BE (Civil Engineering)

BE (Civil) - I SEMESTER

THEORY			SESSIONAL		
CODE	**TITLE**	**UNIT**	**CODE**	**TITLE**	**UNIT**
HU 1101	Technical English	1.0	ME 1102	Engineering Graphics	1.0
PH 1101	Physics- I	1.0	CP 1202	Unix & C Programming	1.0
CH 1201	Engineering Chemistry	1.0	PH 1102/	Physics Lab./	
MA 1101	Mathematics- I (Except BT)	1.0	CH 1202	Chemistry Lab.	0.5
ME 1101	Engineering Mechanics	1.0	PE 1102	Work Shop Practice- I	0.5
MA 1105	Fundamental of Engineering Mathematics	1.0	GA 1002	NCC/ NSS/ PT & Games/ Creative Arts	0.5

BE (Civil) - II SEMESTER

MA 2101	Mathematics- II	1.0	ME 2102	Computer Aided Drafting	1.0
EE 2101	Basic Electrical Engineering	1.0	CH 1202/	Chemistry Lab./	
CP 2101	Data Structure in C++	1.0	PH 1102	Physics Lab.	0.5
CH 2103	Environmental Science	1.0	ME 2104/	Engineering Mechanics Lab./	
PH 2103	Physics- II	1.0	EE 3102	Basic Electrical Engineering Lab.	0.5
			CP 2102	Data Structure Lab.	0.5
			PE 2102	Workshop Practice- II	0.5
			GA 2002	NCC/ NSS/ PT & Games/ Creative Arts	0.5

BE (Civil) - III SEMESTER

EC 3101	Basic Electronics	1.0	EC 3102	Basic Electronics Laboratory	0.5
MA 3101	Mathematics III	1.0	EE 3102	Basic Electrical Engg /	
EE 3101	Introduction to System Theory	1.0		Engg. Mech. Lab	0.5
ME 3206	Thermal Engineering	1.0	CE 3202	Field Surveying	0.5
CE 3201	Plane Surveying	1.0	CE 3204	Engineering Geology Lab.	0.5
CE 3203	Engineering Geology	1.0	GA 3002	NCC/NSS/PT & Games/Creative Arts	0.5

[Please tick (✓) out your appropriate Extra Curricular activity]

BE (Civil) - IV SEMESTER

CE 4201	Concrete Structures	1.0	CE 4202	Design & Drawing of	
CE 4203	Fluid Mechanics	1.0		Concrete Structures	0.5
CE 4205	Soil Mechanics	1.0	CE 4204	Fluid Mechanics Laboratory	0.5
CE 4207	Strength of Materials	1.0	CE 4206	Soil Mechanics Laboratory	0.5
CE 4209	Determinate Structural Analysis	1.0	ME 4204	Strength of Materials Laboratory	0.5
CE 4211	Building Materials & Construction	1.0	GA 4001	NCC/NSS/PT & Games/Creative Arts	0.5

[Please tick (✓) out your appropriate Extra Curricular activity]

BE (Civil) - V SEMESTER

CE 5201	Steel Structures	1.0	CE 5202	Design & Drawing of Steel Structures	0.5
CE 5203	Hydraulics & Hydraulic Machines	1.0	CE 5204	Hydraulics & Hydraulic M/c Laboratory	0.5
CE 5205	Highway Engineering	1.0	CE 5206	Highway Engineering Laboratory	0.5
CE 5207	Geodesy & Astronomical Surveying	1.0	CE 5208	Adv. Field Surveying	
CE 5209	Cnstrn. Planning & Project Mngt.	1.0		(incl. Survey Camp)	0.5
CE 5211	Specification, Estimating & Costing	1.0			

BE (Civil) - VI SEMESTER

CE 6201	Indeterminate Structural Analysis	1.0	CE 6202	Structural Engineering Laboratory	0.5
CE 6203	Advance Concrete Structures	1.0	CE 6204	Adv. Dsgn & Drwg of Concrete Structures	0.5
CE 6205	Foundation Engineering	1.0			
CE 6207	Water Supply & Sanitary Engg.	1.0	CE 6206	Foundation Engineering Laboratory	0.5
CE 6209	Railway Engineering	1.0	CE 6208	Environmental Engineering Laboratory	0.5
CE 6211	Open Channel Hydraulics	1.0			

BE (Civil) - VII SEMESTER

CE 7201	Advanced Structural Analysis	1.0	CE 7202	Concrete Laboratory	0.5
CE 7203	Advanced Steel Structures	1.0	CE 7204	Adv. Design & Drawing of Steel Structures	0.5
CE 7205	Irrigation Engineering & Hydrology	1.0			
CE 7207	Environmental Pollution & Control	1.0	CE 7206	Computer Applications in Civil Engineering	0.5
CE 7209	Computer Aided Structural Design	1.0			
CE 7211	Advanced Construction	1.0	CE 7208	Project – 1	0.5

BE (Civil) - VIII SEMESTER

CE 8201	FE Application in Civil Engineering	1.0	CE 8202	Adv. Computer Application in Civil Engg.	0.5
CE 8203	Dam and Water Applns in Civil Engg.	1.0			
CE 8205	Remote Sensing Applns in Civil Engg.	1.0	CE 8204	Design & Drawing of Hydraulic Strudtures	0.5
CE 8207	Disaster Management	1.0			
CE 8209 A	Pre-Stressed Concrete		CE 8206	G I S Laboratory	0.5
CE 8209 B	Advanced Soil Mechanics		CE 8201	Project II	
CE 8209 C	Ground Water Engineering				
CE 8209 D	Bridge & Tunnel Engineering				
CE 8209 E	Earthquake resistant Designs				

CE 8211 A Thin-Walled Structures
CE 8211 B Rock Mechanics
CE 8211 C Computational Hydraulics
CE 8211 D Harbour, Dock & Airport Engineering
CE 8211 E Pavement Design

FIRST SEMESTER

HU 1101	TECHNICAL ENGLISH	1.0

MODULE – I
Single word substitution, Idioms and phrases, Pairs of words, Common errors, Précis, Comprehension, Expansion.

MODULE – II
Official Correspondence - Memorandum, Notice, Agenda, Minutes, Circular letter, applying for a job, Resume, Demo-official letter.

MODULE – III
Business Correspondence-Types, sales letters; Social Correspondence- Invitation to speak, Congratulations; etc.

MODULE – IV
Report writing; general and technical report, Definition, Types, structure.

MODULE – V
Technical proposals, Definitions, types and format.

MODULE – VI
Research papers and articles.

MODULE – VII
Mechanics of manuscript preparation.

BOOKS FOR REFERENCE:

1. Blickle, Margaret D., and K.W.Houp.
2. Reports for Science and Industry, Henry Holt & Co. N.Y.
3. Duddy, E.A. & M.J. Freeman Written Communication in Business, Amercian book Co. N.Y.
4. Berry, Thomas Elliot, The most Common Mistakes in English Usage; Tata McGraw Hill.
5. Stevensin, B.W., J.R. Spicer and E.C. Ames, English in Business and Engineering. Prentice Hall, Eaglewood
6. Cliffs, N.J.
7. Raul, Asha, Effective Business Communication, Prentice Hall of India.
8. Singh B. Business Correspondence including Bank letters.
9. Singh B. Theory and Practice of Business Correspondence, HPJ Kapoor Publications.
10. Report Writing and Business Correspondence Mohan and Sharma, Tata McGraw Hill Publications, India.
11. Best, W.D. The Students companion, Rupa & Co. Publications.

PH 1101	PHYSICS- I	1.0

MODULE – I

Waves and Oscillations: (SS* : Wave motion: longitudinal and transverse waves, plane waves, phase velocity). Wave packets and group velocity, wave equation, superposition of waves (RHK-Ch-18), equation of motion of simple harmonic oscillator and solutions, damped harmonic motion and forced oscillations(RHK 17.2-17.4,17.7,17.8)

[6]

MODULE – II

Fields: Vector and scalar fields, physical and mathematical concepts of gradient, divergence and curl (Cartesian coordinates only), Gauss's theorem and Stokes' theorem (Statements only, SAD-Ch.3).

[5]

MODULE – III

Electromagnetic Theory: Gauss's law in integral and differential form, electric potential and relation with E(SAD 4.5-4.8),(SS*- capacitance(SAD-6.5) and electrostatic energy density (SAD 4.10)), dielectrics, three electric vectors, dielectric susceptibility boundary conditions on E and D(SAD 5.5-5.7, 5.9).

[5]

Amperes law in integral and differential form, applications.(SAD 7.1-7.4), Hall effect (RHK-32.4), three magnetic vectors (SAD 7.5), magnetic permeability and susceptibility, boundary conditions on B and H (SAD 8.5-8.7).

[5]

Faraday's law in integral and differential form(SAD 9.2-9.3), (SS - Inductance, magnetic energy density (SAD 8.8, 8.9)), continuity equation for charge (SAD 5.8), displacement current (SAD 9.4), Maxwell's equations in free space (SAD 9.5), electromagnetic wave equation for plane waves in dielectric medium and free space, relation between $\vec{E}, \vec{B}$ and $\vec{k}$, Poyinting vector (SAD 10.3-10.7).

[5]

MODULE – IV

Plasma Physics: Plasma state, types of plasma, applications of plasma(FFC-Ch-1,2)

[4]

MODULE – V

Physical Optics:

Interference: Two-Beam Interference(AG 12.1-12.6), interference in thin films and wedge-shaped layers(AG 13.8-13.9), reflection and anti-reflection coatings(AG 13.2-13.4), applications of interferometry: Newton's rings(AG 13.10), Michelson' Interferometer (AG 13.11)

[5]

Diffraction: Fraunhofer diffraction by single slit(AG 16.1-16.3) , double slit and grating (AG 16.6-16.8), limit of resolution, Rayleigh criterion(AG 16.5), Fresnel diffraction(Qualitative, AG 17.1-17.3)

[5]

Polarization : (SS- Polarization of light, Malus's law, polarization by reflection, Brewster's law, Double refraction) Analysis of linearly and circularly polarized light(RHK 44.1-44.5), Fresnel's equations and their applications (AG 21.1-21.2)

[5]

Text Books:

1. Mathew N.O. Sadiku (SAD), Elements of Electromagnetics, Oxford University Press (2001)
2. A.Ghatak(AG), Optics, 3rd Edition, Tata Mcgraw Hill, 2005
3. Resnick, Halliday and Krane(RHK), Physics- Part-I & II, 5th Edition, John Wiley(2002)
4. F.F.Chen(FFC), Introduction to Plasma Physics, 2nd Edition, Plenum Press, 1994

References:

1. W.H.Hayt and J.A.Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
2. M.R.Srinivasan, Physics for Engineers, New Age International, 1996
3. S.N.Sen, Introduction to Plasma Physics, Pragati Prakasan, Meerut -1, India

MODULE – I

Chemical Bonding: Trends in periodic properties (ionization energy, electron affinity, electro negativity), VBT, VSEPR theory, MOT for diatomic molecules and polyatomic molecules, coordination complexes & ligands, CFT, colour and magnetism of coordination complexes, spectrochemical series

MODULE –II

Kinetics and catalysis: kinetics of chain reactions, parallel reactions, side reactions, fast reactions in solutions, flash photolysis, kinetics of catalytic action (acid base catalysis, biological catalysis), application of catalyst in industrially important processes (Haber's processes, Ostwald process, Bergius process)

MODULE – III

Thermo-chemistry and Fuels: Hess's law, entropy, enthalpy and combustion calculations, characterization and application of fossil fuels, solid fuel (carbonization & gassification), liquid fuels (refining, reforming, petrol & diesel, knocking characteristics, octane and cetane number) and gaseous fuels (water gas, producer gas, coal gas and biogas), lubricants and its properties

MODULE –IV

Electrochemistry and corrosion sciences: Redox process cell, potential and free energy, galvanic cells, electrolysis and Nernst's equation, Fuel cells, and its applications, chemical and electrochemical corrosion, general methods of corrosion prevention (with brief introduction to chemistry of paints, varnishes and enamel)

MODULE –V

Fundamentals of spectroscopic techniques: Basic principles of vibrational, rotational and Mossbauer spectroscopy

MODULE – VI & VII

Macromolecules: Classification, Addition and Condensation polymers, molecular weight of polymers (M_n, M_w, M_v), glass transition temperature (T_g), structure property relationship in polymers (chemical, electrical, optical and mechanical), examples and use of inorganic polymers, synthesis of some commercially important polymers and their use (Nylon 6, Nylon 6, 6, PE, PET, PS)

MODULE – VI & VII

An introduction to computational chemistry

Text Book:

1. Applied chemistry A text book for engineers and technologists, H. D. Gesser, Plenum publishers.
2. Inorganic chemistry: J. D. Lee.
3. Engineering chemistry: Sashi Chawla

Reference:.

1. Fundamentals of molecular spectroscopy: C. N. Banwell, TMH publication
2. Computational chemistry: E. Lewars, Kluwer publication
3. Physical chemistry: P. W. Atkins

MA 1101	MATHEMATICS- I (EXCEPT BT)	1.0

MODULE – I

Differential Calculus I: Higher order derivatives and Leibnitz's theorem, Tangent and normal, Concavity and convexity, Points of inflexion, Curvature and radius of curvature (Cartesian & Polar forms of curves,) Pedal eqns., Asymptotes (for Cartesian curves only) Taylor's and Maclaurin's series, Indeterminate forms, Maxima & minima of one variable.

MODULE – II

Integral Calculus I: Reduction formula for indefinite & definite integrals, Beta & Gamma functions (definition and related problems), Area, Length, Volume & Surface.

MODULE – III

Ordinary Differential Equations I: First Order linear and non- linear differential equation and application to Engineering problems. Vector Algebra: Triple product, Product of four vectors, Applications of vectors in three dimensional coordinate geometry (plane, straight line, sphere).

MODULE – IV

Numerical Methods: Principle of Intermediate values, Graphical solution, Newton Raphson method and its rate of convergence, False position method, Difference table and difference operators.

BOOK REFERENCE:

1. Calculus for Technical Students : Part I & Part II, By Pran Nath., Tara Publications, Varanasi.
2. Engg. Mathematics by H.K. Dass, S. Chand & Co. Ltd.
3. Advanced Engg. Mathematics, E. Kreyzig, Wiley Eastern Ltd., N. Delhi.

Equivalent Force System and Equilibrium: Principles of statics, laws of mechanics, freebody diagram, coplanar, non-coplanar and spatial force system and conditions of equilibrium, vector representation and analysis of forces and moments, Varignon's theorem.

Structural Mechanics: Analysis of simple plane truss by method of sections and methods of joints, analysis of frames and parabolic cables, cantilever and simply supported beams with concentrated, distributed and moment loads, shear force and bending moment diagrams, concept of stress and strain.

Interfacial Friction: Friction and impending motion, static, kinetic and rolling friction, application to inclined planes, wedges, screws jacks and belts.

Kinematics and Kinetics of Particle and Rigid Bodies: Conceptual framework and vector representation of displacement, velocity, acceleration, linear and angular momentum, rectilinear and curvilinear motion in two dimensions, centroidal and non-centroidal rotation, general plane motion, Newton's laws of motion, D'Alembert's principle, equilibrium of dynamic forces.

Work and Energy: Translation and rotation of rigid body about a fixed axis, conservation of energy, energy and work equations in translation and rotational motion, virtual work.

Impulse and Momentum: Impulse force and momentum, conservation of momentum, coefficient of restitution, momentum equation. Vibrating Systems: Inertia, features of a vibrating system, free vibration, systems with single degree of freedom.

Books Recommended:

1. Kumar, Engineering Mechanics
2. Shames, Engineering Mechanics

MA 1105 FUNDAMENTAL OF ENGINEERING MATHEMATICS 1.0

Algebra:

Complex numbers:

Definition Fundamentals operations with complex numbers, amplitude, conjugate of a complex number, Graphical representation of complex numbers, Demoivre's theorem, Roots of complex numbers.

Arithmetie Geometric and Hamonic progressions. Binomial theorem, Exponential and

Logarithm series

Determinant and Matries:

Determinants and their properties, Cramer's rule type of matrices, Addition Multiplication. Transpose, Adjoint and Inverse of a matrix Solution of linear system of equations by matrix inversion method. 10L

Trigenometry:

Circular functions, trigonometric functions and equations, sides of a triangle and T-ratios, Inverse trigonometric functions. 5L

Co-ordinate Geometry (Two dimensional):

Cartesion & Polar Co-ordinates. Distance between two points, Area of a triangle, Equation of a straight line. Angle between two lines. Distance of a point from a straight line. Equations of circle, parabola, ellipse, and Hyperbola.

10L

Vector Algebra:

Notation, Types, Addition and Subtraction of vectors, Linearly dependent & independent vectors, Scalar and vector product of two vectors. 2L

Differential Calculus:

Function, Limits and continuity, Differential coefficients, Differentiation of Algebric, Inverse and Transcendental function, Differentiation by substitution, Differentiation of Implicit functions, Logarithmic differentiation, Differentiation of parametric equations, Geometrical meaning of the derivative Equation of tangent and normal lines to a curve. Rate measure and approximations.

10L

Integral Calculus:

Integration as the inverse pro ess of differentiation Integration by the methods of substitution, by parts and by partial fractions, The definite integrals and their simple applications to areas.

8L

Suggested Books:

1. Senior Secondary School Mathematics, By R.S. Aggarwal, Bharti Bhawan Publications.
2. Mathemztics, by R.D. Sharma, Dhanpat Rai Publications.
3. A text Book of Algebra & Co-ordinate Geometry, By K.C. Sinha, Students Friends publications.

SECOND SEMESTER

MA 2101	MATHEMATICS- II	1.0

Integral Calculus:
Operations under the sign of integration, Multiple integrals, change of order of integration, Transformation of Co-ordinates, Area, Volume and Surface area of solids using multiple integrals.

(8L)

Ordinary Differential Equations:
Linear differential equations: Bernoulli's from Exact equations, Nonlinear equations, Clairaut's form, Higher order equations with constant coefficients. Cauchy's and Legendre's differential equations. Solution of higher order equation by the change of independent variable, Method of variation of Parameters in Simple cases, Applications to Engieering problems.

Series solution of Differential equations by the method of Frobenius.(Roots differing by non integer and equal roots).

(14L)

Algebra of Matrices:
Rank of a matrix. Consistency and inconsistency of a system of linear equations. Eigen values and eigen vectors. Cayley Hamiliton Theorem.

(3L)

Vector spaces:
Definition, examples and some simple properties. Subspaces, linear combination, linear dependence and independence, Basis and dimension. Norm of a vector, Inner Product. Cauchy-schwartz inequality, orthogonal sets. Gram-schmidt process of construction of orthogonal sets. Parallelogram law and Pythagorian theorem.

(8L)

Vector Calculus and Tensor Analysis:
Differentiation of vectors, Radial and transverse, tangential and normal acceleration of a particle moving on a plane curve. Directional derivatives, Gradient, Divergence and Curl. Expansion Identities. Vector integration. Conservative system of forces. Solenoidal and Irrotational vectors. Theorems of Green, Stoke and Gauss and their applications,

Tensors, transformation of Co-ordinates, contravariant and covariant vectors and Tensors. Rank of a tensor. Addition and multiplication of tensors. Mixed tensors Contraction.

(10L)

Books Recommended:

1. Advanced Engineering Mathematics byE. Kreyszig
2. Advanced Mathematics for Engineers By Chandrika Prasad (Prasad Mudranalaya)
3. Advanced Engineering Mathematics By H.K. Das.

MODULE – I

Introduction: Importance of Electrical Engineering in day-to-day life. Electrical elements and their classification. KCL and KVL equations. Loop current and Node voltage method. D.C. Circuits: Steady state analysis with independent and dependent sources; Series and Parallel circuits; Star-Delta conversion. D.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(12)

MODULE – II

A.C. Single-phase Series Circuits: Common signals and their waveforms. RMS and Average value. Form factor & Peak factor of sinusoidal waveform. Impedance of Series circuits. Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – III

A.C. Single-phase Parallel Circuits: Admittance method, Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – IV

Resonance and Q-factor, A.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(7)

MODULE – V

Three Phase Circuits: Line and Phase relation for Star and Delta connection. Power relations. Analysis of balanced and unbalanced 3 phase circuits.

(7)

MODULE – VI

Magnetic Circuits: Introduction. Series-parallel magnetic circuits. Analysis of Linear and Non-linear magnetic circuits. Energy storage. A.C. excitation. Eddy currents and Hysteresis losses.

(5)

MODULE – VII

Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling.

Basic Indicating Instruments: Moving coil and moving iron type instruments.

(4)

Text Books:

1. Basic Electrical Engineering, Fitzgerald, Hinginbotham
2. Basic Electrical Engineering I.J. Nagrath and D.P. Kothari, 2nd Edition, TMH, Delhi.

Reference Books:

1. Electric circuits- Schaum Series
2. Electrical Engineering- Del Toro.
3. Basic Electrical Engineering- Mittle.

MODULE – I & II
Introduction to C++ and algorithm analysis: C++ classes, C++ details, Using matrics, Mathematical background for algorithm analysis, model and what to analyze, Running Time calculations.

MODULE – III
Lists, Stacks and Queues: Abstract Data Types, The list ADT, The Stack ADT, The Queue ADT

MODULE – IV
Trees: Preliminaries, Binary Trees, The Search Tree ADT – Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals, B-Trees.

MODULE – V
Hashing and Priority Queues: Model and Simple implementations, Binary Heap, Applications of Priority Queues, d-Heaps, Leftist and Skew Heaps.

MODULE – VI
Sorting: Preliminaries, Insertion sort, A Lower Bound for Simple Sorting Algorithms, Shell sort, Heap sort, Merge sort, and Quick short.

MODULE – VII
Graph Algorithms: Definitions, Topological Sort, Shortest Path Algorithms, Network Flow Problems and Minimum Spanning Tree.

Text Books:
1. Mark A. Weiss – Data Structures & Algorithm Analysis in C++, 2nd Edition, Pearson Education, New Delhi – 2002.

Reference:
1. Gregory L. Heilean – Data Structures Algorithms, and Object Programming, Tata McGrow Hill, New Delhi – 2002.
2. Adam Drozdek – Data Structures and Algorithms in C++, Thomson Learning (Vikas Publishing House) New Delhi – 2001.
3. John R. Hubbard – Data Structures with C++, Tata McGraw Hill, New Delhi, 2004

CH 2103	ENVIRONMENTAL SCIENCE	1.0

MODULE– I

Environmental Awareness: Multidisciplinary nature of environmental Science, Definition, scope, importance and need for public awareness

(2)

MODULE– II

Ecology and Environment: concept of an ecosystem ,structure and function of an ecosystem, producer ,consumer and decomposer, energy and nutrient flow biogeochemical cycles, food chain ,food web, ecological pyramid

(3)

MODULE– III

Environmental Pollution **:** Segments of environment, sources, pathways and fate of environmental pollutants, causes of environmental pollution , physical ,chemical and biological transformation of pollutants , population explosion, environment and human health, human rights, value education ,women and child welfare

(5)

MODULE– IV

Air Pollution: various segments of atmosphere and their significance,classification of air pollutants, toxic effects, sampling and analysis, stationary and mobile emission, sources and their control, photochemical smog ,sulphurous smog, green house effect, global warming, ozone depletion, Air (prevention and control of pollution) Act

(10)

MODULE– V

Water Pollution: Water resources ,sources of water pollution ,various pollutants, their toxic effect, potability of water , municipal water supply , disinfection, characteristics of waste water, primary and secondary waste water treatment, BOD and COD measurement and their significance ,rain water harvesting ,water shed management,Water (pollution and control) Act.

(12)

MODULE– VI

Natural Resources and Biodiversity: Renewable and non renewable resources, Forest resource, consequences of deforestation, floods and draughts, equitable use of resources for sustainable development, Dams benefits and problems, Biodiversity: ecosystem diversity , threats to biodiversity, conservation of biodiversity**.**

(4)

MODULE– VII

A brief introduction to Noise Pollution, Soil Pollution, Solid Waste Management.

(4)

Books Recommended:

1. Sharma and Kaur, Environmental Pollution
2. De, Environment Chemistry

MODULE – I

Special Theory Of Relativity

Postulates, Galilean transformations, Lorentz transformations, length contraction, time dilation, velocity addition, mass change and Einstein's mass energy relation. (AB: 1.1,1.2,1.4,1.7,1.8,1.9, and Appendix to chapter-1

[6]

MODULE – II

Quantum Mechanics:

Planck's theory of black-body radiation (AB: 2.2, 9.5, 9.6), Compton effect (AB: 2.7), wave particle duality, De Broglie waves, Davisson and Germer's experiment(AB:2.4, 3.1, 3.2, 3.3, 3.4, 3.5), uncertainty principle(AB:3.7,3.8,3.9), physical interpretation of wave function and its normalization(AB:3.2), expectation value(AB:5.4).

[8]

Schrodinger equation in one dimension(AB:5.2), solutions of time-independent Schrodinger equation for free particle(AB:3.6, 5.5, 5.6), particle in an infinite square well, potential barrier and tunneling(AB:5.7, 5.8), hydrogen atom (qualitative)(HRW:40-8).

[8]

MODULE – III

Statistical Physics And Thermodynamics:

Elementary ideas, comparison of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics (AB: 9.1, 9.2, 9.3, 9.4).

[4]

Zeroth law, first law, second law, entropy, heat transfer, steady state one-dimensional heat conduction [(HRW:19-2, 19-9, 21-3, 19-11),(SS:14.2, 14.7)].

[6]

MODULE – IV

Lasers And Applications:

Emission of light by atoms, spontaneous and stimulated emission (AB: 4.9, and AG: 23.1), Einstein's A and B coefficients, laser: population-inversion (AG: 23.4), properties of laser radiation, Ruby & He-Ne lasers, applications of lasers (AB: 4.9) and AG: 23.1), elementary ideas of holography (AG: 18.1) and fiber optics (AG: 24.1-24.3).

[8]

MODULE – IV

Nuclear Physics:

Nuclear forces, binding energy, liquid drop model (AB: 11.1-11.6), fission, nuclear reactors, fusion, energy processes in stars, controlled thermonuclear reactions (AB: 12.9-12.12).

[5]

Text Books:

1. Arthur Beiser, Concepts of Modern Physics, 5th edition, Tata McGraw Hill, 1997.
2. Ajoy Ghatak, Optics, 2nd edition, Tata McGraw Hill, 1997.

Reference Books:

1. Jasprit Singh, Modern Physics for Engineers, John Wiley & Sons, 1999.
2. Kenneth Krane, Modern Physics, 2nd edition, John Wiley & Sons, 1998.
3. Wehr, Richards and Adair, Physics of the Atom, 4th edition, Addison Wesley.

THIRD SEMESTER

EC 3101	BASIC ELECTRONICS	1.0

MODULE – I

Introduction: Importance of Electrical Engineering in day-to-day life. Electrical elements and their classification. KCL and KVL equations. Loop current and Node voltage method. D.C. Circuits: Steady state analysis with independent and dependent sources; Series and Parallel circuits; Star-Delta conversion. D.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(12)

MODULE – II

A.C. Single-phase Series Circuits: Common signals and their waveforms. RMS and Average value. Form factor & Peak factor of sinusoidal waveform. Impedance of Series circuits. Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – III

A.C. Single-phase Parallel Circuits: Admittance method, Phasor diagram. Power. Power factor. Power triangle.

(5)

MODULE – IV

Resonance and Q-factor, A.C. Circuit Theorems: Superposition theorem; Thevenin's & Norton's theorem; Maximum Power Transfer theorem.

(7)

MODULE – V

Three Phase Circuits: Line and Phase relation for Star and Delta connection. Power relations. Analysis of balanced and unbalanced 3 phase circuits.

(7)

MODULE – VI

Magnetic Circuits: Introduction. Series-parallel magnetic circuits. Analysis of Linear and Non-linear magnetic circuits. Energy storage. A.C. excitation. Eddy currents and Hysteresis losses.

(5)

MODULE – VII

Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling.
Basic Indicating Instruments: Moving coil and moving iron type instruments.

(4)

Text Books:

1. Basic Electrical Engineering, Fitzgerald, Hinginbotham
2. Basic Electrical Engineering I.J. Nagrath and D.P. Kothari, 2nd Edition, TMH, Delhi.

Reference Books:

1. Electric circuits- Schaum Series
2. Electrical Engineering- Del Toro.
3. Basic Electrical Engineering- Mittle.

Special Functions:

Bessel's equation: solution and Bessel's function of the first kind, Recurrence relations. Orthogonality of Bessel's Functions. Generating function and Bessel's integral. Legendre's equation: solution and Legendre's polynomials, Rodrigue's Formula. Orthogonarity relations. Generating function and recurrence relation. Definition of Hankekl's function. Elliptic Integral of the first and second kind. Jacobi's form of elliptic integrals.

(8L)

Complex Variables:

Continuity, differentiability and analyticity of a function of a complex variable, Cauchy Riemann differential equations in Cartesian and polar forms. Harmonic functions, Bilinear and conformal transformations. Complex integration, Cauchy's integral theorem and formula. Derivatives. Taylor's and Laurent's Series. Poles and Singularities. Cauchy's Residue Theorem. Contour integration (Poles on real axis excluded)

(13L)

Partial differential equations:

Formation of partial differential equations. Lagrange's first order linear equations. Non linear equations. Higher order differential equations with constant Co-efficients. Non homogeneous equations: solution by separation of variables. Boundary value Problems. wave equation in one dimension and its solution. Derivation of one dimensional heat equation and its solution.

(10L)

Fourier Series and Fourier Transform:

Periodic functions Existence conditions Euler's formulae. Half range series. Fourier series of functions with arbitrary period.

Fourier Integral Formula, Fourier Transform, Inversion Theorem, Fourier sine and cosine transforms and inversion formulae, Linearity property, Convolution or Faltung theorem. Relationship between Fourier and Laplace transform. Finite Fourier Transforms. Heaviside, Unit step function and Dirac Delta Function

(10L)

Statistics:

Mean and variance. Moments. Concept of Random variable. Probability density and Distribution functions Problems, Elements of error analysis

(4L)

Books Recommended:

1. Engineering Mathematics – E. Kreyszig
2. Advanced Engineering Mathematics – C. Prasad
3. Fourier Transforms – I.N. Sneddon

MODULE – I

Introduction to signals and systems: Definition, Basis of classification, Representation of common signals and their properties, System modeling

(4)

MODULE – II

Analogous System: Introduction, D Alembert's Principle, Force-voltage and force-current analogies, Electrical analogue of mechanical, Hydraulic and thermal systems.

(5)

MODULE – III

Fourier Transform Method: Introduction, Fourier transform pair, Amplitude spectrum and phase spectrum of signals, Sinusoidal transfer function.

(3)

MODULE – IV

Laplace Transform Method: Introduction, Laplace transform pair, Laplace transformation of common functions, Gate function, Step function and impulse function, Laplace theorems shifting, initial value, final value and convolution theorems.
Inverse Laplace transform by partial fraction expansion and convolution integral method.

(12)

MODULE – V

System Analysis: System Analysis by Laplace Transform method, System response. Natural, forced, transient and steady state responses. Transfer function and characteristic equation, Superposition integral, Concept of poles and zeros, Nature of system response from poles and zeros.

(6)

MODULE – VI

System Stability: Concept of stability, Types, Necessary and sufficient conditions, Routh Hurwitz stability criterion, Limitations and its applications to closed loop systems.

(4)

MODULE – VII

State-Space Concept: Introduction, Definition: State, State variable, State vector and state space, State space representation, Derivation of State model from transfer function, Bush form and diagonal canonical form of state model, Non-uniqueness of state model, Derivation of transfer function from state model, Transition matrix and its properties, Solution of time invariant state equation.

(6)

Text Books:

1. Analysis of Linear Systems – D.K.Cheng.
2. Control System Engineering – Nagrath & Gopal
3. Control System – A. Anand Kumar

Reference Books:

1. Networks and Systems – D. Roy Choudhury
2. Signals and Systems - Basu & Natarajan

ME 3206	THERMAL ENGINEERING	1.0

MODULE – I

Definitions and Elementary concepts of Thermodynamics, Zeroth law of Thermodynamics and its significance. Concept of heat and worr and Properties of Ideal gas.

(8 Lectures)

MODULE – II

First law of Thermodynamics and its applications to non-flow and steady flow systems.

(6 Lectures)

MODULE – III

Second law of Thermodynamics, Concepts of heat engines, refrigerator and heat pump. Concept of Entropy, Entropy changes for various reversible processes.

(6 Lectures)

MODULE – IV

Cycles – Carnot cycle, Otto cycle, Diesel cycle, Joule/Brayton cycle, Rankine cycle. Vapour compression refrigeration cycle and its C.O.P.

(4 Lectures)

MODULE – V

Principle of I.C. engines, Two-stroke and four stroke cycle engines, indicated and brake power.

(4 Lectures)

MODULE – VI

Principles of steam Turbine, Impulse and Reaction turbines, Velocity diagrams.

(5 Lectures)

MODULE – VII

Heat transfer, one dimensional steady state conduction. Application to composite walls and cylinders, Critical thickness of insulation, Forced and free convection. Radiation heat transfer.

(8 Lectures)

References:

1. An Introduction to Thermodynamics – P.K. Nag
2. Engineering Thermodynamics – R.K.Rajput

1. Thermal Engineering – P.L. Ballaney
2. Thermal Engineering – R.K. Rajput
3. Thermal Engineering – A.S. Sarao

CE 3201	PLANE SURVEYING	1.0

CE 3203	ENGINEERING GEOLOGY	1.0

FOURTH SEMESTER

CE 4201	CONCRETE STRUCTURE	1.0

Properties of Concrete and its Ingredients:
Types of cement and their characteristics; ingredients of concrete; Aggregates quality and grading – coarse and fine aggregates; Concrete types and their composition : use in different structural units; law of water-cement ratio; compaction requirement; additives and admixtures; Tests on cement and concrete; design of mix proportions by fineness modulus and trial mix methods Reinforcements – types of reinforcement and their properties;

Limit State Method of Design :
Design concepts, limit state of serviceability; characteristic strength of materials; characteristic loads; factored moment; partial safety factors; stress-strain relationship for concrete and steel; stress block parameters; limit state of collapse for flexure; singly and doubly reinforced rectangular and Tee beams

Limit state design for Shear, Bond and Torsion :
Shear reinforcement in form of vertical stirrups and bent-up bars; shear strength of concrete; minimum shear reinforcement; development length; design for torsion reinforcement

Design of Slabs:
One way and two way slabs; circular slabs

Design of Columns :
Short axially loaded columns; helical reinforcement; columns with axial load and uniaxial / biaxial bending; interaction charts as per SP – 16

Design of Foundations :
Isolated column footings of square, rectangular and circular shapes; combined footing; strip footing

Design of Staircases :
Types of staircases; design of doglegged and open-well types

References :

1. MALLICK and GUPTA : Reinforced concrete
2. PUNMIA B. C. : R C C
3. VAZIRANI and RATWANI : R C C
4. RAM CHANDRA : Limit State Design
5. NEVILLE A. M. : Properties of Concrete

Fundamental Concepts related to Fluids :
Characteristics of fluids; continuum concepts; physical properties – bulk modulus; cohesion and adhesion; vapour pressure; surface tension; Newton's Law of viscosity – Newtonian and non-Newtonian fluids; rheological diagram

Fluid Statics (Fluids in Equilibrium) :
Pascal's law; pressure variation; scales and methods of pressure measurement; forces acting on plane and curve surfaces; stability of floating and submerged bodies

Fluid Kinematics :
Description of fluid flow; classification; flow patterns; acceleration; equation of continuity; velocity potential; stream function; flownets

Fluid Dynamics :
Eulers's Equation of Motion- Bernoulli's equation; significance of terms in Bernoulli's equation; Kinetic Energy correction factor

Flow Studies and its Measurements :
Flow through nozzles, orifices, notches and weirs; Venturimeter and Pitot tube

Laminar Flows :
Reynolds experiments, Flow between parallel plates, Laminar flow through circular pipes

Turbulent Flows :
Prandtl's mixing length theory; velocity distribution; boundary layer concepts; head loss due to friction; variation of friction factor; minor losses; hydraulic and energy grade line; combinations of pipes; siphon

References :

1. STREETER V. L. : Fluid Mechanics
2. SHAMES I. H. : Mechanics of Fluids
3. MODI P. N. and SETH S. M. : Hydraulics and Fluid Mechanics

CE 4205	SOIL MECHANICS	1.0

Introduction – Nature of Soil, Phase Representation and Relationships :
History, development and areas of application; Structure of soil; soil texture; Size and range of soil particles; shapes of individual sand and clay particles; field identification of soils; Introduction to particulate behaviour. Three-phase system : representation by Phase diagram – soil solids, water and air; Basic definitions and relationships : Specific gravity; Void ratio; Porosity; water content; Unit Weights : bulk, dry, saturated, submerged and natural; Degree of saturation and Density index

Index Properties and Soil Classification :
Particles size distribution : Sieve analysis; distribution curve characteristics; grain size analysis for fine-grained and mixed soils; use of hydrometer; Consistency limits and indices; Activity and Sensitivity of clays Classification of Soils : Descriptive, based on soil type; by origin; by structure; Textural, Unified and Indian Standard Classifications

Soil Moisture Relationship – Capillarity, Permeability and Seepage :
Capillarity in soils; Free and adsorbed water; Permeability of soils : Darcy's Law; Determination of coefficient of permeability by constant head & falling head tests, Permeability of stratified soil deposits. Factors affecting permeability; Seepage Analysis : Head, Gradient & Potential, Seepage pressure. Two dimensional flow - Laplace equation; Phreatic line in Earth dams; Graphical method of flow net construction : for flow below sheet piles, earth dams with or without core / filter; Seepage discharge across hydraulic structures; Piping; Flow net – electrical analogy; Pore water pressure and the concept of effective stress; Quick condition

Compressibility, Compaction and Consolidation :
Difference between Compaction and Consolidation; Compaction tests : Standard and Modified Proctor; Harvard miniature compaction test; Factors affecting compaction; Field compaction methods and control One-dimensional consolidation – spring analogy; Terzaghi's theory of one-dimensional consolidation; Solution of consolidation equation; Consolidation of undisturbed & remoulded soils; Laboratory consolidation test – analysis and results; Definitions : Coefficient of volume change, Coefficient of consolidation, Compression index, Degree of consolidation; Secondary consolidation

Earth Pressure Theory :
Plastic equilibrium in soil – active & passive cases. Active earth pressure – Rankine's Theory; Active earth pressure of cohesive soil; Rankine's active thrust by trial wedge; Coulomb's wedge theory – Rehbann's construction & Culmann's construction

Shear Strength :
Measurement of shear strength – Unconfined strength test; Direct shear tests; Vane shear test; and Triaxial tests – strain-controlled and stress-controlled tests, Unconsolidated and Consolidated Specimens subjected to shear without drainage (with or without pore water pressure measurement); drained shear; Mohr strength envelopes for Total and Effective stresses; Mohr-Coulomb failure theory; Hvorslev's strength parameters, Skempton's pore-pressure parameters; Stress paths

Stability of Slopes :
Stability analysis of finite & infinite slopes; Types of slope failures; Methods of analysis for slope stability – method of slices; Bishop's simplified method; Friction circle method; Stability Number; Stability of slopes of Earth dams; Slope protection and Drainage

References :

1. VENKATARAMAIAH C : Geotechnical Engineering
2. RANJAN GOPAL and RAO A. S. R. : Basic & Applied Soil Mechanics
3. LAMBE T. W. and WHITMAN R. V. : Soil Mechanics

CE 4207	STRENGTH OF MATERIALS	1.0

A. Generalized Hooke's Law for Isotropic materials-plane stress & plane strain problems; Two-dimensional analysis of stresses and strains with graphical representations Tresca's and Von Mises theories of failure-Graphical representations for plane stress problems

B. Bending stress analysis for symmetrical and unsymmetrical cross-sections

C. Shear stress distribution in massive and thin-walled cross-sections; shear center for thin-walled cross sections with at least one axis of symmetry

D. Differential equation for deflection of beams - Principle of superposition – application on statically determinate beams - Successive integration of differential equation - Macaulay's method - Area Moment Theorems - Effect of shear

E. Shear force and bending moment diagrams for Propped cantilever, Fixed and Continuous beams

F. Torsion of bars with circular cross-sections-Membrane analogy-Torsion in bars with thin walled open cross-sections

G. Strain energy for axial load, bending, torsion and shear; Buckling of long columns - Euler's theory - Rankine's formula

References :

1. TIMOSHENKO S. P. & YOUNG : Elementary Strength of Materials
2. TIMOSHENKO S. P. : Strength of Materials – Vol. I & Vol. II
3. SRINATH L. S. : Advanced Mechanics of Materials
4. POPOV E. P. : Mechanics of Materials

Analysis of Statically Determinate Pin-Jointed Trusses :
Stability and Determinateness, Force analysis of Compound and complex trusses, Tension co-efficient method – application to simple space trusses

Deflection of Pin-Jointed Trusses :
Application of Castigliano's theorem and principle of virtual work, Unit load method, Graphical method – Williot - Mohr diagram

Influence Lines for statically determinate beams and trusses :
ILD for reaction, SF and BM of simple and compound beams, ILD for member forces of simply supported truss girders with parallel and non-parallel chords; effect of moving live loads; Focal length and counter bracing

Three-Hinged Arches :
Eddy's theorem, BMD, Normal thrust and Radial shear at any c/s, Influence Lines

Suspension Bridges :
Analysis of cables, effect of temperature, anchor cables, three-hinged stiffening girder, ILD for BM and SF

Masonry Structures :
Conditions for stability; stability and stress analysis of dams Retaining walls : supporting backfills - without and with surcharge

Energy Concepts :
Principle of virtual work; Maxwell-Betti reciprocal theorem; Castigliano's theorem; Application to determinate structures

References :

1. TIMOSHENKO S. P. & YOUNG : Theory of Structures
2. JUNNARKAR S. : Mechanics of Structures

Building Stones : Varieties of Indian Stones, Quarrying blasting, Dressings of stones, Characteristics of good building stones, Slate, Marble, Artificial stones, Stone Preservation

Bricks and Tiles : Constituents of brick earth and their properties, Tempering, Manufacture of bricks, Clamps & Kilns, Types of brick, Defects in bricks, Tests on bricks; Firebricks constituents and properties; Mosaic and Ceramic tiles – manufacture and advantages

Limes & Cements : Lime – Types, properties and uses. Cement – Composition, Varieties, Properties, Methods of manufacture; Tests on cement

Mortar : Lime mortar, Cement mortar, Surkhi mortar, Mud mortar, Stabilized mud mortar, Gypsum and plaster of paris, Hydraulic mortar, Puzzolona mortar

Timber : Structure of an exogenous tree, Varieties of Indian timber, Characteristics and suitability for different uses, Defects in timber, Diseases and decay timber, Preservation and Seasoning, Plywood, Veneers, Fiber boards, Block boards

Metals and Alloys : Ferrous, Non-Ferrous metals and Alloy; Properties and uses, Ferrous metal-Cast Iron, Wrought Iron and Steel, Non ferrous metals – Aluminium, Lead, Copper Alloys-Brass and Bronze, Corrosion of steel and its prevention

Paints, Varnishes and Distemper : Object of painting, Ingredients in paints, their types and functions, Characteristics of a good paint, Types of paints, Prime and subsequent coats, finishes; Varnishes and Distemper; Maintenance requirements of buildings and equipments; Building finishes – interiors and exteriors; colour orchestration

Planning for Construction : Site Preparation, Layout for building, Earthwork; anti-termite and other pests treatments; site office and material storage; Construction of various building components – Foundation, Superstructure, Roofs and Floors of different types and their construction procedures; Services in buildings : plumbing, water supply and electrical fixtures; House Drainage : Floor slopes for efficient drainage; Drainage from roof tops and around buildings; Drainage Plans and water harvesting measures

Load-Bearing Walls : Types of walls, Design considerations; Cavity walls : Introduction, General features and construction; Partition walls : Brick, Concrete and Glass partitions; Damp Proofing : Cause and effects of damping; materials and methods for Damp Proofing – D P C treatment

Brick and Stone Construction :
Stone and Brick masonry : different types with sketches; Necessity of Bonds; Different types of Bonds; Definitions – Quoin, header, stretcher, closer, frog, etc., Mixing of mortar, Preparing Bricks and tiles for laying, curing of masonry work

Concrete Construction :
Formwork, shuttering and centering – precautions and statutory requirements; batching of mixes; casting process, compaction and curing; requirement of mix design and casting of test cubes – removing cubes from moulds and curing for strength tests; bar-bending equipments and preparation of reinforcement for R C C works

References :

1. JHA JANARDAN : Building Materials
2. RANGWALA S. C. : Engineering Materials
3. PUNMIA B. C. : Building Construction
4. BINDRA and BINDRA : Building Construction

FIFTH SEMESTER

CE 5201	STEEL STRUCTURES	1.0

1. **Properties of structural steel** – yield stress and limiting stress for elastic design; structural steel sections
   Principles and design of : (a) Riveted connections, (b) Welded connections

2. **Elementary structural members** :
   Design of (a) Laterally supported beams, (b) Axially loaded columns

3. **Bracket connections for eccentric loads** – two types

4. **Beam-end connections:** (a) Framed connections : beam – column flange / web;
   beam – beam
   (b) Seated connections - (i) Unstiffened, (ii) Stiffened

5. **Built-up structural members:** (a) Beams, (b) Columns

6. (a) Laterally unsupported beams, (b) Eccentrically loaded columns

7. **Columns bases and foundations:**
   (a) Column Bases : (i) Slab base (ii) Gusseted base
   (b) Grillage foundations : (i) Isolated (ii) Combined

References :

1. RAMACHANDRA : Steel Structures - Vol.I & II
2. VAZIRANI & RATWANI : Steel Structures
3. KAZIMI & JINDAL : Steel Structures
4. PUNMIA B. C. & JAIN ASHOK : Steel Structures

CE 5203	HYDRAULICS & HYDRAULIC MACHINES	1.0

A. Dimensional and Model Analysis:
Buckingham-Pi theorem; concept of non-dimensional numbers; model analysis

B. Drag on Immersed Bodies:
Concepts of drag and lift; circulation; Maguns effect; Prandtl's mixing length theory boundary layer; velocity distribution in boundary layers; drag and lift on plate, sphere, cylinder and airfoils

C. Impact of Jets:
Fixed and moving plates; hinges

D. Hydraulic Turbines:
Classification of turbines; Pelton wheel; Reaction turbines; hydraulic efficiency; overall efficiency; specific speed; unit speed; unit power; similarity of turbines

E. Turbine regulation, Turbine setting, Cavitation-free installation of reaction turbines, Draft tubes

F. Pumping Machinery:
Reciprocating pumps, centrifugual pumps, multi-stage pumps; similarity of pumps; pump characteristics and operation; installation of pumps

G. Hydraulic Machinery :
Hydraulic lifts, cranes, accumulators, hydraulic press, hydraulic ram

References :

1. LAL JAGDISH : Hydraulic Machines
2. HUNTER ROUSE : Engineering Fluid Mechanics
3. RAMAMRUTHAM S. : Hydraulics, Fluid Mechanics and Fluid Machines

CE 5205	HIGHWAY ENGINEERING	1.0

A. Highway Development & Planning :
Brief history and development; characteristics of road transport; road classification; road patterns; Nagpur plan; Jaykar Committee recommendations; Bombay plan; Road Plan – 2020; road layouts

B. Traffic Engineering :
Traffic characteristics, Accidents and their preventive measures, Traffic studies, Traffic control devices, Types and design of traffic signal systems – Approximate method, Trial cycle method, Webster's method. Traffic Islands, Divisional islands, Channelising islands, Rotaries, Design of intersections, Design of parking facility, Highway lighting

C. Highway Alignment, Survey and General considerations :
Fundamental principles of alignment. Factors controlling the selection of alignment Highway survey, Width of formation, Right of way, Width of pavement, Camber, Gradient, Super elevation, Extra widening on curves, Design speed, Sight distances, Set back distances, Road Cross-section; Provision of Shoulders, Cycle tracks, Footpaths and Drains; Arboriculture

D. Geometric Design of Highways :
Simple curves – scope, Degree of curve, characteristics, offset from chord produced, Rankine's method, obstacles in curve setting
Compound and Reverse Curves : Different cases
Transition Curve- Superelevation: Length of transition curve; Characteristics; equations; shift; tangent length and curved length of combined curve; setting out of combined curve
Vertical curve – scope, assumption of vertical curve, equations, setting out vertical curve
Summit and Valley curves

E. Road Pavements :
Types of pavements; elements of pavement; CBR and other methods of design of flexible pavement; rigid pavement : stresses in rigid pavements and stress combinations; subgrade reaction; design of rigid pavement; joints in concrete roads; relevant IRC Codes of Practice

F. Tests on Road Materials and Proportioning of Mixes :
Tests on aggregates, gravel, sand, *moorum*, bitumen, cement, concrete; concrete mix design; CBR of soil; relevant IS and IRC Codes of Practice

G. Road Construction and Maintenance :
Highway Construction : Construction of cement concrete pavements, W B M roads; Soil stabilised roads; Drainage; Culverts : earth cushion and wing walls; Bitumen Roads – Surface dressing; BM, SDBC; Grouting and premix; Quality control; Highway maintenance

References :

1. KHANNA S. K. and JUSTO C. E. G. : Highway Engineering
2. VASWANI N. K.: Highway Engineering
3. BINDRA S. P.: A Course in Highway Engineering

CE 5207	GEODESY & ASTRONOMICAL SURVEYING	1.0

A. Curves and Curve Setting :

Introduction: Necessity of providing curves; curve types and application

i. Simple curves – Degree of curve, characteristics; offsets from chord produced; Rankine's method; obstacles

ii. Compound and Reverse curves – types and formulae

iii. Transition curves – Characteristics; formulae; Lengths : Tangent length and Curve length; Combined curve – computation and setting out

iv. Vertical curves : Summit and Valley curves; design considerations; computations and setting out

B. Triangulation :

Scope, classification, inter-visibility, satellite station, eccentricity of signals, base line and its extension

C. Theory of Errors :

Terms, Laws of weights; Determination of M.P.V., M.P.E., adjustment of geodetic triangle with central station, adjustment of level line**,** adjustment of spherical triangle

D. Geodetic Leveling:

Scope, curvature and refraction correction, axis-signal correction, Single angle Observation; reciprocal leveling

E. Electronic Distance Meter:

Scope, electromagnetic curve, basic definitions, phase of wave, types of waves, distance by transit time and phase difference, carrier wave, method of modulation, Electro-optical EDM measurement, infra-red EDM instrument, microwave EDM instruments, effect of atmospheric conditions and corrections, slope and height corrections, National citation NI 450, Wilde distance meters D1 series, Wilde theomats T1 series, Wilde Tachymat TC series, use of total station.

F. Astronomical Survey:

Terms, Spherical triangle, spherical trigonometry, Time, siderial time, apparent time, mean solar time, equation of time, universal time, standard time, conversion of time, determination of time, determination of azimuth, Latitude, Longitude

G. Hydrographic Surveying :

Scope, methods of sounding, locating of sounding, three-point problem, shore line survey

Reference Books:

1. KANETKAR T. P. : Surveying and Leveling (Vol. II)
2. ARORA K. P. : Surveying Vol. II

CE 5209	CNSTRN. PLANNING & PROJECT MNGT.	1.0

A. Introduction :
Construction as an Industry, Management tools to optimise production

B. Building Construction :
Brief explanation of planning, Foundation : different types and their construction; construction of superstructures; Roofs and Floors : Construction of Different types; Services : plumbing, water supply and electrical fixtures

C. Highway and Railway Construction :
Planning and Construction procedures in Highways and Railways; Bridges & Tunnels

D. Dams and Irrigation :
Dams : Earth and Concrete Gravity Dams : brief construction procedures, Construction of Waterways and Canals

E. Networks :
Elements of Networks and their definitions, events and Activities Rules of Network, partial situation and Fulkerson's rule. Development of Network. Forward planning, Backward planning event oriented, Activity oriented networks; Plan Breakdown; Sequencing example : House construction

F. Management techniques :
CTPM, PERT and BAR CHARTING with particular reference to Building Construction PERT - Time computations, Earliest expected time and its formulations, Latest allowable time and it computation; CPM - Network Analysis, Planning, scheduling and control; Start and finish times of activity EST, EFT, LST and LFT; Float and Total Floats, Free floats, Independent floats, Interfering floats; Per-critical, Sub-critical, Critical Activities, PERT network Analysis, Slack positive, Negative, Zero slacks and Critical Paths in Network

G. Management techniques (contd.) :
CPM Cost Model, Resource allocation and Histograms; Project Management Software

Reference Books:

1. SHARMA S. C. : Construction Equipment and Management
2. PEURIFOY R. L. : Construction Planning, Equipments and Materials
3. PUNMIA B. C. : CPM and PERT Analysis

CE 5211	SPECFICATION, ESTIMATING & COSTING	1.0

A. Specifications –
Introduction : Objects and Types of Specification; General Specification for Buildings, Roads and other infrastructure

Specifications for Materials :
Buildings : Sands, Aggregates, Cement, mortar mixes, water quality standard and assessment; reinforcement and shuttering; Building finishes : interiors and exteriors Roads : Materials for flexible pavements; for rigid pavements Steelwork : Fabrication : Processes and tolerance specifications Specifications for Quality control and evaluation – during construction and post
construction; inspection and acceptance criteria

B. Estimation of Quantities –
Types of Estimate; Building Estimates from drawings – long wall and short wall methods; Estimates for Earthwork – for Earth Dams; Roads : in embankments and / or cuttings; Estimates for various Civil Engineering works : Canals, Culverts and Bridges Steelworks estimate : Roof trusses; Concrete works estimate : structural elements

C. Estimation of Rates –
Working out of Unit rate of items; Schedule of Rates; Provision for changes with time

D. Contracts –
Types : Item rate; Percentage rate; Lumpsum; Material supply; Labour rate; Contract negotiation and Piece work agreement

E. Tenders –
Calling for Tenders : Advertising; Job Specification; Earnest money, Security Deposit; Tendering; Listing and opening of Tenders; Contract documents; Awarding and Termination of contract; Maintenance period and refund of Security Deposit; Liquidated Damages; Informal Tenders; Arbitration

F. Accountancy –
Measurement and Payment : Measurement Book – recording and assessment of work done, valuation and payment procedure; Payments : intermediate, running and final; Loss of measurement book; Permanent Measurement Book

G. Book Keeping –
Accounts : Accounting divisions – Tools and Plants; Stores Registers and Ledgers; Transfer entries; Physical verification of materials at site, probable reasons for deviation from book entry

References :

1. DUTTA B. N. : Estimating & Costing
2. CHAKRABORTY M. : Estimating & Costing

SIXTH SEMESTER

CE 6201	INDETERMINATE STRUCTURAL ANALYSIS	1.0

A. Three-Moments Theorem:
Analysis of continuous beams, without or with support settlement

B. Influence lines for Continuous Beams:
Muller-Breslau principle, ILD for reaction, SF and BM of statically indeterminate beams using conjugate beam method

C. Principle of Least Work:
Analysis of statically indeterminate trusses and frames

D. General Method:
Consistent deformation method, Flexibility method, Analysis of statically indeterminate beams, trusses and frames

E. Analysis of Arches :
Two-hinged arches : circular and parabolic

F. Slope Deflection Method:
Analysis of continuous beams and portal frames without or with side sway, use of symmetric and anti-symmetric conditions

G. Moment Distribution Method:
Analysis of continuous beams and portal frames without or with side sway, use of symmetric and anti-symmetric conditions

References :

1. TIMOSHENKO & YOUNG : Theory of Structures
2. KINNEY : Statically Indeterminate Structures

A. Retaining Walls :
Types of retaining walls, lateral earth pressure on retaining walls, Rankine's theory, Design of cantilever and counterfort retaining walls and foundation

B. Containers :
Design of Bunkers and Silos, Jansen's and Airy's theories

C. Domes :
Membrane stresses; design of segmental domes without and with lantern

D. Liquid Storage Tanks :
Design of liquid retaining structures – Strength and Cracking considerations; Combined Tension and Moment; Ground tanks; Overhead Circular, Rectangular tanks and Intze tank with staging

E. Building Frames:
Analysis and design of building frames for wind and earthquake forces

F. Concrete Bridges:
I. R. C. loadings; Dispersion principles; Design of Slab, Box culverts and Tee-beam bridges

G. Prestessed Concrete :
Basic concepts, Materials used in prestressed concrete, methods of prestressing, Basic inequalities, Design of rectangular sections, losses in prestressed concrete

References :

1. MALLICK S. K. and GUPTA A. P. : Reinforced concrete
2. PUNMIA B. C., JAIN ASHOK KUMAR and JAIN ARUN KUMAR :
3. Reinforced concrete structures (Vol. I & II)
4. VAZIRANI V. N. and RATWANI M. M. : Concrete structures
5. JAIN O. P. and JAIKRISHNA : Plain and Reinforced Concrete (Vol. I & II)

CE 6205	FOUNDATION ENGIGEERING	1.0

A. Site Investigation and subsoil exploration :
Methods of soil exploration; Planning a subsoil exploration : Number of boreholes and depths of exploration for various types of works; Field Tests : Standard penetration test; Dynamic and Static cone penetration tests; Vane shear test; Soil samplers & collection of soil samples

B. Stress Distribution in Soil Media and Settlement :
Stress Distribution : Boussinesq's and Westergaard's equations, Pressure distribution diagram, Newmark's influence chart; Contact pressure below foundations – Steinbrenner's coefficients Settlement of foundations : Elastic, Consolidation and Creep settlements; Total and Differential settlements; Rate of settlement, I. S. Code limitations for different structures Settlement calculation from consolidation characteristics and using N-values

C. Bearing capacity :
Terminology : Ultimate and Safe Bearing Capacities; Allowable Bearing Pressure Gross and Net Bearing Capacities; Net Soil pressure for a specified settlement; Bearing capacity from equations of Terzaghi, Skempton, Brinch Hansen and Meyerhoff; I. S. Code of Practice; Bearing capacity from N-values; Effect of ground water table Plate Load test : Procedure, Limitations and determination of permissible bearing capacity for footings in sand and clay soils
Eccentrically loaded footings – useful width concept

D. Shallow Foundations :
Type of foundations : Isolated and combined footings; Rafts foundations Proportioning of footings for even settlement

E. Pile Foundation :
Types of piles; Pile construction; Load carrying capacity of piles : Dynamic and static Formulae; Elastic analysis of single axially loaded pile; Group action and efficiency; Under-reamed pile foundation; Introduction to Laterally loaded piles and Batter piles Negative skin friction – cause and prevention of n s f effect on piles; factor of safety of pile subjected to negative skin friction Pile load tests : ultimate, routine, vertical and horizontal; permissible settlement

F. Machine Foundations:
Soil dynamics, Mass-spring system; Mass-system with damping; Natural frequency of foundation soil systems; Machine Foundations : Types of Machines and Machine Foundations
Vibration isolation : Types and Methods of Isolation

G. Caissons:
Shapes and Types of wells or caissons, their advantages and disadvantages; components of a well foundation; Depth of well foundation and bearing capacity; Forces acting on a well foundation. Well sinking : operation and problems; Drilled caissons; Pier foundations

Books References :

1. VENKATRAMIAH C. : Geotechnical Engineering
2. GARG S. K. : Soil Mechanics and Foundation Engineering
3. BRAHMA S. P. : Foundation Engineering
4. BOWLES J. F. : Foundation Analysis and Design

A. Elementary principles :
Ecology & Ecosystem and their interaction with environment;
Engineering activity and environmental pollution;
Environment and its effect on human health and activity

B. Water Resources :
Estimation of water resources – Ground & surface water
Quality & demand of water, factors effecting demand, Population forecast
Intake works – Classification, Special types

C. Water Treatment and Distribution :
Characterisation and drinking water standards; Treatment of water – Screening, Plain sedimentation and with coagulation Filtration- Slow sand, Rapid sand and Pressure Filters; Softening & other miscellaneous treatments of water; Water borne disease, Disinfection
Distribution of water – Different types of pipe line networks; Layout of Pipe Lines Pipe joints & fittings; Pumping, Boosters, Safety and relief measures

D. Municipal and Domestic Wastes :
Characterization; Terminology; Sampling; Laboratory Tests

E. Sewage and Drainage :
Quantity of Sewage and Storm water, Design of sewers and Water drains; Plumbing and house drainage – Appurtenances, Layout, Septic tank, Imhoff tank, Special plumbing requirements of Hospitals, Theatres, Hotels, Industries Sewer appurtenances, Pumping of sewage

F. Treatment of Sewage and Wastes :
Screening; Detritus Chambers; Sedimentation; Design aspects; Activated sludge process, Trickling filter, Oxidation pond, Chlorination & other miscellaneous treatments. Industrial waste treatment – Introduction, Significance, Case studies

G. Industrial Wastes :
Types of Industries and nature of wastes; waste pretreatment and disposal measures; Disposal of hazardous wastes; Case studies

Books References :

1. GARG S. K. : Water Supply
2. BABBIT : Water Supply
3. GARG S. K. : Sanitary Engineering
4. STEEL : Sanitary Engineering

CE 6209	RAILWAY ENGINEERING	1.0

A. Introduction :
Development and classification of Indian Railways Rails – Function, Composition and requirement of rail section, Comparison of sections, Length, Welding, Expansion and length of welded rails, Corrugated rails, Hogged rails, Buckling of rails, Creep of rails, Wear on rails, Rail joints

Sleepers : Functions and requirements of sleepers, Classification of sleepers; Timber, Metal, Concrete – R.C.C. and prestressed concrete sleepers, Spacing of sleepers and sleeper density
Ballast : Functions and requirements of ballast, Types of ballast, Size and section of ballast, Rail Fixtures and Fastenings :Purpose and types, Fish plates, Spikes, Bolts, Chains, Blocks, Keys, Bearing plates, Check rails and Guard rails

B. Formations and Subgrade :
Formation width requirement and sub grade improvement; drainage; rail embankment stability

C. Geometric Design of Rail Tracks :
Cross-section, Gradients, Speed, Radius of curve, Super elevation, Maximum and Minimum super elevation, Equilibrium super elevation, Absolute minimum and ruling minimum radii, Cant deficiency, Negative super elevation

D. Points and Crossing :
Turnouts, Points and switches, Crossing number and angle of crossing, types of track junctions, Design calculations of turnout. Design of diamond crossing and cross-over

E. Station yard Layout :
Railway Station – Types; Sidings, Marshalling and Loco Yards

F. Signalling :
Object and Principles of signalling, classification of signals

G. Interlocking :
Necessity and functions of interlocking.

Traction and Tracting resistance

Books References :

1. VASWANI N. K. Railway Engineering
2. SAXENA and ARORA : A Text Book of Railway Engineering

CE 6211	OPEN CHANNEL HYDRAULICS	1.0

A. General Introduction :
Types of flow in open channel; state of flow, properties of open channel; velocity distribution; energy and momentum corrections factors; pressure distribution

B. Energy and Momentum in Open channel Flow :
Specific energy; alternate depths; specific force; sequent depths

C. Critical flow :
Computation of critical flow in prismatic channel

D. Application of Specific Energy and Discharge Diagrams to Channel Transitions :
Transitions with reduction in width, transition with raised bottom; metering flumes

E. Uniform flow :
Various formulae for uniform flow; most economical channel sections, computation of uniform flow

F. Non-Uniform flow :
Basic assumptions; Dynamic equation of gradually varied flow; classification of surface Profiles; methods of computation

G. Rapidly Varied flow :
Hydraulic jump; classifications, uses – Dynamic equation governing jump in a rectangular channel; energy dissipation characteristics

References :

1. VEN TE CHOW : Open channel Hydraulics
2. MODI P. N. & SETH S. M. : Hydraulics and Fluid Mechanics.
3. Ranga Raja : Flow through Open Channel
4. R.H. French: Open Channel Hydraulics

SEVENTH SEMESTER

CE 7201	ADVANCE STRUCTURAL ANALYSIS	1.0

A. Frame Analysis :
Moment Distribution Method – Analysis of elastically supported beams and portal frames, Gable Frames, members with internal hinges, non-prismatic members

B. Frame Analysis (contd.) :
Automatic sway correction method, Substitute frames, Virendeel girders

C. Slope-Deflection Method :
Non-prismatic members, Stiffness and carry-over factors; Analysis of non-prismatic beams and rigid-jointed frames with non-prismatic members

D. Kani's Method :
Analysis of continuous beams and building frames

E. Secondary Stresses :
Analysis of rigid-jointed trusses

F. Stiffness Method :
Analysis of beams and pin-jointed plane trusses; stiffness matrix of plane rigid-jointed frames

G. Plastic Theory :
Basic assumptions, definitions, upper bound, lower bound and uniqueness theorems- Effect of axial load- analysis of beams and portal frames.

References :

1. CHU-KIA-WANG : Statically Indeterminate Structure
2. PARCEL and MOORMAN : Statically Indeterminate Structures
3. NEAL B. G. : Plastic Method of Structural Analysis
4. MARTIN H. C. : Matrix Method of Structural Analysis
5. RUBENSTEIN M. F. : Matrix Analysis of Structures

CE 7203	ADVANCE STEEL STRUCTURES	1.0

A. Roof Trusses :
Different types, load combination and design loads for member groups, design of members and joints

B. Plate Girders :
Elements of the plate girder, selection of section by flange area method, checking for maximum bending stresses, permissible values for shear in web, web stiffener requirements – intermediate and load-bearing stiffeners

C. Plate Girders (contd.) :
Flange plate curtailment, splicing of flange plate, flange angle and web

D. Gantry Girders :
Loadings, permissible stresses and deflections, analysis and design

E. Water Tanks :
Design of rectangular overhead tanks and components; supporting system of beams and staging; pressed steel tanks

F. Steel Bridges :
Railway loadings; different types of truss girders; load combinations; fatigue

G. Steel Bridges (contd.):
Design of bridge truss members; Joints of bridge truss members; Plate girder bridges

Books References:

1. RAM CHANDRA: Steel Structures (Vol. I & II)
2. VAZIRANI and RATWANI: Steel Structures
3. KAZIMI and JINDAL: Steel Structures
4. PUNMIA B. C. and ASHOK JAIN: Steel Structures

A. Irrigation Principles and Practices :
Introduction, Necessity, Advantages and disadvantages of irrigation, Classification, Methods of irrigation.Soil Water Crop and their Relationship: Soil classification, Indian soils, Soil-water plant relationship, Soil moisture relationship, Frequency of irrigation.

B. Water Requirement of Crops :
Optimum use of water, Factors affecting water requirement of crops, Duty, Delta and Base period and their relationship. Determination of consumptive use, Direct methods, By using equations, Irrigation efficiency

C. Flow Irrigation :
Classification of canals, Canal alignment, Components of permanent canal system; Flow in Alluvial Channels, Design of channels for maximum permissible velocity, Kennedy's silt theory and design of channels on its basis. Lacey's silt theory and regime equations, Various types of relations, Design of channels based on Lacey's equation.

D. Flow Irrigation (contd.) :
Canal capacity, Canal losses, Lined channels & their design, Construction and maintenance of irrigation channels. Lift Irrigation : Classification, Location, Water lifting arrangement, Yield of wells, Well troubles

E. Diversion Head Works :
Selection of site, Constituent parts of weir, Causes of failure of weir on permeable foundation, Bligh's creep theory, Khosla's theory Cross Drainage Works : Necessity, Types and their selection, Foundation and cross sections, Important features of design of cross drainage works, River training works

F. Hydrology :
Hydrological cycle, Precipitation, Measurement analysis, Average depth of rainfall, Factors affecting run off, Run off measurements, Mass curves, Flood frequency studies

G. Hydrology (contd.) :
Hydrograph, Unit hydrograph, Infiltration, Estimation of run off by infiltration method, Principles of Flood Routing

References :

1. BHARAT SINGH : Irrigation Engineering
2. GARG S. K. : Irrigation Engineering & Hydraulic Structures

A. Solid Wastes:
Definitions, sources, characteristics and perspectives; Types of Solid Wastes : Municipal wastes, Industrial wastes, Hazardous wastes;

B. Solid Waste Generation :
Generation, Typical generation rates and factors that affect them; Estimation of solid waste quantities, Physical and Chemical Characteristics of Solid Wastes

C. Solid Waste Management :
Materials flow in society, collection services, types of collection systems, Determination of vehicle and labour requirements, Collection routes. Reduction in raw materials usage, Reduction in solid waste quantities. On-site handling, Storage and mechanical and thermal processing of solid wastes. Re-use of solid wastes, Materials recovery, Energy recovery; Day to day solid waste management. Transfer Stations : Location of transfer stations, transfer means and methods

D. Treatment and Disposal :
Land fills : design and operation of land fills, Deep well Injection; Incineration; Composting; Pyrolysis

E. Air Pollution :
Air Pollution : Past, present and future, Historical review, Global implications, Scales of Concentration; Classification and Properties of Air pollutants; Sources, Behaviour and Effects of Pollutants; Photochemical smog; Indoor Air Pollution; Air quality management concept

F. Meteorology and Natural Purification Processes :
Elemental properties of the atmosphere : Heat, Pressure, Winds, Moisture, Relative Humidity; Lapse rate; Inversions and Stability Dispersion of Air Pollutants : Atmospheric dispersion equations; Modelling estimation of plume rise; Effects of Air Pollution on Meteorological Conditions

G. Environmental Pollution Control :
Air Pollution Sampling and Measurement; Source Correction Method; Design and Development of Process equipments for Air Pollution Control; Settling Chambers; Cyclone Separators; Filters, Electrostatic Precipitators, Scrubbers; Absorption by Liquids and Solids; Combustion Reverse osmosis, Ultra filtration and evaporation, Recovery, Utilisation, Disposal and Recycle operations in liquid wastes, Energy aspects

Books References:

1. PEAVY R., ROWE and TECHOBANOLOUS : Environmental Engineering
2. CHATTERJEE A. K. : Water Supply, Waste Disposal and Environmental Engineering

A. Flexibility Method :
Member actions, reactions, and joint displacements – flexibility equations – effects of settlement, temperature and prestraining

B. Flexibility Method (contd.) :
Equivalent loads – matrix formulation of displacements by unit load method – member flexibility matrices -system flexibility matrix- development of algorithm for computer applications

C. Flexibility Method (contd.) :
Simple problems –beams, pin-jointed plane trusses and rigid-joined plane frames

D. Stiffness Method :
Coordinate systems – member actions, reactions and joint displacement – effects of settlement, temperature and prestarining – stiffness equations

E. Stiffness Method (contd.) :
Member stiffness matrices – transfer matrices – rotation transformation – system stiffness matrices – partitioning to formulate stiffness equation development of algorithm for computer applications

F. Stiffness Method (contd.) :
Simple problems : beams, pin-jointed plane trusses and rigid-jointed plane frames

G. Finite Element Method :
Introduction : Necessity and general description of the method; steps in analysis by F E; Linear constitutive equations – linear isotropic elasticity, plane strain, plane stress and axisymmetric cases Concept of an element; Element shapes- one dimensional, triangular and rectangular Profile discretization and element assembly; node and element numbering procedure; Bandwidth minimization; consideration of material properties

References :

1. VANDERBILT M. DANIEL : Matrix Structural Analysis
2. MARTIN H. C. : Matrix Method of Structural Analysis
3. GERE and WAVER : Analysis of Framed Structures
4. RAJASEKARAN S. : Finite Element Method in Engineering Design
5. MARTIN and CAREY : Finite Element Method
6. DESAI and ABEL : Introduction to the Finite Element Method

A. Vaults and Domes Flues and Chimneys : Shapes and Construction techniques

B. Acoustic and Seismic consideration in construction
Heating, Cooling and Ventilation of Buildings, including underground structures

C. Steel and R. C. Framed Buildings; Pre-fabricated construction

D. Typical design considerations and layout of the following :
Stadia; Auditoriums and Swimming Pools

E. Earthwork in construction : Use of Mass diagrams in determination of Haul;
Earth-moving machinery;
Dewatering : Requirement, Planning, Layout of System and Process; Precautions

F. Construction Plant & Machinery :; Concrete Mixers, Batching Plants,
Compaction equipments

G. Deep Excavations and Tunneling : Safety Practices; Precautions and support – Shoring, Timbering, Centering and Shuttering

References :

1. KELLOG F. H. : Construction Methods and Machinery
2. STUBBS F. W. : Handbook of Heavy Construction
3. PEURIFOY R. L. : Construction Planning, Equipments and Methods

EIGHTH SEMESTER

CE 8201	FE APPLICATION IN CIVIL ENGINEERING	1.0

1. Introduction to the Finite Element Method :
General description and analysis procedure; linear constitutive equations; two-dimensional problems; constitutive relationships for plane strain, plane stress and axis symmetric cases

2. The Basic Component – Element :
Concept of the Element; element shapes; two – and three – dimensional elements; choice of elements, Element Aspect Ratio; Element stiffness; nodal degrees of freedom

3. Displacement Models :
Generalised coordinate form of displacement; Selection of Order of the Polynomial; Convergence requirements; Element compatibility;

4. Displacement Models (contd.) :
Interpolation displacement model; Interpolation function or Shape function; Interpolation Functions for a one-dimensional element; Comparison of Generalised Coordinate and Interpolation formulations; Isoparametric Element Concept

5. Element Stiffness :
Direct formulation of element stiffness; force vector to be applied at nodes of element; Constant Strain Triangle Element; Element stress and strains

6. The Overall Problem :
Discretisation of the Body or Profile; Natural subdivisions at discontinuities; Bandwidth Minimization; Interconnections at Nodes; Stiffness matrix and Loads for Assemblage of Elements; Computer application of the Direct Stiffness Method

7. Civil Engineering Applications :
Constitutive laws; Elastic-plastic Behaviour; Finite representation of Infinite Bodies – significant extent of profiles for discretisation; Boundary conditions; Strip Footing Finite element mesh for embankments and cuttings; Simulation of sequential construction in Excavations (unloading) and in Embankments (loading); Structural Engineering applications – Beam analysis

References :

1. DESAI C. S. and ABEL J. F. : Introduction to the Finite Element Method
2. SARAN SWAMI and SINGH : Computer Programming and Numerical Methods
3. MOTEWAR S. N. : Computer Programming with Numerical Techniques

A. Reservoir Regulation:
Multipurpose reservoir operation to control floods, Supply of water for irrigation, Power combined demand, Capacity of reservoir, dead & live storage

B. Earth Dams:
Selection of site, Types of earth dams, factor of safety, Slope stability with & without seepage forces, Construction details for homogeneous and Non homogeneous sections

C. Gravity Dams:
Forces on gravity dams including earthquake Stress analysis, Overflow & Non-overflow sections, Uplift forces consideration, Drainage of dams etc. Stability checks. Joints.

D. Arch Dams , Buttress and Other Dams:
Constant radius & constant angle section factor of safety, Advantages, etc.

E. Water Power Development:
Introduction, Planning of a hydropower. Basic definitions. Various loads. Different Components

F. Surge Tanks
Simple surge tank, restricted orifice tank and differential rank. Surges in rectangular and non-rectangular sections, Surges for partial and complete closure of turbine.

Rigid water column theory for concrete pipes, Elastic water column theory, Graphical and numerical methods to solve water hammer problems.

G. Economical Design of Penstocks :
Economical velocity and economical diameter, Material cost and power cost analysis to determine the diameter.

Design of hydraulic passages like Scroll cases, Draft tubes, Installation of turbines, Materials of constructions etc.

Books References :
1. JUSTIN, CREAGER and HINDS : Hydro-Electric Engineering Handbook
2. DANDEKAR M. M. and SHARMA K. N. : Water Power Engineering
3. PUNMIA, B. C., PANDEY and LAL B. B. : Irrigation and Water Power Engineering

CE 8205	REMOTE SENEING APPLNS IN CIVIL ENGG.	1.0

A. Principles of Remote Sensing :
Definitions, Electro-magnetic Remote Sensing; Data acquisition and analysis; Energy sources and Radiation sources

B. Systems of Remote Sensing :
Photographic Systems : General, Films and their sensitivity – Black and White, Colour and Infra-red; Aerial Cameras : Single lens and multi lens, Strip and Panchromatic types; Aerial Photography – Types, Scale and Resolution

C. Systems of Remote Sensing (contd.) :
Scanning Systems : Passive and Active systems; Aircraft and Satellite based Systems; Microwave Scanning Radiometers; Multi-spectral Scanners; Satellite-based Systems : Landsat, SPOT and IRS

D. Data Interpretation :
Introduction – Satellite imagery data interpretation Topographical Mapping, Stereo Parallax Measurements; Examples

E. Remote Sensing Applications :
General; Use in regional planning and development

F. Remote Sensing Applications in Civil Engineering :
Urban Development and Highway Engineering Projects

G. Remote Sensing Applications in Civil Engineering (contd.) :
Water Resources and Environmental Engineering

References :

1. WOLF : Elements of Photogrammetry
2. SABINS FLOYD F. Jr. : Principles and Image Interpretation
3. LILLESAND and KEIFER : Remote Sensing and Image Interpretation
4. KENNIE T. J. M. : Remote Sensing in Civil Engineering

CE 8209 A PRE-STRESSED CONCRETE

A. Introduction to the Prestressing Systems :
Review of basic concepts and properties of materials; tensioning devices; pre-tensioning and post-tensioning techniques; Fressynet, Magnel Blaton, CCL and other systems

B. Flexural Strength of Prestressed Concrete :
Rectangular and flanged beams at limit state; simplified code procedure; flexural design of slabs rectangular and flanged beams in service for type I behaviour; design of two-span continuous beam – parasite reactions; concordant cable; profiles; linear transformations

C. Losses in Prestressed Concrete :
Estimation of losses due to elastic deformation; shrinkage, creep relaxation in steel; friction and anchorage slip

D. Deflection of Prestressed Concrete Members :
Factors influencing deflection; short and long term deflection of uncracked members; deflection of cracked beams; code reuirements

E. Shear and Torsion in Prestressed Concrete Beams :
Principal and shear stresses; ultimate shear resistance; design of reinforcements for shear and torsion

F. Transfer of Prestress in Prestressed Members :
Transmission length; bond stresses; transverse stresses; end-zone reinforcement; code provisions

G. Anchor Zone Stresses in Post-Tensioned Members :
Stress distribution in the end blocks; anchor zone reinforcement

References :

1. MALLICK and GUPTA : Prestressed Concrete
2. GUYON : Prestressed Concrete
3. RAJU N. K. : Prestressed Concrete

CE 8209 B ADVANCED SOIL MECHANICS

A. Clay Mineralogy :
Clay minerals : molecular structure of clay minerals, atomic & molecular bond, adsorbed and double layer water; Structure of clay in deposits : honey-combed, flocculated & dispersed structures; Structure of compacted clays

B. Excavation, Drainage & Dewatering :
Stability of slopes: Stability of open cut – braced open cut. Bishop's rigorous method , Limit equilibrium approach. Ditches & sumps, Well point system, Shallow well system, Deep well drainage, Electro-osmosis method, Protective filters.

C. Shear Strength :
Use of stress path in triaxial test – Undrained & drained tests for N.C. & O.C. clay samples. Elastic & Plastic deformation, yielding , hardening and plastic flow, Elastic & Elasto-Plastic behaviour,

D. Critical State Soil Mechanics :
Introduction, Critical State line, Roscoe and Hvorslev surfaces, Critical state boundary - Interpretation and significance, applications

E. Bulk head & Cofferdams :
Classification – cantilever sheet pile wall in cohesionless and in cohesive soils. Anchored bulkheads – Free-earth and fixed earth concepts; Design aspects

D. Shaft, Tunnels & Conduits :
Stress distribution in the vicinity of shaft, Stress distribution around tunnels, arching in soils; Classes of underground conduits – loads on positive projecting and negative projecting conduits.

E. Geoenvironmental Engineering : Sources of underground contamination and transportation, site characterisation, remediation methods Environmental Geotechnology : Management of solid waste, land fills, flyash management, earthquakes, landslides

F .Geotechnical earthquake Engineering.:_ earthquakes, ground shaking, liquefaction, surface rupture, permanent ground deformations & other related natural disasters; Earthquake force effect on soil structures

References :

1. GRIM R. E. : Clay Minerology
2. LEONARDS G. A. : Foundation Engineering, Mc Graw Hill
3. ATKINSON and BRANSBY : Critical State Soil Mechanics
4. SCOTT R. F. : Soil Mechanics

CE 8209 C GROUND WATER ENGINEERING

A. Introduction :
Historical Background, Utilization of Groundwater, Groundwater in the Hydrologic cycle, Origin and Age of Groundwater, vertical distribution of Groundwater, Types of Aquifers, Storage coefficient.

B. Groundwater Movement :
Darcy's Law, Permeability, Determination of Hydraulic conductivity, Anisotropic Aquifers, Groundwater Flow Rates, Groundwater Flow Directions, Groundwater Tracers General Flow Equations

C. Groundwater and Well Hydraulics :
Steady Unidirectional flow, Steady Radial Flow to a well, Unsteady Radial flow in a confined aquifer, Unsteady Radial flow in an unconfined aquifer, leaky aquifer, well flow near aquifer Boundaries, Multiple well system, characteristic well losses, specific capacity

D. Quality of Groundwater :
Sources of Salinity, Measures of water Quality, Chemical, Physical and Biological Analysis, water quality criteria, Pollution of Groundwater, Management of Groundwater

E. Groundwater Modeling Techniques :
Porous media models, Analog models Electric Analog Models, Digital Computer Models

F. Surface Investigations of Groundwater :
Geologic methods, Remote Sensing, Geophysical exploration, Electric Resistivity method, Seismic Refraction Method; water witching

G. Artificial Recharge of Groundwater :
Concept of Artificial Recharge methods, Research on Water Spreading, Wastewater Recharge, Recharge mounds, Induced Recharge.

References :

1. TODD D. K. : Groundwater Hydrology, John Wiley & Sons
2. RAGHUNATH H. M. : Groundwater, New Age Intl.

I. Bridge Engineering

I.A. Introduction :
Definition, Importance of bridge, Components of Bridge, Classification of Bridges 2

I.B. Investigation for Bridges :
Site section, Preliminary data to be collected, Preliminary drawings- Determination of Design discharge – Lineal waterway, Economical span, Location of piers and Abutment, Vertical clearance above HFL, Sub-soil exploration- Scour depth, traffic projection, Investigation report, preparation of Detailed Project Report (DPR) of bridges choice of bridge type, Quality assurance for bridge projects 3

I.C. Loading Standards for Road Bridges :
Evolution of Bridge loading standard as per relevant IRC specification i.e. Dead load IRC standard live load, Impact effect, Application of live loads on deck slabs, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water currents, Buoyancy effect, Earth pressure, Temperature effect, Seismic force, etc. 3

I.D. Design Considerations :
(a) General Design of B :ridges :
Slab culvert, Box culvert, pipe culvert, T-beam bridge superstructure, Design of Deck Slab, Abutment, Piers, Wing wall, etc. Brief Introduction to rigid frame, Arch and Bowstring girder bridges 4

(b) Prestressed Concrete Bridges
Pretension and post tensioned concrete bridges, prestressed concrete T-beam bridge superstructure.

I.E. Bridge Bearings :
Introduction function of bearings, Bearings for steel bridges and concrete bridges, Bearing for continuous span bridge, IRC provisions for bearing, Material specifications 3

I.F. Foundations :
Types of bridge foundations, general design criteria and methods of construction : Open foundation, Caisson foundations – Open, Monolith, Pneumatic and Box or Floating types, Drilled caissons, Pier foundations, Pier Nosing 3

I.G. Construction, Repair, Rehabilitation of Bridges :
Introduction to construction of of bridges and maintenance, Inspection of bridges, Types of failure in bridges, Maintenance and Rehabilitation of bridges, Protective and Training Works at Bridge sites
3

References :

1. VICTOR D. J. : Essentials of Bridge Engineering
2. KRISHNA RAJU N. : Design of Bridges
3. ALGIA J. S. : Bridge Engneering

II. Tunnel Engineering

II.A. Introduction :
General Aspects, Classification, Definitions and Purpose of Tunnels, Advantages and Disadvantages, Conditions favorable for Tunnel construction, Economics

II.B. Tunnel Alignment :
Location of centre line on ground, Surveying, Preliminary exploration, Approaches to Tunnels, Tunnel alignment and grade, Size and Cross-section of Tunnels, Design and Construction of Portals, Verification of Tunnel Cross-sections

II.C. Drilling and Blasting :
Types of Drills, Selection of Drilling Equipment and Drilling Pattern, Types of Explosives and Requirement, Detonators and Triggering operation, Blasting techniques

II.D. Geotechnical Aspects and Tunneling Operations :
Geotechnical Exploration for Profile and Nature of Rock; Planning operation – Number of Entrances and sequence of operations in driving of tunnels Tunneling Methods : Hard rock, Soft soils, Choice of Method of Construction, Ground Support, Compressed Air tunneling

II.E. Shafts in Tunnels :
Advantages, Classification of Shafts, Location and Size of Shafts in Rocks, Shaft Sinking in Soft Soils, Protection around Shaft Openings and Shaft Support

II.F. Ventilation, Lighting and Drainage of Tunnels :
Objects of Tunnel Ventilation, Methods of Ventilation, Air Requirement and Air Conditioning, Lighting and Drainage of Tunnels

II.G. Safety in Tunneling :
Precautions in Handling and Storing Explosives, Safety Requirements during Blasting Operation and during Tunneling

References :

1. SRINIVASAN R. : Harbour, Dock and Tunnel Engineering

CE 8209 E EARTHQUAKE RESISTANT DESIGNS

A. Ground Motion during Earthquakes :
Seismology, Seismic Zoning Map, Characteristics and Study of Strong Motion; Types of Waves : P-, R- and S-waves; Epicenter, Hypocenter, Locating Epicenter; Terminologies - magnitude, intensity and measurement, Record of notable earthquakes

B. Dynamics of Structures :
Introduction; Single of systems, Seismic Pickups, Dynamic Response and Response Spectra

C. Earthquake Resistance consideration for R C Buildings :
Concepts; Effect of Vibration on Structures; Basics of Earthquake Resistant Design; Architectural consideration in Design of Buildings to resist earthquakes

D. Seismic Analysis and Modeling of R C Building :
Design Lateral Load – determination on Code Procedure; Infill wall consideration in Seismic Analysis; Mathematical modeling and Stepwise Procedure for Analysis

E. Earthquake Resistant Design of R C Buildings :
Ductility consideration in Earthquake Resistant Design; Typical Designs of Building and Shear Wall; Capacity Based Design

F. Earthquake Resistant Design of Masonry Buildings :
Identification of Damages to and Survival from Earthquakes Masonry Buildings in Past; Elastic Properties of Structural Masonry; Lateral Load Analysis of Masonry Buildings

G. Seismic Evaluation and Retrofitting of Buildings :
Practical Approach towards Seismic Evaluation of R C Buildings; Provisions for Improving Performance of non-engineered Masonry Construction; Retrofitting Strategies of R C and Masonry Buildings

References :

1. AGARWAL PANKAJ and SHRIKHANDE MANISH : Earthquake Resistant Design of Structures, Prentice-Hall (2006)
2. COBURN ANDREW and SPENCER ROBIN : Earthquake Protection, John Wiley
3. CHOPRA A. K. : Dynamics of Structures – Theory and Applications to Earthquake Engineering, Prentice Hall
4. IS : 1893 - 2002, Indian Standard Criteria for Earthquake Resistant Design of Structures :
5. Part I – General Provisions and Buildings
6. IS : 13920-1993, Indian Standards Guide to Practice for Ductile Detailing of Reinforced
   Concrete Structures Subjected to Seismic Forces

CE 8211 A THIN-WALLED STRUCTURES

A. Basics of plates :
Pure Bending of plates – Slopes & curvatures – relations between moments and curvatures – particular cases – strain energy

B. Laterally Loaded Rectangular Plates :
Differential equation – boundary condition – Navier's solution for uniform load and concentrated load – Levy's solution for uniform load and hydrostatic load

C. Circular plates :
Circular plates subjected to symmetrical bending – differential; equation – uniform load circular plate with concentric circular hole – circular plate with concentric rigid circular inclusion

D. Special cases :
Simply supported equilateral triangular plate under uniform edge moments- uniformly loaded elliptic plate with clamped edge- bending of plates under combined lateral and in-plane loading –differential equation-simple problems

E. Basics of shells & classification :
Deformation of shells without bending –definitions and notations –classification axi symmetric problems- equilibrium equations –displacements

F. Membrane Analysis :
Membrane analysis of spherical, conical and cylindrical shells under axisymmetric consignment loading

G. Folded plates :
Types, assumptions and methodology for analysis of prismatic folded plate, Whitneys method

References :

1. TIMOSHENKO S. P. and WINOWSKY-KRIEGER : Theory of Plates & Shells
2. RAMASWAMY G. S. : Design and construction of Concrete Shell Roofs

CE 8211 B ROCK MECHANICS

A. Introduction and Basic Concepts :

Rock as material - geological considerations; rock forming minerals; fabric of rocks; mechanical nature of rock; joints & faults

B. Rock exploration :

Objective; Methods of rock exploration; Direct penetration, Core boring , Core recovery, Rock quality designation, Geophysical prospecting, Seismic methods - theory and limitations, Electrical methods, Gravity methods, Magnetic methods

C. Engineering Properties of Rocks :

Elasticity & Strength of rocks, stress – strain curves, effect of confining pressure & temperature; types of fracture; Munel's extension of Griffith; effect of anisotropy Friction in rocks, Amonton's law, Phenomenon with smooth surfaces, stick-slip oscillations; sliding on plane of weakness – 2-D theory

D. Tests on Rock and Rock Specimens :

Laboratory Testing of Rock specimens : Physical tests – Grain Specific Gravity, Unit Weight and Porosity; Strength Tests : Uniaxial compression, tension, indentation, Direct shear and Triaxial shear tests at high confining pressures In-situ tests, Plate bearing test, Pressure tunnel test, Deformability test, Borehole test, Shear tests, Strength tests, Flat jack test

E. Rock Engineering Behaviour :

Mechanical Behavior : strength of rock, influence of discontinuities upon engineering behavior of rock masses, rock-quality indices; joints, folds and faults Mass Behavior : Structure & anisotropy of rock masses; orientation of geological planes, statistical density of fissures, rock mechanics surveys Methods of improving properties of rock masses : Pressure-grouting, consolidation grouting, rock reinforcement, rock freezing

F. Failure Theories :

Various theories of failure and yield criteria; Rankine, St. Venant, Tresca, Maxwell, and Mohr-Coulomb; Griffith's theory of fracture; strength criteria of jointed rocks; Barton's theory; Rheological models – St. Venants, Kelvin, Maxwell, Bingham and Burger models

G. Application of Rock Mechanics in Mining :

Structural nature of mineral deposits, forces due to weight of strata, tectonic and orogenic; residual and thermal forces; stress fields, stress concentrations and ground failures – bumps and rock bursts; concept of ring stresses; open cast mining; design of pillars, land subsidence

References :

1. JAEGER and COOK : Fundamentals of Rock Mechanics
2. STAGG K. G. and ZIENKIEWICZ O. C. : Rock Mechanics in Engineering Practice
3. FARMER : Rock Mechanics
4. FAIRHURST C. : Design Methods in Rock Mechanics
5. HOSKINS E. R. Jr. : Applications of Rock Mechanics
6. HARDY H. R. Jr. : New Horizons in Rock Mechanics
7. O'BERT and LEONARD : Rock Mechanics and Design of Structures

CE 8211 C COMPUTATIONAL HYDRAULICS

A. Introduction :
Basic equations of Fluid Motion; need for Numerical Solution

B. Solution Techniques :
Governing Equations – Types : Parabolic, Elliptic and Hyperbolic

C. Explicit and Implicit Finite Difference Schemes :

D. Consistency, Convergence and Stability of Schemes :

E. Typical Problems :
Analysis of Water Distribution Networks, Hydraulic Transients in Closed Circuits

F. Flood Routing in Streams – St. Venant's equation

G. Numerical Solution of Two-dimensional Ground Water Flow equations

Reference:

KOUTITTAS : Elements of Computational Hydraulics
BEAR and VERRUIJT : Ground Water Flow Modelling

CE 8211 D HARBOUR, DOCK & AIRPORT ENGINEERING

A. Introduction:
History and development of water transportation; Types of water transportation; Advantages and disadvantages

B. Ports & Harbours:
Classification, based on location & utility; differences between port & harbour and their requirements; selection of site for harbours; Essential features of a good harbour – size, depth, turning basin, harbour entrances. Natural phenomena in harbour engineering : Tides, wind and waves, littoral drift. Harbour works : Breakwaters – different types and their construction, Wharves, Piers, Jetties; Quays – Forces on quay walls, construction Berthing Structures – Dolphins, Trestles, Moles, Moorings accessories, Apron, Transit sheds and Warehouses – essential features, Dredging – different types and their operation; choice of dredgers, Navigational aids – Necessity, different types and requirements

C. Docks:
Types of Docks – Wet Docks, Tidal Basins, Repair Docks, Dry Docks, Floating Docks; Marine railway; Lift Docks, Locks and Lock Gates

D. Airways :
Introduction: History & development of air transport; Advantages & disadvantages; Airport Planning : Regional planning, Factors affecting site selection, Surveys for site selection; Airport classification.
Airport obstructions : Zoning laws, classification of obstructions, Imaginary surfaces, approach zone, turning zone

E. Runway : Orientation – Windows diagram, Basic runway length corrections for elevation. Temperature and gradient, Geometric design, cruising speed, airspeed beaufort scale, different types of runways, Airport capacity

F. Terminals :
Terminal area – Building functions; Apron, Hanger, Aircraft parking system, Typical Airport layouts

G. Air Traffic Control & Visual Aids :
Airport marking and landings; Landing systems; Landing aids, Instrument landing system

References :

1. SRINIVASAN R. : Harbour, Dock & Tunnel Engineering
2. BINDRA S. P. : A Course in Docks & Harbour Engineering
3. OZA H. P. : Dock and Harbour Engineering
4. VASWANI N. K. : Airport Engineering
5. KHANNA S. K. & ARORA M. G. : Airport Planning & Design

CE 8211 E PAVEMENT DESIGN

A. Introduction:
Types of Pavement and structure : Flexible pavement; Rigid Pavement

B. Survey, Investigations and General Consideration:
Road Survey, Formation, Width of pavement, Camber, Gradient, Super elevation, Design speed, Road Cross-section, Tests of road materials: Soil, moorum, gravel, sand cement, concrete, Bitumen, CBR test, and other tests required as per IS & IRC Codes.

C. Design of Flexible Pavement:
Elements of Flexible pavement; methods of design CBR method; other methods subgrade, subbase, base, WBM, BM, BUSG, Premix, carpet, SDBC, Road shoulders; Relevant IRC Codes of Practice

D. Design of Rigid Pavements:
Elements of Rigid pavements; Methods of design; Stresses in rigid pavements and stress combinations; Subgrade reaction; Joints in concrete pavements; Concrete Mix Design; Relevant IRC Codes of Practice

E. Road Drainage:
Necessity of drainage; Surface drainage; Sub-soil drainage; Road-side drains : Open and covered types

F. Pavement Marking:

Recommended Books:

1. KHANNA S. K. & JUSTO C. E. G. : Highway Engineering
2. VASWANI N. K. : Highway Engineering