fluid mechanics, plotting of contours.

AUTOCAD: Introduction to AUTOCAD, basic commands for 2D drafting, Dimensioning, Layers and Blocks, Basic drawings using AUTOCAD, Simple building drawing using AUTOCAD, plan, section and elevation, 3D view.

INTRODUCTION TO GRAPHIC SOFTWARE: Basic commands, plotting of graphs and data analysis.

CE 15013: ENVIRONMENTAL ENGINEERING LABORATORY (0-0-3) CR-02

1. Determination of Taste, Odour and Color of water/wastewater sample
2. Determination of pH, Temperature, E. Conductivity and D.O. of water/wastewater sample
3. Determination of TS, TDS and SS of water/wastewater sample
4. Determination of hardness & alkalinity of water sample
5. Determination of Turbidity and SO_4^{-2} of water sample
6. Determination of Ca^{+2}, Na^{+} and K^{+} of water sample
7. Determination of residual chlorine and Cl^{-} of water sample
8. Determination of BOD of water/wastewater sample
9. Determination of COD of water/wastewater sample
10. Microbiological analysis of water/wastewater sample

BHU-1301 ORGANISATIONAL BEHAVIOUR (3-1-0)

Module-1(8 hours)

OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager
LEARNING: Nature of learning, How learning occurs, Learning & OB
Case Study Analysis

Module-2 (10 hours)

PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB
PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB
MOTIVATION: Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory
Case Study Analysis

Module-3 (10 hours)

COMMUNICATION: Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness
GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building
LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader
CONFLICT: Nature of Conflict & Conflict Resolution
TRANSACTIONALANALYSIS: An Introduction to Transactional Analysis
Case Study Analysis

Module-4 (12 hours)

ORGANISATIONAL CULTURE: Meaning & Definition, Culture &Organisational Effectiveness
HUMAN RESOURCE MANAGEMENT: Introduction to HRM, Selection,Orientation,Training& Development, Performance Appraisal, Incentives
ORGANISATIONAL CHANGE: Importance of Change, Planned Change & OB Techniques
INTERNATIONAL OB: An Introduction to Individual & Interpersonal Behaviour in Global Perspectives
Case Study Analysis

Text Books/References:

[1] Stephen P. Robbins, Organisational Behaviour, Printice hall of India, New Delhi,2000.
[2] K. Aswathappa, Organisational Behaviour, Himalaya Publishing House, Bombay, 1997.
[3] S. S. Khanka, "Organisational Behaviour", S. Chand Publication, Revised edition 2009.

Course Objectives:

1. To predict, understand and control the human behaviour in an organisation
2. To develop interpersonal relation in organisation
3. To maintain cordial industrial relation
4. To manage human resources efficiently in an organisation

Course Outcomes:

1. Students will be able to maintain the interpersonal and industrial relation when they will join into one organization.
2. Able to develop effective leadership quality.
3. Able to apply appropriate motivational techniques in accordance to the nature of the individual employee.
4. Able to manage human resources efficiently in an organisation.

FIFTH SEMESTER

CE 15014: STRUCTURAL DESIGN (3-1-0) CR-04

(IS: 456-2000 and other related codes are permitted in the examination)

Module-I **(10 Hours)**

Properties of concrete and reinforcing steel, Philosophy, concept and methods of reinforced concrete design, Introduction to limit state method: Limit state of collapse and limit state of serviceability. Application of Limit state method to rectangular beams for flexure, shear, bond and torsion.

Module-II **(10 Hours)**

Design of doubly reinforced beams. Design of T-and L-beams. Design of one way and two way slabs, Design of staircases.

Module-III **(10 Hours)**

Design of short and long columns with axial and eccentric loading, design of isolated column footing.

Module-IV **(10 Hours)**

Design principle of masonry structures: Brick and stone masonry. Design of masonry short and long walls, columns and retaining walls.

Text Books:

1. Reinforced concrete: Limit state by A.K. Jain
2. IS 456, SP-16 and SP-32.

Reference Books:

1. Limit state design of reinforced concrete by P.C. Verghese, PHI
2. Reinforced concrete by B.C. Punmia, A.K. Jain and A.K. Jain

CE 15015: WATER RESOURCES ENGINEERING (3-1-0) CR-04

Module –I **(10 Hours)**

Hydrologic cycle, availability of water on earth, importance of hydrology and its applications in engineering.

Precipitation: Forms & types, measurement of rainfall, optimum number of rainguage stations, consistency of rainfall data, presentation of precipitation data, mean aerial rainfall, depth–area-duration curve, design storm, lossess from precipitation, evaporation, infiltration.

Module – II **(12 Hours)**

Run off: Computation, factors affecting runoff, Design flood: Rational formula, Empirical formulae, Stream flow: Discharge measuring structures, approximate average slope method, area-velocity method, stage-discharge relationship.

Hydrograph; Concept, its components, Unit hydrograph: use and its limitations, derivation of UH from simple and complex storms, S-hydrograph, derivation of UH from S-hydrograph. Synthetic unit hydrograph: Snyder's approach, introduction to instantaneous unit hydrograph (IUH).

Module – III **(10 Hours)**

Reservoir management: Fixation of reservoir capacity, Rippl's mass curve, sequent peak algorithm, allocation of storage space for various uses, reservoir sedimentation and tis control, determination of sediment yield at a reservoir site.

Module – IV **(8 Hours)**

Flood frequency analysis: Gumbel's method. Flood routing: Hydrologic channel routing, Muskingum equation, hydrologic reservoir routing: Modified Plus method, Flood control measures.

Text Books

1. Engineering Hydrology by K. Subramanya. Tata Mc Graw Hill Publication

Reference Books:

1. Elementary Hydrology by V.P. Singh, Prentice Hall Publication
2. Hydrology by P. Jayarami Reddy
3. Handbook of applied hydrology, V.T. Chow, Mc Graw Hill.

CE 15016: GEOTECHNICAL ENGINEERING-I (3-1-0) CR-04

Module –I **(10 Hours)**

Introduction: Origin of soils, formation of soils, clay mineralogy and soil structure, basic terminology and their relations, index properties of soils.

Soil classification: Particle size distribution, use of particle size distribution curve, Particle size classification, textural classification, HRB classification, Unified classification system, Indian standard soil classification system, Field identification of soils.

Soil moisture: Types of soil water, capillary tension, capillary siphoning.

Stress conditions in soil: Total stress, pore pressure and effective stress.

Module – II **(10 Hours)**

Permeability: Darcy's law, permeability, factors affecting permeability, determination of permeability (laboratory and field methods), permeability of stratified soil deposits. Estimation of yield from wells.

Seepage analysis: Seepage pressure, quick condition, laplace equation for two –dimensional flow, flow net, properties and methods of construction of flow net, application of flow net, seepage through anisotropic soil and non-homogenous soil, seepage through earth dam.

Module – III **(10 Hours)**

Soil compaction: Compaction mechanism, factors affecting compaction, effect of compaction on soil properties, density moisture content relationship in compaction test, standard and modified proctor compaction tests, field compaction methods, relative compaction, compaction control.

Soil consolidation: Introduction, spring analogy, one dimensional consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation.

Module –IV **(10 Hours)**

Shear strength of soils: Mohr's stress circle, theory of failure for soils, determination of shear strength (direct shear test, tri-axial compression test, unconfined compression test, van shear test), shear characteristics of cohesionless soils and cohesive soils.

Stabilization of soil: Introduction, mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization, thermal stabilization, electrical stabilization, Introduction to modern methods of stabilization

Text Book:

1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.

Reference Books:

1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
2. Soil Mechanics, T.W. Lambe & Whiteman, Wiley Eastern Ltd, Nw Delhi.

CE 15017: ENVIRONMENTAL ENGINEERING (3-1-0) CR-04

Module – I **(10 Hours)**

Quantity of water: Sources of water, Percapita demand, design period, population forecast, fluctuation in demand. General requirement for water supply: Sources, Types of intakes, Pumping and Transportation of water.

Quality of water: Physical, chemical and biological characteristics of water and their significance, necessity of treatment, water quality standards for various water uses

Module – II **(10 Hours)**

Engineering system for water purification: Aeration, Screening, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection

Methods of treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation.

Advanced water treatment: Ion exchange, electro-dialysis, RO (principles only)

Module – III **(10 Hours)**

Generation and collection of wastewater, sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system.

Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation.

Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended-culture systems, Attached-culture systems, Secondary clarification, Disinfections of effluents.

Sludge treatment and disposal: Sludge characteristics, thickening, disposal

Module – IV **(10 Hours)**

Air pollution: Units of measurement, Sources and Classification of air pollutants.

Influence of meteorological phenomena on air quality: Lapse rate and dispersion, Pressure systems and dispersion, Winds and dispersion, Moisture and dispersion, Gaussian dispersion equation, Determination of stack heights.

Engineered systems for air pollution control: Gravitational settling chamber, cyclone, ESP, Bag filter and scrubbers, National Ambient air quality standards.

Text Book:

1. Environmenatal Engineering (Volume I & II) by S. K. Garg-Khanna Publishers

Reference Books:

1. Environmenatal Engineering (Volume I & II) by B. C. Punmia-Khanna Publishers

2. Environmenatal Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

CE 15018: STRUCTURAL ANALYSIS -II (3-1-0) CR-04

Module – I **(15 Hours)**

Introduction to Force and Displacement methods of structural analysis, Analysis of continuous beam and plane frame by slope deflection method and moment distribution method.

Module –II **(7 Hours)**

Analysis of continuous beam and simple portals by Kani's method, Analysis of two pinned and fixed arches with dead and live loads, suspension cable with two pinned stiffening girders.

Module – III **(8 Hours)**

Plastic Analysis: Plastic modulus, shear factor, plastic moment of resistance, load factor, plastic analysis of continuous beam and simple rectangular portals, Application of upper and lower bound theorems

Module – IV **(10 Hours)**

Matrix method of analysis: flexibility and stiffness method, Application to simple trusses and beam

Text Book

1. Indeterminate Structures by C.K. Wang.

Reference Books

1. Indeterminate Structures by J.S. Kenney
2. Matrix methods of Structural Analysis By Pandit and Gupta

CE 15019: FLUID FLOW LAB (0-0-3) CR-02

1. Establishment of different types of hydraulic jumps and their classification
2. Determination of characteristics of the jumps
3. Flow measurement using Acoustic Doppler Velocimeter (ADV)
4. Determination of characteristics of PVC pipes
5. Determination of Rankine efficiency of hydraulic ram and D'Aubussin's efficiency
6. Determination of overall efficiency of Francis turbine with constant DC loading
7. Determination of overall efficiency of Pelton turbine under constant speed with alternating load
8. Determination of percentage of slip and efficiency of the double acting reciprocating pump and draw its characteristic curve

CE 15020: GEOTECHNICAL ENGINEERING LABORATORY (0-0-3) CR-02

1. Determination of specific gravity of soil grains
2. Determination of grain size distribution of soil: (a) sieve analysis; (b) Hydrometer/pipette test
3. Determination of Atterberg limits of soil: (a) liquid limit, (b) plastic limit, (c) shrinkage limit
4. Measurement of unit weight of soil in the field: (a) Core cutter method, (b) Sand replacement method
5. Determination of Density-water content relationship of soil: Proctor compaction tests.
6. Determination of relative density of granular soil
7. Determination of shear strength of soil: (a) Direct shear test (b) Tri-axial shear test, (c) Unconfined compression test (d) Vane shear test
8. Determination of consolidation characteristics of soil using fixed ring Oedometer
9. Determination of California Bearing Ratio (CBR) of soaked and un-soaked soil samples
10. Determination of coefficient of permeability of soil: (a) Constant head permeameter (b) Falling head permeameter

CE 15021: ENVIRONMENTAL ENGINEERING DESIGN (0-0-3) CR-02

1. Design of conventional water supply system for a city. The system must include design of intake well, clariflocculators, filtration unit, disinfection, aeration & distribution network etc. including underground & overhead tank.

2. Design of waste treatment system (suspended growth process & attached growth process) for the city.

3. Design of septic tank & soak pit.

4. Design of aerobic, facultative & anaerobic ponds.

CE 15022: DESIGN OF CONCRETE STRUCTURE (0-0-3) CR-02

1. Design and detailing of singly and doubly reinforced sections

2. Design and detailing of flanged sections

3. Design and detailing of slabs: one way, two way, cantilever and continuous

4. Design and detailing of staircases

5. Design and detailing of axial, uniaxial and biaxial loaded columns

6. Design and detailing of isolated footings

7. Design and detailing of framed building with different structural elements : manual and using commercial software

SIXTH SEMESTER

CE 15023: FLUID DYNAMICS (3-1-0) CR-04

Module-I **(10 Hours)**

Dimensional Analysis: Introduction, Dimensional homogeneity, Methods of Dimensional Analysis, Model investigation, Similitude, Types of similarity, Model Laws, types of Models, Dimensionless numbers, Application of dynamic similarity to specific models.

Module – II **(10 Hours)**

Boundary Layer Theory: Introduction: Thickness of boundary layer, Boundary layer along a long thin plate and its characteristics, Boundary layer Equations, Momentum Integral Equations of boundary layer, separation of Boundary Layer, Methods of controlling Boundary layer.

Navier-Stokes Equations of Motion: Significance of Body Force, Boundary Conditions, Viscous Force, Limiting cases of Navier – Stokes Equations, Applications of N-S Equations to Laminar flow between two straight parallel boundaries, and between concentric rotating cylinders.

Module – III **(10 Hours)**

Drag and Lift: Introduction; Types of Drag, Drag on a sphere, Cylinder, Flat plate & on an air foil, Polar diagram, Profile Drag, Lift on immersed bodies.

Turbulent Flow in pipes: Reynolds observation on pipe flow, Causes and characteristics of turbulence. Reynolds stresses, Prandtl's Mixing length Theory, Velocity distribution in Rough pipes, Karman – Prandtl's resistance equations.

Module-IV **(10 Hours)**

Impact of free jet: Introduction, force exerted by fluid jet on stationary flat plate, moving flat plate, Stationary curved vane, moving curved vane, Torque exerted on a wheel with radial curved vanes.

Turbines: Classification, reaction, impulse, outward flow, inward flow & mixed flow turbines, Francis & Kaplan turbines, Pelton Wheel, Physical description and principle of operation, Governing of turbine.

Centrifugal Pump: Principles of classification, Blade angles, Velocity triangle, Efficiency, Specific Speed, Characteristic curves.

Reciprocating Pump: Principle of working, Slip, work done, effect of acceleration & Frictional resistance, Separation.

Text Book:

1. Fluid Mechanics by A.K. Jain, Khanna Publishers

Reference Book:

1. Fluid Mechanics and Hydraulic Machines, Modi & Seth, Standard Pulishers
2. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som & G. Biswas,

CE 15024: TRANSPORTATION ENGINEERING-I (3-1-0) CR-04

Module-I **(12 Hours)**

Transportation by roads, railways, water ways & air ways – their importance& limitation. Road development & planning in India. Financing, Highway alignment & engineering surveys for highway location.
Geometric design-Cross section elements, Design speed, sight distance, super elevation, horizontal & vertical alignment including curves.

Module-II **(10 Hours)**

Traffic Engineering – Traffic studies & their importance.
Highway materials – Properties & tests, selection, requirements of bituminous mixes, marshall test.

Earthwork – measurement & rates, setting out of earth work, computation of areas & volumes-Prismoidal & Trapezoidal methods.

Module-III **(10 Hours)**

Pavement design-Use of CBR method for design of flexible pavement, IRC recommendation for design of rigid pavement.

Highway drainage, pavement failure, Evaluation, Maintenance & Strengthening of existing pavement.

Module-IV **(8 Hours)**

Classification of bridges, Consideration of location of bridge site, Investigation & data collection, Calculation of run off under bridge, Determination of water way, Choice of bridge span-economic span, Determination of maximum scour depth.
Bridge Superstructure-types, suitability. Bridge foundation-Types, Sinking of well.

Text

(1) Highway Engineering-By Khanna & Justo (Nemchand & Bros., Roorkee (U.A))
(2) Bridge Engineering – By S.P. Bindra (Dhanpat Rai publication)

Reference Books:

(1) Principles & Practice of Highway Engineering – By Dr. L.R. Kadiyalli (Khanna publisher)
(2) Bridge Engineering-By D.J. Victor

CE 15025: GEOTECHNICAL ENGINEERING-II (3-1-0) CR-04

Module – I **(10 Hours)**

Stress distribution in soil: Boussinesq equations, Stress isobar and pressure bulb concept, pressure distribution on horizontal and vertical planes, stresses due to point load, line load, strip load, uniformly loaded circular and rectangular areas. Use of newmark's chart. Westergaard's solution. Approximate methods (point load method, two-to-one load distribution method). Contact pressure distribution due to loaded areas. Concept of active zone.

Module –II **(10 Hours)**

Lateral earth pressure and retaining structures: Earth pressure at rest, active and passive earth pressure. Earth pressure theories, Rankine's theory, Coloumb's wedge theory, Rebhann's and Culmann's graphcal methods, stability conditions for retaining walls. Stability of earth slopes: Stability of infinite slopes, stability analysis of finite slopes, Swedish method of slices, fiction circle method, Bishop's method. Use of Taylor stability number. Fellnious metod for locating centre of critical slip circle.

Module – III **(10 Hours)**

Subsoil exploration: Methods, direct (test pits, trenches), semi-direct (borings), indirect (sounding, penetration tests, and geophysical methods).

Planning of exploration programme, spacing and depth of boring, soil sampling, types of samples, standard penetration test, static and dynamic cone penetration test, in-situ vane shear test. Seismic refraction method, electrical resistivity methods,

Module-IV **(10 Hours)**

Shallow foundation: Introduction, bearing capacity, methods and determination of bearing capacity, settlement of foundations.

Deep foundation: Classification of pile, pile driving methods, pile capacity (static and dynamic analysis) pile-group analysis, load test on piles.

Text Books:

1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.

Reference Books:

1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
2. Soil Mechanics, T.W. Lambe & Whiteman, Wiley Eastern Ltd, Nw Delhi.
3. Foundation Engineering, P.C. Verghese, Prentice Hall of India

CE 15026: STEEL STRUCTURES (3-1-0) CR-04

(IS: 800-2007 and Steel tables are permitted in the examination)

Module – I **(10 Hours)**

Philosophy, concept and methods of design of steel structures, structural elements, structural steel sections, Bolted Connections, Failure of Bolted Joints, Specifications for Bolted Joints, Analysis and design of bolted connections,

Welded connections, Welding Processes and defects, Design of fillet welds, Failure of welds,

Design of tension members

Module – II **(10 Hours)**

Design of compression members, Types of Buckling, Design of axially loaded compression member, Design of Columns Lacing, Design of Column battening, Design of Column Slab base, Design of Column Gusseted base, Design of Moment Resisting base plates, Design of Foundation Bolts.

Module – III **(10 Hours)**

Design of beams, Lateral stability of beams, Lateral torsional buckling, Bending strength of beams, Shear strength of beams, Web buckling, Web crippling, Design of rolled beams,
Plate girder, Design of plate girder, Plastic section modulus, Design of a Welded plate girder, Design of Gantry girder.

Module – IV **(10 Hours)**

Design of Roof trusses, Selection of the type of trusses, Loads and Load combinations in roof trusses, Design procedure, Design of component members in a roof truss.

Text Book:

1. Limit state design of steel structures by S.K. Duggal, Tata McGrawhill 2011

Reference Books:

1. Design of Steel Structures by B.C. Punmia, A.K. Jain and A.K. Jain. Laxmi Publishers.
2. Design of Steel Structures, Vol 1, By Ram Chandra and Virendra Gehlot. Scientific Publishers, Jodhpur.
3. Design of Steel Structures by L.S. Negi, Tata McGraw Hill Book Co.

CE 15027: DESIGN OF STEEL STRUCTURES (0-0-3) CR-02

1. Types of steel sections and their properties
2. Design and detailing of bolted connections
3. Design and detailing of welded connections
4. Design and detailing of tension members
5. Design and detailing of compression members
6. Design and detailing of lacing and battening system
7. Design and detailing of slab base and gusseted base
8. Design and detailing of beams and plate girders
9. Design and detailing of roof truss
10. Detailing of framed and bracket connections

CE 15028: TRANSPORTATION & GEOTECHNICAL ENGINEERING DESIGN (0-0-3) CR-02

1. Design of earthen slope
2. Landfill Design
3. Design of retaining walls and sheet piles
4. Design of shallow foundation
5. Design of deep foundation
6. Design of machine foundation
7. Geometrical design of Highway
8. Design of flexible and rigid pavements by IRC method
9. Orientation and geometrical design of Runway.
10. Turn out design.
11. Earthwork calculation.

CE 15029: TRANSPORTATION ENGINEERING LAB (0-0-3) CR-02

Test on Soil-CBR Test
Tests on Aggregate:
(1) Crushing Value Test
(2) Impact Value Test
(3) Los Angels Abrasion Value Test
(4) Shape Test
Tests on Bitumin-
(1) Penetration Test
(2) Softening Point Test
(3) Ductility Test
(4) Specific gravity Test
Test on Bituminous Mix by Marshall Test

CE 15030: SURVEY PRACTICE II (0-0-3) CR-02

1. Determination of sensitivity of bubble tube

2. (a) Determination of tacheometric constants.

   (b) Solution of Height & distance using tacheometer

3. Measurement of distance, angle and height using total station

4. Layout of a building using total station

5. Setting out of simple circular curve and transition curve using total station

   (b) Transition Curve

6. Measurement of angles and distances using Differential Global Positioning System (DGPS)

SEVENTH SEMESTER

CE 15031: ADVANCED CONCRETE STRUCTURES (3-1-0) CR-04

Module-I **(10 Hours)**

Introduction to EQ Engineering: Cyclic behavior of concrete and reinforcement, significance of ductility, ductility of beam, design and detailing for ductility, simple problems based on above concept, Computation of earthquake forces on building frame using Seismic Coefficient Method as per IS 1893-2002

Module-II **(10 Hours)**

Design of Foundations: Combined Footing: Design of Rectangular and Trapezoidal footing, Design of Raft Foundation, Design of Pile Foudation

Module-III **(10 Hours)**

Retaining walls: Forces acting on retaining wall, Stability requirement, Design of Cantilever and Counterfort Retaining walls

Module-IV **(10 Hours)**

Design of Water tanks: Design requirements, Design of tanks on ground and underground

Introduction to Prestressed Concrete: Prestressing methods, Analysis of prestressing systems and losses

Text Book:

1. Advanced Concrete Structure Design by P. C. Verghese, Prentice Hall of India
2. Limit state design- A K Jain, Nem Chand and Brothers

Reference books

3. Limit state design of reinforced concrete by B.C. Punmia, AK Jain and A.K. Jain, Laxmi Publishers New Delhi 2007
4. A K Chropra,Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall of India

CE 15032: HYDRAULIC STRUCTURES (3-1-0) CR-04

Module – I **(10 Hours)**

Water requirement of crops, factors affecting water requirement, crop season, crop period, base period, delta and duty, consumptive use of water, frequency of irrigation, irrigation efficiency.

Water logging: causes and effects of water logging, anti-water logging measures, Land drainage, Design of drainage system, Tile drains.

Module - II **(10 Hours)**

Systems of irrigation, lift irrigation, flow irrigation, methods of distribution of water, Flow irrigation: selection of dam or barrage site, types of canals, alignment of canals, Design of canal section: Kennedy's and Lacey's theory, canal lining, Diversion head works, Canal head regulators, canal falls, outlets..

Cross drainage works (Theory only).

Module - III **(14 Hours)**

Weirs and barrages: types of weirs and barrages and their components, Bligh's creep theory, Khosla's theory. Calculation of scour depth.

Dams: classification of dams, forces acting on gravity dams, economical height of gravity dams, Gravity dams (Stability Analysis, Design and construction), earth dams, causes of failure of earth dams, methods of preventing failure of earthen dams, design of filters.

Module – IV **(6 Hours)**

Spillways: Type of Spillways, Spillway gates, Types of hydraulic jumps, Energy dissipaters, River training works.

Text Book

1. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Standard Publishers

Reference Books

1. Engineering Hydrology by K. Subramanya, Tata Mc Graw Hill
2. Irrigation Engineering by N.N. Basak, PHI

CE 15033: TRANSPORTATION ENGINEERING-II (3-1-0) CR-04

Module – I **(10 Hours)**

History of Indian Railways, Component parts of railway track, Problems of multi gauge system, Wheel and axis arrangements, Coning of wheels, Various resistances and their evaluation, hauling capacity and tractive effort, stresses in rail, sleepers, ballast and formation.

Permanent way component parts : Types of rail section creep, wear and failure in rails, Rail joints, bearing plates, anti-creep devices, check and guard rails, Ballast requirements, Specifications, Formation, Cross-section, drainage.

Module – II **(10 Hours)**

Geometric design : Alignment, horizontal curves, super elevation, equilibrium cant and cant deficiency, Length of transition curves, Gradients and grade compensation, vertical curves.

Point and Crossing : Design of simple turn out, various types of track junction and their configurations.

Module – III **(10 Hours)**

Signaling and interlocking : Control of train movement and monitoring, types of signals, principles of interlocking.

Air Transport Development : Airport scenario in India – Stages of development, Aircraft characteristics, airport planning, site selection, Obstruction and zoning laws, Imaginary surfaces, Approach zones and turning zones.

Module – IV **(10 Hours)**

Runways and Taxiway design : Elements of runway, orientation and configuration, Basic runway length and corrections, Geometric elements design, Taxiway design, Main and exit taxiway, Separation clearance, Holding aprons, Typical airport layouts, Terminal building, gate position.

Visual Aids and Air Traffic Control : Airport making and lighting, Airway and airport traffic control, Instrumental landing systems and Air navigation aids.

Text books:

1. A Text Book of Railway Engineering by S C Saxena and S P Arora, Dhanpat Rai & Sons
2. Airport Planning & design by S. K. Khanna, M.G. Arora & S. S. Jain- Nemchand & Bros.

Reference books:

1. Railway Engineering, M.M. Agrawal, Prabha & Co., New Delhi
2. Railway Track Engineering by J. S. Mundrey, Tata McGraw Hill Book Co.

CE 15034: STRUCTURAL ENGINEERING LAB (0-0-3) CR-02

1. Determination of tensile strength and percentage of elongation of steel, Stress- strain curve of steel, Modulus of Elasticity.
2. Bend and re-bend test of steel reinforcement.
3. Mix design of Concrete as per IS:10262-1982
4. Testing of RCC beam
5. Non-destructive tests of concrete
6. ILD for indeterminate structure
7. Finding reactions and forces for three hinged arch.

CE 15035: MINOR PROJECT (0-0-3) CR-02

EIGHTH SEMESTER

CE 15036: CONSTRUCTION MANAGEMENT (3-1-0) CR-04

Module-I **(10 Hours)**

Objectives and functions of construction management

Project Management: Project Planning, Scheduling and Controlling, Bar charts: Development of Bar charts and its shortcomings. Network techniques: Event, activity, Dummy activity. Network rules, Numbering of events, Critical Path Method, Critical activities, Slack, Project Evaluation and Review Techniques (PERT): Time estimates, Different types of Float of activity, Probability of meeting schedule date for the project.

Module-II **(8 Hours)**

Cost Model: Project cost, indirect and direct cost, slope of direct cost curve, optimum project duration, contracting the network for cost optimization. Introduction to updating, resources smoothing and resources leveling, Work Motion Study, Multiple Activity Chart.

Inventory management: Functional role of Inventory, factors involved in inventory problem Deterministic Inventory control model: single and multiple item inventory control model with and without shortage.

Module-III **(12 Hours)**

Construction equipment: Different types of construction equipment, earth moving equipment-Choice of equipment. Power shovels, Draglines, Clamshells, Trenchers, Bucket excavators, Dredges, Bulldozers, Tree dozers, Rippers, Scrappers, Crawler vs Wheeled equipment and related numerical problems. Dewatering and pumping. Grouting and Pile driving equipment, Conveyors, cranes, concrete mixture, vibrators, Rollers, Compactors and other road construction equipment, Factors affecting selection of construction equipment.

Module-IV **(10 Hours)**

Quality Control and Safety in construction:

Quality Control by Statistical Methods, Sampling Plan, Control Charts, X Chart, R Chart, C chart and P Chart. Problem Areas in Construction Safety, Accidents and their Causes, Human Factors, Safety measures in construction work, construction safety course by BIS.

Text books:

1. Construction Planning & Management by UK Srivasttav,
2. Construction project Management – Theory and Practice, Neeraj K. Jha, Peerson Publication

Reference Books:

1. Construction planning, Equipment and Methods, R. L.Peurify. Tata McGraw Hill
2. Construction Management and Planning, B Sengupta & H Guha, Tata McGraw Hill
3. Construction Planning and Management, Mahesh Verma
4. PERT & CPM, L. S. Sreenath. East - West Press.

CE 15037: ESTIMATION AND PROFESSIONAL PRACTICES (3-1-0) CR-04

Module – I **(14 Hours)**

Quantity Estimation: Principles of estimation, methods and units, Estimation of materials in Buildings, Culverts and Bridges.

Module – II **(7 Hours)**

Principles of general and detailed specification for various types building works, Specifications of different items.

Module – III **(7 Hours)**

Analysis of rates: Description, Prime cost, Schedule of rates, Analysis of rates for various types of works.

Module – IV **(12 Hours)**

Contract Management: Legal aspects, contract laws related to land acquisition, labour safety and welfare, Different types of contacts, their relative advantages and disadvantages, Elements of tender operation, Evaluation of tenders and Award of work, Disputes and arbitration.

Valuation of Civil Engineering structures.

Text books:

1. Estimating and costing in Civil Engineering Theory & Practice, B.N.Dutta, UBS Publishers.
2. Estimating, Costing, Specification and Valuation on Civil Engineering, by M. Chakraborti

Reference Book:

1. Construction Management and Planning, B. Sengupta & H Guha, Tata McGraw Hill

CE 15038: COMPREHENSIVE VIVAVOCE (0-0-0) CR-02

CE 15039: SEMINAR (0-0-3) CR-02

CE 15040: MAJOR PROJECT (0-0-6) CR-08

OPEN & CORE ELECTIVES

CE 15041: ADVANCED SURVEYING (3-1-0) CR-04

Module – I **(10 Hours)**

Application of Theodolite Surveying – Tacheometry, Height & distance, Curve setting problems (Compound, Reverse & Transition), Traversing & Triangulation survey: Principle, Planning & Methods. Geodesy

Module – II **(10 Hours)**

Photogrammetric Surveying – Principle, Scale, Number of Photographs, Deduction of distance & height, Elements of Astronomical survey, Solution of problems dealing with celestial triangle.

Module – II **(12 Hours)**

Principles of Remote Sensing & Geographic Information System, Application to Civil Engineering.

Module – IV **(8 Hours)**

Electronic distance measurement, Total Station, Global Positioning System.

Text Book

(1) Surveying – Vol –II – By B.C. Punmia, A K Jain and A K Jain, Laxmi Publishers
(2) Higher Surveying – Vol –II By B.C. Punmia, A K Jain and A K Jain, Laxmi Publishers

Books for Reference:

(3) Surveying – Vol – I – By S.K.Duggal, Tata McGraw Hill Book Co.
(4) Surveying – Vol – II – By S.K. Duggal, Tata McGraw Hill Book Co.

CE 15042: TOWN PLANNING & ARCHITECTURE (3-1-0) CR-04

Module – I **(8 Hours)**

Elements of City plan, Surveys, Zoning, Housing, Slums, Parks & Play grounds, Public buildings & Town centres and Industries

Module – II **(8 Hours)**

Communication & Traffic Control, Urban renewal & replanning the existing towns, Master plan, Planning law & Legislation.

Module – III **(12 Hours)**

i) Architecture as a fine art, its aim, importance and methods of study. Fundamental principles of architecture- Truth, beauty and Goodness.
ii) Qualities and factors of beauty.
iii) Qualities : Strength, Vitability, Restraint, Refinement, Repose, Grace, Breadth, Scale, Expression or setting out of purpose, Unity in concept, Factors : Mass, Form, Proportion, Balance, Symmetry, Solids, and voids, Light and shade.

Module – IV **(12 Hours)**

i) Influence on architectural development : Effects of topography, Climate, Religion, Customs, Traditions, Technological development and aspirations of time.
ii) Class in Orders : Definition, Doric, Ionic, Corinthian, Composite and Tuscan orders, Knowledge of the details of their parts and proportions.
iii) Indian Architecture : Stupas, Chaityas and Viharas with examples. Jain style - Architectural character and example .
Hindu style – Dravidian temples and gopuram, Orissan group of temples with examples, Indo- Islamic architecture with examples.
iv) Architectural character of modern architecture.

Text Book

1. Fundamentals of town planning -G.K. Hiraskar - Dhanpat Rai & Publication

Books for reference :

1. Architects & Builders hand book – Kiddar & Parker
2. The great ages of world architecture - G.K.Hiraska

CE 15043: ECONOMIC EVALUATION AND ANALYSIS OF TRANSPORT PROJECT (3-1-0) CR-04

Module-I **(10 Hours)**

Project Formulation: Project Preparation – Flow Chart for Project preparation. Project Cycle- Project Formulation – Need and Scope of Project Formulation - Various Aspects and Approaches in Project Formulation. Stages in Project Formulation. Preparation of Feasibility Report and DPR – Guidelines.

Module -II **(10 Hours)**

Economic Evaluation: Need for Economic Evaluation; Stages involved in Economic Analysis; Cost and Benefit components; Discounting Criteria; Welfare economics; Social costs; Rate of Return; Road User Cost study in India ; Value of Travel time Savings - Economic concept of evaluation of travel time savings; Issues connected with evaluation of travel time savings. Vehicle operating costs - Components of VOC, Accident costs; Methodologies for economic evaluation of an accident.

Module -III **(12 Hours)**

Economic Analysis; Basic Concepts of Economic Analysis, Principles of Economic Analysis; Cash flow diagrams; Time value of Money; Development of cash flow Diagrams; Methods of Economic Evaluation -Equivalent Uniform Annual Cost Method; Present worth of cost method;- Equivalent uniform annual net return method; Net present value method; Benefit cost ratio method; Rate of Return Method. Applications of these methods to highway projects.

Module -IV **(8 Hours)**

Project appraisal by shadow pricing with case studies; Toll system analysis, Financial analysis;Budgeting.

Text Book

1. Traffic Engineering and Transport Planning - L.R Kadiyali, Khanna Publishers.
2. Transportation Engineering Economics - Heggie. I. G.; Mc Graw Hill Publishers.

Reference Book

1. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects.
2. IRC:SP: 30, Manual on Economic Evaluation of Highway Projects in India.
3. Economic Analysis for Highways - Winfrey.R; International TextBook Company.
4. Road User Cost Study, CRRI
5. Road Project Appraisal, for Developing Countries, J.W.Dickey ,John Wiley & Sons.

CE 15044: PAVEMENT MANAGEMENT SYSTEM (3-1-0) CR-04

Module -I **(9 Hours)**

Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design,

Construction and Maintenance; Rehabilitation and Feedback systems; Pavement Maintenance Management Components of Maintenance Management and Related Activities – Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies.

Module -II **(15 Hours)**

Techniques for functional and structural evaluation of pavements: Serviceability Concepts; Visual Rating; Pavement Serviceability Index; Roughness Measurements ;Distress Modes – Cracking, Rutting, etc; Pavement Deflection – Different Methods and BBD, Skid Resistance, Roughness, Safety – Aspects; Inventory System. Causes of Deterioration, Traffic and Environmental Factors, Pavement Performance Modeling Approaches and Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000, Sampling Techniques – Tolerances and Controls related to Profile and Compaction

Module -III **(8 Hours)**

Pavement rehabilitation techniques: overlay design procedures, recycling of flexible and rigid pavements

Module -IV **(8 Hours)**

Maintenance of paved roads: Fog spray, Slurry seal and micro surfacing, Treatments of cracks and joints in Rigid pavement, Mud Jacking.

Text Book

1. Y. H. Huang, Pavement Analysis and Design, Second ed.,Pearson Education
2. Rajib B. Mallick,Tahar El-Korchi, Pavement Engineering: Principles and Practice, Second Edition, CRC Press

References Book

1. Ralph Haas, W. Ronald Hudson, John P. Zaniewski, Modern pavement management Modern Pavement Management, Krieger Pub Co
2. Croney, D. and P. Croney, The design and performance of road pavements, McGraw-Hill Book Company, London, UK.
3. Derek Pearson, Deterioration and Maintenance of Pavements, ICE Publishing
4. IRC: 81-1997 Guidelines for strengthening of flexible pavement.

CE 15045: ENVIRONMENTAL GEOTECHNICS (3-1-0) CR-04

Module-I **(10 Hours)**

Sources and Site Characterization: Scope of Environmental Geotechnics, Various Sources of Contaminations, Need for contaminated site characterization; and Characterization methods.

Solid and Hazardous Waste Management: Classification of waste, Characterization solid wastes, Environmental Concerns with waste, waste management strategies.

Module-II **(10 Hours)**

Contaminant Transport: Transport process, Mass-transfer process, Modeling, Bioremediation, Phytoremediation.

Module-III **(10 Hours)**

Remediation Techniques: Objectives of site remediation, various active and passive methods, remediation NAPL sites, Emerging Remediation Technologies.

Module-IV **(10 Hours)**

Landfills: Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system.

Text Books:

1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008
2. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)

References:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook, Kluwer Academic, 2001
2. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).
3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001

CE 15046: GROUND IMPROVEMENT TECHNIQUE (3-1-0) CR-04

Module – I **(10 Hours)**

Introduction, Necessity of ground improvement, Dewatering, methods, Analysis and design of dewatering systems. Grouting types, Properties, Method of grouting, Ground selection and control.

Module – II **(10 Hours)**

Compaction, Methods of compaction, Engineering prosperities of compacted soil, Field compaction and its control.

Module – III **(10 Hours)**

Soil stabilization, Use of chemical additives, Stone columns, Principle, design and method of installation.

Module – IV **(10 Hours)**

Reinforced earth, Concept, Materials, Application and design, Use of geo-synthetics and geo-cells in construction work.

Text books:

1. Ground Improvement Technique, P. Purusothom Raj

Reference Book

1. Foundation Design and Construction, M.J. Tomlinson

2. Foundation Engineering, G.A. Leonard, Tata McGraw Hill

3. Modern Geotechnical Engineering, Alam Singh, IBT Publishers

CE 15047: CONCRETE TECHNOLOGY (3-1-0) CR-04

Module 1 **(10 Hours)**

Introduction of concrete, Historic development, Composition of concrete, Advantages of concrete over other materials, Advances and future trends in concrete, Overview of Sustainability and Concrete development.

Cement: Production, composition, and properties; cement chemistry, Types of cements; special cements; Aggregates: Classification, IS specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates; Water : General requirements & limiting values of impurities

Module 2 **(8 Hours)**

Admixtures: Water reducers, air entrainers, set controllers, special admixtures - structure properties and effects on concrete properties; Introduction to supplementary cementing materials and pozzolans; Other mineral additives - reactive and inert.

Concrete mix design**:** Basic principles; IS method; ACI method; new approaches based on rheology and particle packing.

Module 3 **(10 Hours)**

Concrete Production & Fresh concrete**:** Batching of ingredients; mixing, transport, and placement; Consolidation, finishing, and curing of concrete; initial and final set - significance and measurement; Workability of concrete and its measurement.

Engineering properties of concrete**:** Compressive strength and parameters affecting it; Tensile strength -direct and indirect; Modulus of elasticity and Poisson's ratio; Stress strain response of concrete.

Dimensional stability and durability: Introduction to durability; relation between durability and permeability; Chemical attack of concrete; corrosion of steel rebars; other durability issues**;** Creep and relaxation - parameters affecting; Shrinkage of concrete - types and significance; Parameters affecting shrinkage; measurement of creep and shrinkage**.**

Module 4 **(12 Hours)**

Non-Destructive testing of concrete: Introduction to Destructive, semi -destructive & Non-destructive testing methodology, Problems faced during Non-destructive evaluation, Test methods like Rebound Hammer test, Ultra-sonic pulse velocity, Penetration tests, Pull out test

Special concretes**:** Properties and applications of: High strength - high performance concrete, reactive powder concrete; Lightweight, heavyweight, and mass concrete; fibre reinforced concrete; self-compacting concrete; shotcrete; other special concretes.

Overview of Fracture Mechanics: Origin of fracture mechanics, Understanding the quassi-brittle nature of concrete, Failure of concrete under low stress, Micro-cracking, crack propagation, stress concentration at openings.

Text books:

1. A. M. Neville, Concrete Technology (English) 1st Edition; Pearson India publications.
2. M.L. Gambhir, Concrete Technology, 5th Edition; by; McGraw Hill Education (India) Private Limited.

Reference Books:

1 P. Kumar Mehta, and Paulo J.M. Monteiro; Concrete: microstructure properties and materials: Tata Mcgraw Hill Education Private Limited

2. M S Shetty, Concrete Technology: Theory and Practice; 7th Edition;; S. Chand & Company Ltd-New Delhi.

CE 15048: PRE-STRESSED CONCRETE (3-1-0) CR-04

(Relevant IS Codes are permitted in the examination)

Module –I **(10 Hours)**

Different systems of prestressing, Characteristics of concrete and steel, Other suitable materials, Losses in prestress.

Analysis and design of section for flexure, shear and torsion. Design of flexural member. Limit state design as per IS code.

Module –II **(10 Hours)**

Deflection of prestressed structures- short term as well as long term deflections of uncracked and cracked members.

Module –III **(10 Hours)**

Stress distribution in end-block of post tensioned section. Magnel's method, Guyen's method, Rowe's method and IS code method.

Module –IV **(10 Hours)**

Indeterminate structures- Principles of design of prismatic continuous beams of two equal, unequal spans with same and variable moments of inertia, Cap cable, Design concept of concordancy of cable, Secondary design consideration.

Design of Pre-tensioned and Post-tensioned beam

Text Book

1. N. Krishnaraju- "Prestressed concrete"- Tata McGraw-Hill, New Delhi-2004.

2. S. K. Mallik & A. P. Gupta- "Prestressed concrete"- Oxford & IBH, New Delhi-1982

Reference Books:

3. E. W. Bennet- "Prestressed concrete theory & design"- Chapman & Hall, London-1962.

4. T. Y. Lin & H. Burns Ned,- "Design of prestressed concrete structures", Johnwilley & Sons, New York-1982.

CE 15049: BRIDGE ENGINEERING (3-1-0) CR-04

Module 1: **(10 Hours)**

Introduction: classification and components of a standard bridge, Engineering and aesthetic requirements, introduction to bridge codes.

Investigation for bridge: Site selection, data drawing, design discharge linear water way, economical span, location of piers and abutments, vertical clearance above HFL, scour depth and choice of bridge type.

Standard Loadings for Road Bridges: Dead load, Live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.

Module 2: **(10 Hours)**

Foundation and substructures: Types of foundation (open, pile, well and caisson), design of piers, abutments, wing wall and bed blocks.

Design of Culverts: Design of Pipe culverts (hydraulics and structural), Analysis and design of right, skew and curved slab culvert; design of single vent rectangular box culvert.

Module 3: **(10 Hours)**

Design of Girders: Design and detailing T-beam bridge (without footpath), load distribution, design and orthographic plate analysis of bridge deck.

Bearings: Bearings for slab bridges and girder bridges, design of elastomeric bearing.

Joints: Design and construction of expansion joints.

Module 4: **(10 Hours)**

Introduction to long span bridges: Cantilever bridges, Arch bridges, Cable stayed bridges, suspension bridges, Pre-stressed concrete bridge (pre-tensioned and post-tensioned) and steel bridges.

Bridge Launching: Methods of erection of concrete, steel, pre-stressed and composite bridges

Inspection and Maintenance of Bridges: Types of inspection (routine inspection, principal inspection and special inspection), Types of maintenance (Ordinary maintenance and specialized maintenance).

Text Book

1. Essentials of Bridge Engineering, by DJ Victor, Oxford IBH.

Reference Books:

2. Design of Bridge Structures, by T. R. Jagadeesh, PHI.

3. Principles and Practice of Bridge Engineering, SP Bindra, Dhanpat Rai Publications

CE 15050: GROUND WATER ENGG (3-1-0) CR-04

Module-I **(10 Hours)**

Groundwater Occurrence: Groundwater hydrologic cycle, origin of groundwater, rock properties effecting groundwater, vertical distribution of groundwater, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

Groundwater Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing groundwater flow in three dimensions, groundwater flow equation in polar coordinate system. Groundwater flow contours their applications.

Module – II **(10 Hours)**

Analysis of Pumping Test Data – I: Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well, well tests.

Analysis of Pumping Test Data – II: Unsteady flow towards a well – Non equilibrium equations – Thesis solution – Jocob and Chow's simplifications, Leak aquifers.

Tube wells- Types, strainers, yield of a tube well, Interference of wells, causes of failure, optimum capacity, rehabilitation and maintenance of tube wells.

Module – III **(12 Hours)**

Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Groundwater: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Groundwater along with Case studies.

Module – IV **(8 Hours)**

Saline Water Intrusion in Coastal aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunctive use, Case studies.

Text Books:

1. Groundwater - H.M.Raghunath [Wiley Eastern Ltd.]

References :

1. Groundwater Systems Planning & Management - R.Willes & W.W.G.Yeh [Prentice Hall of India.]
2. Applied Hydrogeology - C.W.Fetta [CBS Publishers & Distributors]

3. Groundwater Hydrology - David Keith Todd [John Wiley & Son, New York.]

CE 15051: MECHANICS OF COMPOSITE MATERIALS (3-1-0) CR-04

Module –I **(10 Hours)**

Classification and characteristics of Composite materials, advantages and limitations,

Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotopy, Orthotopy and Anisotropy; Characteristics and configurations of lamina, laminate, micromechanics and macromechanics. Constituent materials and properties.

Module –II **(10 Hours)**

Elastic behaviour of unidirectional lamina, Strength of unidirectional lamina, Macromechanical failure theories : Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill),Interactive tensor polynomial theory (Tsai-Wu)

Module –III **(10 Hours)**

Elastic Behaviour of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties,

Module –IV **(10 Hours)**

Bending of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, specially orthotropic, anti-symmetric cross-ply laminates.

Text Book

1. Robert M. Jones, "Mechanics of Composite materials", McGraw-Hill Book Company
2. I M Daniel and O. Ishai, "Engineering mechanics of Composite materials", Oxford university press

Reference Books:

1. P.K. Mallick , "Fiber-reinforced Composites", Marcel Dekker inc
2. D. Hull and T W Clyne, "An introduction to composite materials", Cambridge university press
3. J N Reddy, Mechanics of laminated composite plates and shells: theory and analysis, CRC Press

CE 15052: REMOTE SENSING AND GIS (3-1-0) CR-04

Module – I **(10 Hours)**

Remote Sensing : Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

Module – II **(10 Hours)**

Geographic Information System: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS.

Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

Module – III **(10 Hours)**

GIS Spatial Analysis: Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

Module – IV **(10 Hours)**

Applications: Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development, Watershed characteristics.

Reservoir sedimentation, Fluvial Geomorphology, water resources management and monitoring, Ground Water Targeting, Identification of sites for Artificial Recharge Structures, Drainage Morphometry, Inland water quality survey and management, water depth estimation and bathymetry.

Text Books:

1. Remote Sensing and its applications - LRA Narayana [University Press 1999.]

References:

1. Concepts & Techniques of GIS - C.P.Lo Albert, K.W. Yonng,[Prentice Hall (India) Publications.]
2. Remote Sensing and Geographical Information systems - M.Anji Reddy [B.S.Publications.]
3. GIS by Kang – tsung chang, [TMH Publications & Co.]
4. Basics of Remote sensing & GIS - S.Kumar [Laxmi Publications.]

5. Principles of Geophysical Information Systems – P. A. Burragh and R. A. Mc Donnell [Oxford Publishers 2004.]

CE 15053: WATER POWER ENGG (3-1-0) CR-04

Module-I **(10 Hours)**

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module-II **(10 Hours)**

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels.

Module-III **(10 Hours)**

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house.

Module-IV **(10 Hours)**

Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house.

Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

Text Book:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books

References:

1. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
2. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal, Laxmi Publications Private Limited

CE 15054: GREEN BUILDINGS (3-1-0) CR-04

MODULE - I GREEN BUILDING PROCESS AND ECOLOGICAL DESIGN (10Hours)

Fundamental Principles of Green Building, Introduction to high-performance green buildings, Conventional versus green building delivery systems - Design and construction relationships - Green building project execution - the integrated design process - green building documentation requirements - design versus ecological design - historical perspective -

contemporary ecological design - future ecological design - green design to regenerative design.

MODULE - II GREEN BUILDING SYSTEMS (9 Hours)

Sustainable sites Design and landscaping – enhancing ecosystems - building envelop – selection of green materials - products and practices - passive design strategy – internal load reduction – indoor environment quality strategies - Building energy system strategies – Water cycle strategies- building water and waste management – relevance to LEED / IGBC standards.

MODULE - III GREEN BUILDING IMPLEMENTATION (9 Hours)

Site protection planning - health and safety planning - construction and demolition waste management - reducing the footprint of construction operations - maximizing the value of building commissioning in HVAC System, lighting and non mechanical Systems - costs and benefits relevance to LEED / IGBC standards.

MODULE - IV ASSESSMENT AND ECONOMICS (15 Hours)

Methods and tools for building assessment- USGBC LEED building assessment standard - LEED certification process – Green Globes building assessment protocol- international building assessment systems - LEED-NC Platinum / gold / silver building case studies – trends in building rating systems – IGBC standards – ECBC compliances. Florida Green Building Coalition. Future directions in green high performance building technologies- Carbon accounting-Green Building specifications.

Business case for high-performance green buildings - the economics of green building - benefits - managing initial costs - cost barrier in project management – long term environment benefits.

TEXT BOOKS:

1. Jerry Yudelson, Green building A to Z, Understanding the buildings, 2008.
2. Green building guidelines: Meeting the demand for low-energy, resource efficient homes. Washington, D.C.: Sustainable Buildings Industry Council,

2004.

REFERENCES:

1. Jerry Yudelson, Green Building through Integrated Design, McGraw Hill, 2008
2. Alex Wilson and Mark Peipkorn., Green Building Products: the GreenSpec guide to residential building materials, 2nd Edition, Gabriola Island, BC:
3. Jane Anderson, David E. Shiers, and Mike Sinclair. The green guide to specification: an environmental profiling system for building materials and components, 3rd Edition, Oxford; Malden, MA: Blackwell Science, 2002.
4. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, 2nd Edition, Wiley, 2007.
5. ECBC 2007 Manual, Bureau of Energy Efficiency, New Delhi

CE 15055: WASTE MANAGEMENT (3-1-0) CR-04

Module - I (10 Hours)

Solid waste – sources and engineering classification, characterization, generation and quantification.

Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Treatment methods - various methods of refuse processing, recovery, recycle and reuse, composting – aerobic and anaerobic, incineration, pyrolysis and energy recovery,

Disposal methods – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Module - II **(10 Hours)**

Hazardous Waste Management- Introduction, Sources, Classification, Physico-chemical, Chemical and Biological Treatment of hazardous waste, regulations.

Thermal treatment - Incineration and pyrolysis.

Module - III **(10 Hours)**

Biomedical Waste management - Definition, sources, classification, collection, segregation Treatment and disposal.

Radioactive waste management - Definition, Sources, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB

Module - IV **(10 Hours)**

E- waste management: Waste characteristics, generation, collection, transport and disposal

Soil contamination and site remediation – bioremediation processes, monitoring of disposal sites.

Text Book:

1. Tchobanoglous G., Theissen H., and EIiassen R.(1991), “Solid Waste Engineering - Principles and Management Issues”, McGraw Hill, New York.

References:

1. Pavoni J.L(1973)., “Handbook of Solid Waste Disposal”.
2. Peavy, Rowe and Tchobanoglous (1985), “Environmental Engineering”, McGraw Hill Co. 4th Edition
3. Mantell C.L., (1975), “Solid Waste Management”, John Wiley.
4. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental
5. Engineering Organisation, Government of India, New Delhi, 2000.
6. WHO Manual on Solid Waste Management.
7. Vesiland A.(2002), “Solid Waste Engineering”, Thompson Books.
8. Hazardous waste (management and handling) rules, 2001
9. Biomedical (Handling and Management) Rules 2008

CE 15056: PAVEMENT DESIGN (3-1-0) CR-04

Module I: **(10 Hours)**

Classification of pavements: Difference between Highway and Airport pavements, Geometric and structural design requirements of pavements. Factors affecting pavement – design principles and criteria for design of flexible pavements. Wheel loads on Pavements: Different configurations, contact area, equivalent single wheel load (ESWL) and equivalent wheel load (EWL)

Module II **(10 Hours)**

Design methods for flexible pavements: Main aspects of group index, North Dakota. Kansas, U.S.Navy/C.B.R. Highway methods, Design of flexible pavements and IRC, CBR design curves, Burmister's layer theory and its application in flexible pavement design.

Module III **(10 Hours)**

Rigid Pavements: Critical loading regions, Formulas for corner stresses by Older, Picket and others-Westergard's theory for stresses in concrete pavements for corner, Edge and interior loadings.

Module IV **(10 Hours)**

Temperature stresses in rigid pavements, Westergard, Bradbury and concepts.

Text Book

1. Principles of Pavement Design, Yoder.J. & Witzorac Mathew, W. John Wiley & Sons Inc
2. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.

Reference Book

1. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
2. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers
3. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
4. IRC:37-2012 & IRC :58- 2011 Codes for Flexible and Rigid Pavements Design.

CE 15057: ROCK MECH AND TUNNEL ENGG (3-1-0) CR-04

Module-1 **(10 Hours)**

Rock formation and weathering, rock masses, in situ stresses and groundwater, applied mechanics, Properties of rock material, strength and failure criteria, anisotropy, dynamic strength, rock material testing Characteristic and strength of rock joints, flow in joints, coupled properties, joint testing Rock mass classifications, field tests and characterizations, projection method.

Module-2 **(10 Hours)**

Rock mass strength criteria, rock mass modulus, Estimation of foundation bearing capacity, rock slope stability, rock slope rating RSR, slope reinforcement. Simple engineering applications in rock mechanics, underground openings, rock slopes, foundations, mining subsidence – case studies, Rock bolt systems- installation techniques, testing of rock bolts, choice of rock bolts.

Module-III **(10 Hours)**

Tunnel Engineering: Necessity, planning of tunnels, site investigation for tunnels, types of tunnels, tunnel alignment and grade, size and shape of a tunnel, Rock and soil mechanics applied to tunnelling, tunnelling construction methods and technology Stress around opening and ground response, convergence-confinement method, ground-support interaction Tunnel failure and support mechanisms, observational based support method Tunnel support design using rock mass classification systems

Module-IV **(10 Hours)**

Method of constructions, methods of tunneling in hard rocks - full face method - heading and bench method - drift method - different methods of tunneling in soft soils including compressed air and shield tunneling - shafts in tunnels - ventilation of tunnel and various methods - lining of tunnels - drainage and lighting of tunnels, problems in tunnel constructions, boom tunnelling machines, full face tunnel boring machines; support of tunnels; adverse ground conditions; ground treatment and hazards in tunnelling.

Text Book

1. Godman, P.E."Introduction to Rock Mechanics", John Wiley, New York,1989.

2. Jager, G. "Rock Mechanics and Engineering", Cambridge University Press, 1972.

Reference

1. Stillborg, B. "Professional user handbook for racok bolting", Tran Tech publications, 1986.
2. Hock, E. and Brown, E.T. "Underground excavation in rock", Institute of Mining and Metallurgy,1980.
3. Hock, E. and Bray, J. "Rock slope Engineering", Institute of Mining and Metallurgy,1981.
4. Bickel, J.O., T.R. Kuesel, and E.H. King, "Tunnel Engineering Handbook", Chapman & Hall/ITP Publishing Company, 1996, 544 pp.
5. Parker, A. D."Planning and Estimating Underground Construction", McGrawHill, 1970.

CE 15058: MACHINE FOUNDATION (3-1-0) CR-04

Module I **(10 Hours)**

General Theory: Resonance and its effect; Theory of single-degree,two degree and multiple-degree of freedom system; Transient Response.

Module II **(10 Hours)**

Evaluation of Design Parameters: Importance of design parameters; Geometric properties of machine foundations; Physical properties of the elastic base and their experimental evaluation

Module III **(10 Hours)**

Analysis and Design of Block Type Machine Foundation: Mode of vibration of a block foundation; Methods for dynamic analysis; Foundation for machines inducing periodical and impact-type forces.

Module IV **(10 Hours)**

Vibration Isolation: Active and passive type isolation; Methods of isolation in machine foundation; Isolation in existing machine foundation.

Text book

1. Shamsher Prakash, “Soil Dynamics”, McGraw-Hill Book Company.
2. Braja M. Das, “Principles of Soil Dynamics”, PWS-KENT Publishing Company.

REFERENCES

1.Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall Inc.

2. D. D. Barkan, “Dynamics of Bases and Foundations”, McGraw-Hill Book Company.

3. E. E. Richart et al. “Vibrations of Soils and Foundations”, Prentice Hall Inc.
4. Tien Hsing Wu, “Soil Dynamics”, Allyn and Bacon Inc.

CE 15059: SOIL DYNAMICS & EARTHQUAKE ENGINEERING (3-1-0) CR-04

Module-I **(10 Hours)**

Introduction: Dynamic loading and dynamics of vibrations, Earthquake records, Earthquake records of India,

Seismology: Plate tectonics, Causes of Earthquake, seismic waves, faults, earthquakes magnitude and intensity, seismographs, locating the epicenter of an earthquake

Module-II **(10 Hours)**

Seismic hazards in India: Earthquake hazards in India, Earthquake records in north-eastern region, Earthquake hazard zoning, risk evaluation and mitigation, awareness campaign.

Dynamic soil properties: Introduction, soil properties for dynamic loading, measuring dynamic soil properties.

Module-III **(10 Hours)**

Seismicity: site seismicity, seismic soil response and design earthquake. Liquefaction: introduction, factors affecting liquefaction, liquefaction analysis, anti-liquefaction measures.

Module-IV **(10 Hours)**

Earthquake resistant design of shallow and deep foundations.Analysis of retaining walls and slope stability for earthquakes.

Text book

1. Fundamentals of Soil Dynamics & Earthquake Engineering by B.B. Prasad, PHI Learning Pvt. Ltd
2. Basic Geotechnical Earthquake Engineering: Kamalesh Kumar, New Age International Publishing

Reference Books:

1. Geotechnical Earthquake Engineering: S. L. Kramer, Prentice Hall International Publishing
2. Geotechnical Earthquake Engineering Hand Book: R. W. Day, © 2002 McGraw-Hill

CE 15060: ADVANCED STRUCTURAL ANALYSIS (3-1-0) CR-04

Module I **(10 Hours)**

Matrix methods of structural analysis: Introduction, equilibrium, static and kinematic indeterminacy, kinematics, virtual work, concepts of stiffness and flexibility, analysis by displacement and force methods.

Module II **(10 Hours)**

Application of flexibility method to beams and plane trusses

Module III **(10 Hours)**

Application of stiffness method to beams, plane frames and plane trusses.

Module IV **(10 Hours)**

Application of stiffness method to space truss, space frames and grids, basic concepts associated with computer implementation of stiffness method.

Substructure Analysis.

Text Book:

1. G. Pandit & S. Gupta, "Structural Analysis, A Matrix Approach", Tata McGrawhill, New Delhi

References:

2. H.C.Martin," Introduction to Matrix Methods of Structural Analysis.
3. M.B.Kanchi, "Matrix Methods of Structural Analysis", New Age International Publishers, New Delhi
4. Bhavikatti, "Matrix Methods of Structural Analysis", IK International Pvt Ltd

CE 15061: RIVER ENGINEERING (3-1-0) CR-04

Module-I **(10 Hours)**

Introduction to fluvial system and overview of river morphology: regime concept, longitudinal stream profile, river classifications, thresholds in river morphology, hydraulic geometry, geomorphic analysis of river channel responses, Hydraulics of flow in river channels.

Module-II **(10 Hours)**

Alluvial bed forms and flow resistance, Bed forms, prediction of bed form, critical shear, Shields diagram, Sediment transport, Physical properties of sediment, sediment movement in rivers: bed-load formulas, turbulent diffusion and diffusion equation, suspended-sediment discharge.

Module-III **(10 Hours)**

Meander plan form, Flow in curved river channels; basic equations, transverse velocity profiles for fully developed flow, transverse bed slope and grain size distribution, energy expenditure in curved open channels, transverse flow and cross-stream flow, plan geometry and processes of river meanders.

Module-IV **(10 Hours)**

Analytical basis for hydraulic geometry, analytical river morphology, Design of stable alluvial channel, scour criteria, local scour around bridge piers and around embankments, analytical basis of the fluvial model. River protection works.

Text Book

Fluvial Processes in River Engineering , Chang, Howard H., John Wiley & sons

Reference Book

Petersen, M.S., River Engineering, Prentice-Hall, Englewood Cliffs, New Jersey

Jogelkar D.V., Manual on River Behaviour Control and Training, “Publication No. 60, Central Board of Irrigation and Power, New Delhi, India

CE 15062: COMPUTATIONAL HYDRAULICS (3-1-0) CR-04

Module-I **(10 Hours)**

Ordinary and Partial differential equations, well-posed, ill-posed problem, Finite difference schemes, Stencil diagrams, basic aspect of discretization, truncation error, implicit and explicit types, accuracy, convergence, errors and stability analysis,

Module-II **(10 Hours)**

Von Neumann method, CFL condition, some hydrodynamic techniques – Lax-Wendroff, MacCormack, Crank-Nicolson, staggered grid, ADI, ADE, pressure correction,

Module-III **(10 Hours)**

SIMPLE and SOLA algorithm, method of characteristics, finite element method. Variational and weighted residual formulations,

Module-IV **(10 Hours)**

Applications to steady and unsteady flows, Pollutant dispersion, flood wave propagation, tidal model, applications with computer programming, etc.

Text Book

1. Computational Fluid Dynamics: John D. Anderson, Jr.

References:

1. Computational Fluid Dynamics: T. J. Chung
2. Computational Fluid Mechanics and Heat Transfer: Series in Computational and Physical Processes in Mechanics and Thermal Sciences: John C. Tannehill, Dale A. Anderson and Richard H. Pletcher
3. Computational Methods in Surface/Subsurface Flow & Transport Problems:
Computational Methods in Water Resources XI, Volume 1 & 2 : A.A. Aldama and J.Aparicio
4. Computational Methods in Subsurface Flow & Transport Problems:
Computational Methods in Water Resources XI, Volume 2: A.A. Aldama and J. Aparicio
5. Computational Fluid Dynamics: Principles and Applications: J.Blazek

CE 15063: WATER RESOURCES PLANNING & MANAGEMENT (3-1-0) CR-04

Module I **(10 Hours)**

Introduction, Role of water in national development, assessment of water resources of country, scope of water resources development in context of environment

Module II **(10 Hours)**

Water resources planning process, planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis. Introduction to optimization techniques and systems approach.

Module III **(10 Hours)**

Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water.

Module IV **(10 Hours)**

Conjuctive use of surface and groundwater, water quantity and quality modeling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

TEXT BOOKS:

1. Water Resources System Analysis – Vedula & Mujumdar – Tata Mc.Graw Hill Company Ltd.

REFERENCES:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing House.

CE 15064: OPEN CHANNEL FLOW (3-1-0) CR-04

Module I **(10 Hours)**

Basic Fluid flow concepts: Classification of open channels, classification of flow, basic equations, velocity distribution, pressure distribution, energy and momentum coefficients.

Uniform flow in rigid boundary channels: Shear stress on the boundary, flow over scattered roughness elements, Chezy's equation, Manning's equation, effect of channel shape on resistance equation, section factor curves for rectangular and trapezoidal channels, flow in a circular channel, relation between conveyance and depth, channels of efficient cross-section.

Module II **(10 Hours)**

Uniform flow in mobile boundary channels: Incipient motion condition, regimes of flow, resistance to flow in alluvial streams.

Design of channels: Rigid boundary channels, non-scouring erodible boundary channels, alluvial channels, Shield's diagram and its application

Specific energy, specific force, critical depth computations, control section, application of specific energy in channel transition

Module III **(10 Hours)**

Gradually varied flow: Types of non uniform flow, governing equations, characteristics of surface curves, classification of water surface profiles, sketching of water surface profiles, discharge from reservoir, profiles in compound channels, computation of gradually varied flow in prismatic channels, gradually varied flow in non prismatic channels, critical slope, limit slope

Module IV **(10 Hours)**

Rapidly varied flow: Application of conservation laws, channel transitions, supercritical flow past weirs, spillways, hydraulic jumps

Unsteady flow: Waves and their classification, celerity of a wave, surges, equation of motion, method of characteristics, dam break problem.

Text Books

1. Flow in open channels - K. Subramanya

Reference Books

1. Open Channel Hydraulics - V. T. Chow
2. Flow through open channels - K. G. Ranga Raju
3. Open channel flow - M. Hanif Chaudhry

CE 15065: WATERSHED MANAGEMENT (3-1-0) CR-04

Module I **(10 Hours)**

Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making. Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation;

Watershed Management Practices in Arid and Semiarid Regions, Case studies, short term and long term strategic planning.

Module II **(10 Hours)**

Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system. Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall□runoff process, subsurface flows and groundwater flow.

Module III **(10 Hours)**

Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies. Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management. Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality.

Module IV **(10 Hours)**

Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage. Drought assessment and classification, drought analysis techniques, drought mitigation planning. Perspective on recycle and reuse, Waste water reclamation.

Text Book

Murty, J.V.S. “Watershed Management”, New Age Intl., New Delhi 1998.

REFERENCES

American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975.

Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 .

Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.

Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

CE 15066: NUMERICAL METHODS IN ENGINEERING (3-1-0) CR-04

Module 1 **(10 Hours)**

Introduction to digital computers and programming-an overview, Errors-polynomial approximation ,interpolation: finite differences, Newton's formula for interpolation ,central difference interpolation formulae, interpolation with unevenly spaced points, divided difference and their properties, inverse interpolation and double interpolation

Numerical differentiation: errors in numerical differentiation, differentiation formula with function values.

Numerical integration: Trapezoidal rule, Simpson's 1/3rd & 3/8th rule, Romberg integration, newton cote's integration formula, Euler-maclaurin formula, Gaussian integration, numerical double integration

Module 2 **(10 Hours)**

Solution of linear system - Gaussian elimination and Gauss-Jordan methods , necessity for pivoting, LU decomposition methods , Jacobi and Gauss-Seidel iterative methods sufficient conditions for convergence , Power method to find the dominant Eigen value and eigenvector Diagonal dominance, condition number, ill conditioned matrices, singularity and singular value decomposition. Banded matrices, storage schemes for banded matrices, skyline solver.

Solution of nonlinear equation - Bisection method - Secant method - Regula falsi method - Newton-Raphson method

Module 3 **(10 Hours)**

Approximate solution technique, static condensation, Rayleigh-Ritz method, subspace iteration, Application of finite difference method, solution of equilibrium equations in dynamics, direct method, central difference method, Houbolts method, Wilson θ method, Newmarks method

Module 4 **(10 Hours)**

Numerical Solution of Ordinary Differential Equations- Euler's method - Euler's modified method ,Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adams' methods

Text Book

Numerical methods for Scientists and Engineers by M.K. Jain, S.R. Iyengar & R.K. Jain, Wiley Eastern Ltd.

Numerical methods in engineering and science, Grewal, B.S., Khanna Publishers, Delhi.

Reference Books

Mathematical Numerical Analyis By S.C. Scarborough, Oxford and IBH Publishing Company.

Introductory methods in Numerical Analysis by S.S. Sastry, Prentice Hall of India.

Theory and problems in Numerical Methods by T. Veeranjan and T. Ramachandran, Tata McGraw-Hill Publishing Company, New Delhi-2004.

Numerical Methods for Mathematics Sciences and Engineering 2nd ed. By John H. Mathews, Prentice Hall of India, New Delhi 2003.

Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, Narosa-200 &

Computational engineering: introduction to numerical methods, Schafer, Michael, Springer Verlag, Berlin,

Numerical Methods in Science & Engg., Rajasekaran, S Chand Publication, 1983

CE 15067: PROJECT MANAGEMENT (3-1-0) CR-04

Module-I **(10 Hours)**

Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization. Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management.

Module-II **(10 Hours)**

Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks. Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource Constraints: Resource Leveling and Resource Allocation.

Specific methodologies for planning: Critical Path Method (CPM); Precedence Diagramming Method (PDM); Program Evaluation and Review Technique (PERT); Graphical Evaluation and Review Technique (GERT); Queue - Graphical Evaluation and Review Technique (GERT); Simulation Language for Alternative Modelling (SLAM); Dynamic Planning and Control Methodology (DPM); Critical Chain Planning; Resource Loading.

Module-III **(10 Hours)**

Time Cost Tradeoff: Crashing Heuristic. Project Implementation: Project Monitoring and Control with PERT/Cost, Contract Management, Project Procurement Management; Post Project Analysis. life-cycle and post-mortem analysis.

Module-IV **(10 Hours)**

Computers applications in Project Management, Such as Microsoft® Project, Primavera Project Planner®, Primavera® Monte Carlo, Crystal Ball® and ProChain® are available to the project manager for deterministic and probabilistic planning. In this course we will use the following: Primavera® P3 — for deterministic time and resource scheduling; Primavera® Monte Carlo — for probabilistic time and resource scheduling; Primavera® Expedition — for documenting multiple and complex projects; Pro Chain® — for scheduling with the critical chain method; Crystal Ball® — for risk analysis; Vensim® — for system dynamics analysis

Text Book

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, PH Inc.
2. Lock, Gower, Project Management Handbook.

References:

1. Cleland and King, VNR Project Management Handbook.
2. Wiest and Levy, Management guide to PERT/CPM, PHI.
3. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
4. S. Choudhury, Project Scheduling and Monitoring in Practice.
5. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

CE 15068: FINITE ELEMENT METHOD (3-1-0) CR-04

Module – I **(7 Hours)**

Introduction: The Continuum, Equations of Equilibrium, Boundary Conditions, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems, Different methods of structural analysis including numerical methods. Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method.

Module – II **(17 Hours)**

One and Two Dimensional Problems: Detail formulation including shape functions. stress strain relations, strain displacement relations and derivation of stiffness matrices using energy approach, Assembling of element matrices, application of displacement boundary conditions, Numerical solution of one dimensional problems using bar, truss, beam elements and frames. Derivation of shape function using Lagrange's interpolation, Pascal's triangle, Convergence criteria. Finite Element modeling of two dimensional problems using Constant strain Triangle(CST) elements, Stress strain relations for isotropic and orthotropic materials, Four nodded rectangular elements, axisymmetric solids subjected to axisymmetric loading.

Isoparametric Elements: Natural coordinates, isoparametric elements, four node, eight node elements. Numerical integration, order of integration.

Module – III **(8 Hours)**

Plate Bending: Bending of plates, rectangular elements, triangular elements and quadrilateral elements, Concept of 3D modeling.

Module – IV **(8 Hours)**

Dynamic Considerations: General Equation of motion, Lagrange's approach, mass matrix, lumped and consistent mass matrices, Evaluation of eigenvalue and eigenvectors, stability problems.

Text Book

1. R. D. Cook., Concepts and Applications of Finite Element Analysis , Wiley.
2. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata Mc Hill.

Reference

1. Logan, D. L., A First Course in the Finite Element Method, PWS Publishing, Boston,

2. O. C Zienkiewicz .and R. L. Taylor, Finite Element Method, Mc Graw Hill

CE 15069: THEORY OF ELASTICITY & PLASTICITY (3-1-0) CR-04

Module- I **(12 Hours)**

Plane stress and plane strain problems. General stress and strain equations (Equilibrium and compatibility equations).Two dimensional problems in rectangular coordinates.

Stress and strain components, differential equation, equilibrium equations and compatibility equations in polar coordinate. Stress distribution for axisymmetric problems. Pure bending of curved bars, thick walled cylinder. Concentrated force at a point of straight boundary. Force acting on the end of a wedge. Concentrated force acting on a beam. Effect of circular holes on stress distributions in plates.

Module- II **(9 Hours)**

Stress and strain in three dimensions: Principles stresses, maximum shearing stress, principal axes of strain. Stretching of prismatical bar by its own axis. Elementary problems of elasticity in three dimension.

Module- III **(9 Hours)**

Torsion of non-circular prismatic bars. Saint Venant's theory. Various analogies. Torsion of hollow and thin section. Application of energy methods.

Module- IV **(10 Hours)**

Introduction to the theory of plasticity., the yield criteria of metals, stress space representation of yield criteria. stress-strain relations plastic potential, flow rules and maximum work hypothesis. Two dimensional plastic flow problems. Incompressible two dimensional flow, stresses in plastic materials in condition of plane strain, equation of equilibrium the simplest slip-line fields.

Text Book

1. S P Timoshenko and J N Goodier, Theory of Elasticity, Mc Graw Hill
2. Hoffman and Sachs, Theory of plasticity

Reference

1. N.Filonenko-Borodich, Theory of Elasticity, Mir Publishers,Moscow,1965
2. W. Johnson and P B Meller, Plasticity of Mechanical Engineers
3. C.R. Calladine, 'Plasticity for Engineers', Ellis Herwood, Chichester, U.K., 1985

CE 15070: TRAFFIC ENGG & MANAGEMENT (3-1-0) CR-04

Module I: **(15 Hours)**

Traffic Studies: Basic characteristics of Traffic, Volume, Speed and Density; Definitions and their interrelationships; Traffic Volume studies - Objectives, Methods of Volume counts, Presentation of Volume Data; Speed studies- Types of Speeds, Objectives, Methods of speed studies, Statistical Methods for speed data Analysis, Presentation of speed data. Delay Studies; Head ways and Gap Studies - Headway and Gap acceptance, Origin and Destination Studies.

Parking Studies: parameters of parking, definitions, Parking inventory study, Parking survey by Patrolling method; Analysis of Parking Survey data; Accident studies- Causative factors of Road accidents, Accident data collection: Accident analysis and modeling;, Road Safety Auditing, Measures to increase Road safety.

Module II: **(10 Hours)**

Capacity and LOS Analysis: Introduction to Traffic capacity Analysis, Concepts of Level of Service, Basic definitions, Factors affecting Capacity and LOS, Capacity of Urban/Rural Highway, With or without access control, Basic freeway segments - Service flow rate of LOS, Lane width or Lateral clearance adjustment; Heavy vehicle adjustment; Driver population adjustment.

Module III: **(8 Hours)**

Signal Designing – Fixed Time signals, Determination of Optimum Cycle length and Signal setting for Fixed Time signals, Warrants for Signals, Time Plan Design for Pre-Timed Control- Lane group analysis, Saturation flow rate, and Adjustment factors, Uniform and Incremental Delay, Vehicle Actuated Signals, Signal Coordination.

Module IV: **(7 Hours)**

Transportation System Management - Measures for Improving vehicular flow – one way Streets, Signal Improvement, Transit Stop Relocation, Parking Management, Reversible lanes- Reducing Peak Period Traffic - Strategies for working hours, Congestion Pricing, Differential Toll Policies**.**

Text Book

1. Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication

2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers

Reference Book

1. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication.

2. Traffic Engineering by Roger P.Roess, William R. Mc. Shane, Elena S.Prassas , Prentice Hall,1977.

3. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India

4. Fundamentals of Traffic Engineering – McShane & Rogers.

5. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication

6. IRC Codes

7. Highway Capacity Manual -2010.

CE 15071: ENVIRONMENTAL MANAGEMENT (3-1-0) CR-04

Module I **(10 Hours)**

Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of Environmental Management, Introduction to Environmental Policies, Environmental Laws and Legislations, Environmental Legislations in India.

Module II **(10 Hours)**

Environmental Impact Assessment (EIA), Impact Prediction, Evaluation and Mitigation, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure in India, EIA Documentation and Processes, EIA Monitoring and Auditing.

Module III **(10 Hours)**

Environmental Auditing, Elements of Audit Process, Waste Audits and Pollution Prevention Assessments, EA in Industrial Projects. Life Cycle Assessment (LCA), Stages in LCA of a Product, Procedures for LCA, Different Applications of LCA. Sustainable approach towards Environment Management, Environmental Protocols

Module IV **(10 Hours)**

Environmental Management System Standards, Implementation of EMS Conforming to ISO 14001. Environmental Economics: Introduction, economic tools for evaluation, Green GDP, Cleaner development mechanisms and their applications.

Text Book:

1. Vijay Kulkarni and Ramachandra T.V., 2006. Environmental Management, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.

References:

1. Lohani B.N (1984)., “Environmental Quality Management”, South Asian Publishers, New Delhi

2. Chanlett, (1973)“Environmental Protection”, McGraw Hill Publication, Newyork.

3. Danoy G.E., and Warner R.F., (1969), “Planning and Design of Engineering Systems”,Unwin Hyman Publications.

4. MOEF, Government of India, “Carrying Capacity Based Developmental Planning Studies for the 6. National Capital Region”, 1995-96.

5. NEERI, Nagpur, Annual Reports 1995 & 1996.

6. UNEP / UNDP – “Environmental Sustainable Development”.

7. ISO 14001:2004 Environmental management systems -- Requirements with guidance for use

CE 15071: STRUCTURAL DYNAMICS (3-1-0) CR-04

Module I **(16 Hours)**

Oscillatory motion; harmonic motion, periodic motion, vibration terminology, Single degree of freedom system; equation of motion, damped and undamped free vibration, response to harmonic, periodic, impulse load and general dynamic load, Duhamel's integral, vibrating measuring instruments.

Module II **(8 Hours)**

Multi-degrees of freedom system: equation of motion, free vibration analysis, dynamic response and modal analysis.

Module III **(8 Hours)**

Normal mode vibration of continuous beams, vibrating beams, vibrating strings, longitudinal vibration of rods, torsional vibration of rods, Euler equation for beams, effect of rotary inertia and shear deformation

Module IV **(8 Hours)**

Random vibrations, random phenomena, time averaging and expected value, frequency response function.

Text Book

1. M. Paz, 'Structural Dynamics- Theory and Computation', Van Nostrand, 1985

References

1. WT Thomsen, 'Theory of vibration', CBS Publications

2. R.W. Clough and J. Penzien, 'Dynamics of Structures', McGraw-hill Inc

3. A.K. Chopra, 'Dynamics of Structures: Theory and Applications to Earthquake Engineering, Printice Hall of India

4. M. Mukhopadhyay, 'Structural Dynamics Vibrations & Systems, Ane Books India.