

**CENTRAL INSTITUTE OF TECHNOLOGY**  
**(Centrally Funded Institute under Ministry of HRD, Govt. of India)**  
**Bodoland Territorial Council, Kokrajhar, Assam-783370**  
**(B.Tech Syllabus in Civil Engg/Construction Technology)**

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## STUDY PLANS

**Total Credit Requirements : 236**

**Total Number of Semesters : 8**

### 1<sup>st</sup> YEAR: 1<sup>st</sup> SEMESTER (JULY-DEC)

<b>A. Theory</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	MA101	Engineering Mathematics -I	3	1	0	4	4
2.	PH101	Engineering Physics	3	1	0	4	4
3.	CS101	Introduction to Computer Programming	3	1	0	4	4
4.	HU101	Communication Skills	3	0	0	3	3
5.	ES101	Environmental Engineering	3	1	0	4	4
<b>Total of theory</b>							<b>19</b>

<b>B. Practicals</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	PH171	Physics Lab	0	0	3	2	2
2.	CE101	Engineering Graphics	0	1	0	1	1
3.	CE171	Engineering Graphics Lab	0	0	3	2	2
4.	WS171	Workshop Practice -I	0	1	3	3	3
5.	CS171	Computing Lab	0	0	3	2	2
<b>Total of practicals</b>							<b>10</b>

**Total of 1<sup>st</sup> Semester: 29**

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**1<sup>st</sup> YEAR: 2<sup>nd</sup> SEMESTER (JAN-JUNE)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	MA201	Engineering Mathematics -II	3	1	0	4	4
2.	CY201	Engineering Chemistry	3	1	0	4	4
3.	ES201	Basic Electrical Engineering	3	1	0	4	4
4.	ME201	Engineering Mechanics	3	1	0	4	4
5.	EC201	Basic Electronics	3	1	0	4	4
6.	HU201	Professional Ethics and Human value	2	0	0	2	2
<b>Total of Theory</b>							<b>22</b>

<b>B. Practicals</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CY271	Engineering Chemistry Lab	0	0	3	2	2
2.	WS271	Workshop Practice -II	0	1	3	3	3
3.	EE271	Basic Electrical and Electronics Lab	0	0	3	2	2
<b>Total of Practicals</b>							<b>7</b>

**Total of 2<sup>nd</sup> Semester: 29**

**\*\*\* Approved by GU**

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**2<sup>ND</sup> YEAR: 3<sup>RD</sup> SEMESTER (JULY-DEC)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (per week)				Credit Points
			L	T	P	Total	
1.	CE 301	Surveying-I	3	1	0	4	4
2.	CE 302	Strength of materials	3	1	0	4	4
3.	CE 303	Fluid mechanics	3	1	0	4	4
4.	CE 304	Building materials and construction	3	1	0	4	4
5.	CE 305	Engineering geology	3	0	0	3	3
6.	MA301	Mathematics-III	3	1	0	4	4
<b>Total of Theory</b>							<b>23</b>

<b>B. Practical</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CE371	Surveying-I	0	0	2	2	2
2.	CE372	Civil Engineering Drawing	0	0	2	2	2
3.	CE373	Material Testing lab	0	0	2	2	2
4.	HU371	Language Lab	0	0	3	3	2
<b>Total of practical</b>							<b>8</b>

**Total of 3<sup>rd</sup> Semester: 31**

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**2<sup>ND</sup> YEAR: 4<sup>TH</sup> SEMESTER (JAN-MAY)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (per week)				Credit Points
			L	T	P	Total	
1.	HU401	Engineering Economics	3	0	0	3	3
2.	CE 401	Surveying-II	3	1	0	4	4
3.	CE 402	Structural Analysis-I	3	1	0	4	4
4.	CE 403	Geotechnical Engineering	3	1	0	4	4
5.	CE 404	Environmental Engineering-I	3	1	0	4	4
6.	MA401	Numerical Methods and Computer Programming	3	0	0	3	3
<b>Total of Theory</b>							<b>22</b>

<b>B. Practical</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CE 471	Surveying-II	0	0	2	2	2
2.	CE 472	Geotechnical Engineering	0	0	2	2	2
3.	CE 473	Environmental Engineering-I	0	0	2	2	2
4.	MA471	Numerical Methods & Computer Programming Lab	0	0	2	2	1
<b>Total of practical</b>							<b>7</b>

**Total of 4<sup>th</sup> Semester: 29**

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**3<sup>RD</sup> YEAR: 5<sup>TH</sup> SEMESTER (JULY-DEC)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (per week)				Credit Points
			L	T	P	Total	
1.	CE 501	Design of Structures-I	3	1	0	4	4
2.	CE 502	Transportation Engineering-I	3	1	0	4	4
3.	CE 503	Structural Analysis-II	3	1	0	4	4
4.	CE 504	Concrete Technology	3	1	0	4	4
5.	HU501	Industrial Management and Entrepreneurship	3	0	0	3	3
<b>Total of Theory</b>							<b>19</b>

<b>B. Practical</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CE 571	Transportation Engineering-I	0	0	2	2	2
2.	CE 572	Concrete Technology	0	0	2	2	2
3.	CE 573	CAD	0	0	2	2	2
4.	CE 574	Survey Camp	0	0	3	3	3
<b>Total of practical</b>							<b>9</b>

**Total of 5<sup>th</sup> Semester: 28**

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**3<sup>RD</sup> YEAR: 6<sup>TH</sup> SEMESTER (JAN-JUNE)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (per week)				Credit Points
			L	T	P	Total	
1.	HU601	Professional Communication	2	0	0	2	2
2.	CE 601	Design of Structures-II	3	1	0	4	4
3.	CE 602	Environmental Engineering-II	3	1	0	4	4
4.	CE 603	Transportation Engineering-II	3	1	0	4	4
5.	CE 604	Foundation Engineering	3	1	0	4	4
6.	CE 605	Hydraulic Engineering	3	1	0	4	4
<b>Total of Theory</b>							<b>22</b>

<b>B. Practical</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CE 671	Environmental Engineering-II	0	0	2	2	2
2.	CE 672	Transportation Engineering-II	0	0	2	2	2
3.	CE 673	Hydraulic Engineering	0	0	2	2	2
<b>Total of practical</b>							<b>6</b>

**Total of 6<sup>th</sup> Semester: 28**

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**4<sup>TH</sup> YEAR: 7<sup>TH</sup> SEMESTER (JULY-DEC)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (per week)				Credit Points
			L	T	P	Total	
1.	CE 701	Estimation and Costing	4	1	0	5	5
2.	CE 702	Structural Analysis-III	4	1	0	5	5
3.	CE71*	Elective-I	3	0	0	3	3
4.	CE71*	Elective-II	3	0	0	3	3
<b>Total of Theory</b>							<b>16</b>

<b>B. Practical</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CE 791	Major Project-I	0	0	14	14	10
2.	CE 792	Report and Presentation on Practical Training-II	-	-	-	-	3
3.	CE770	Seminar	0	0	3	3	2
<b>Total of practical</b>							<b>15</b>

**Total of 7<sup>th</sup> Semester: 31**



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**4<sup>TH</sup> YEAR: 8<sup>TH</sup> SEMESTER (JAN-JUNE)**

<b>A. Theory</b>							
	Code	Subjects	Contacts (per week)				Credit Points
			L	T	P	Total	
1.	CE 801	Design of Structures-III	3	1	0	4	4
2.	CE 81*	Elective-I	3	0	0	4	3
3.	CE 81*	Elective-II	3	0	0	4	3
<b>Total of Theory</b>							<b>10</b>

<b>B. Practical</b>							
	Code	Subjects	Contacts (periods per week)				Credit points
			L	T	P	Total	
1.	CE 891	Major Project-II	0	0	18	18	09
2.	CE 892	Project Defense	-	-	-	-	4
3.	CE 893	Comprehensive Viva Voce	-	-	-	-	8
<b>Total of practical</b>							<b>21</b>

**Total of 8<sup>th</sup> Semester: 31**

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**List of Elective Courses in Civil Engineering (Construction Technology)**

**7<sup>th</sup> Semester Elective-I (any one)**

CE 711 Hydrology  
CE 712 Soil Stabilization and Ground Improvement Techniques  
CE 713 Highway Construction Practise  
CE 714 Open Channel flow

**7<sup>th</sup> Semester Elective-II (any one)**

CE 715 Pavement Analysis and Design  
CE716 Irrigation Engineering  
CE 717 Design of Water Supply and Treatment System  
CE 718 Optimization Techniques in Engineering

**8<sup>th</sup> Semester Elective-I (any one)**

CE 811 Traffic Engineering  
CE 812 Construction Management  
CE 813 Finite Element Analysis  
CE 814 Earthquake Resistant Structures

**8<sup>th</sup> Semester Elective-I (any one)**

CE 815 Bridge Engineering  
CE 816 Advance Foundation Engineering  
CE 817 Geometric Designs of Transportation Facilities  
CE 818 Environmental Impact Assessments

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**Detail Syllabus**  
**of**  
**B.Tech Programme**  
**in**  
**CIT Kokrajhar**  
  
**2<sup>nd</sup> Year Onwards**

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## **BASIC SCIENCES COURSES**

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**MA301: ENGINEERING MATHEMATICS –III**

**Code: MA301**

**Credits: 04**

**L-T-P: 3-1-0**

**Partial Differential Equations**

Basic concepts, formation of partial differential equations, equation solvable by direct integration, linear and non-linear equations of first order. Homogenous linear equations with constant coefficients, solutions of heat equations, wave equations, transmission line equations and Laplace equations.

**Tensor Analysis**

Curvilinear coordinates, unit vectors in curvilinear system, representation of a vector in terms of unit base vectors, contravariant and covariant components of  $F$ , arc length and volume element in orthogonal curvilinear coordinates. Transformations of coordinates. Definition of tensors, fundamental operations with tensors, Symmetric and skew-Symmetric tensors, Riemannian space and metric tensor, Conjugate tensor, Christoffel symbols.

**Calculus of Complex Variables**

Analytic functions, C-R equations, conjugate functions, Harmonic functions, orthogonal systems. Formation of analytic functions, conformal mapping, integration of a complex functions, Cauchy's Integral Theorem, power series representation of complex functions, Laurent's Series, singularities, Residue Theorem.

**Transformations**

Laplace transformation of elementary functions, inverse Laplace transform, Linearity, Laplace transform of derivatives and integrals, shifting Theorems, Laplace transform of unit step function, Dirac-delta function, Differentiation and integration of transforms, convolution, Application to differential equations.

Definition, properties, Z-transform of some basic sequences, Z-transforms of some basic discrete functions, Shifting theorems.

**Texts / References:**

1. *B.S. Grewal: Higher Engg. Mathematics, Khanna Publishers*
2. *Gilbert Strang: Linear Algebra and applications, Thomson Books*
3. *P.L. Meyer: Introduction to Probability & Statistics*
4. *Shanti Narayan: Functions of Complex Variables, S. Chand & Co.*
5. *Murray R. Spiegel: Laplace Transforms, Thomson Books*
6. *I.M. Snedon: Elements of Partial Differential Equations, S. Chand & Co.*

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**MA-302: DISCRETE MATHEMATICS**

**L T P**  
**3 1 0**

**Unit-I**

Set Theory: Introduction, Combination of sets, Multisets, Ordered pairs. Proofs of some general identities on sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions. Growth of Functions.

**Unit-II**

Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms, Definition and elementary properties of Rings and Fields, Integers Modulo n.

**Unit-III**

Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram. Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Simplification of Boolean Functions, Karnaugh maps, Logic gates, and Boolean algebra.

**Unit-IV**

Propositional Logic: Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference. Predicate Logic: First order predicate, well formed formula of predicate, quantifiers, Inference theory of predicate logic.

**Unit-V**

Trees and Tree's Properties

Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths.

**References:**

1. Koshy, *Discrete Structures*, Elsevier Pub. 2008
2. Kenneth H. Rosen, *Discrete Mathematics and Its Applications*, 6/e, McGraw-Hill, 2006.
3. B. Kolman, R.C. Busby, and S.C. Ross, *Discrete Mathematical Structures*, 5/e, Prentice Hall, 2004.
4. E.R. Scheinerman, *Mathematics: A Discrete Introduction*, Brooks/Cole, 2000.
5. R.P. Grimaldi, *Discrete and Combinatorial Mathematics*, 5/e, Addison Wesley, 2004.
6. Jean Paul Trembley, R Manohar, *Discrete Mathematical Structures with Application to Computer Science*, McGraw-Hill, Inc. New York, NY, 1975.

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**MA401: NUMERICAL METHODS & COMPUTER PROGRAMMING**

**Code: MA01**  
**Credits: 04**  
**L-T-P: 3-1-0**

**Computer Arithmetic**

Floating point Arithmetic, Normalization, Approximations and errors, types of error in computations

**Transcendental and Polynomial Equations**

Methods of iteration for finding solution of transcendental and equations: Newton Raphson Method, Regula-Falsi Method, Bisection Method, Secant Method. Solution of linear simultaneous equations by Gauss Elimination Method & Gauss Siedal Method.

**Curve Fitting and Interpolation**

Linear and non-linear Regression Analysis. Difference table, Newton's Forward and Backward interpolation formulae, Lagrange's Interpolation Formula, Divided differences and Newton's general formula.

**Numerical Differentiation & Integration**

Numerical differentiation, Numerical Integration: Trapezoidal and Simpson's Rules. Gaussian Quadrature Formula.

**Numerical Solution of Ordinary Differential Equations**

Euler method, Modified Euler Method, Taylor Series Method, Runge - Kutta Method and Predictor – Corrector Method.

Lab: Developing C programs for the following methods:

1. Numerical integration by Trapezoidal & Simpson's Rules
2. Various iteration methods for solving transcendental and algebraic equations: viz. Newton Raphson Method, Bisection Method, Regula – Falsi Method, Secant Method
3. Gauss – Siedal Iteration Method
4. Various matrix operations and their uses as sub – routines
5. Use of pointers, data structures, loops, arrays

**Texts / References:**

1. *E. Balaguruswamy: Numerical Methods, Tata McGraw Hill*
2. *Jain, Iyengar and Jain: Numerical Methods for Scientific and Engineering Computations, New Age International, New Delhi*
3. *Sastry, S.S.: Introductory Methods of Numerical Analysis, PHI*
4. *B.S. Grewal: Numerical Methods for Engineering and Science, Khanna Publishers*
5. *Schaum's Outlines: Numerical Analysis, Tata McGraw Hill*

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## **HUMANITIES & SOCIAL SCIENCES COURSES**



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**HU401: ENGINEERING ECONOMICS**

**Code: HU401**

**Credits: 03**

**L-T-P: 3-0-0**

Definition of Economics, Consumer behaviour, Utility analysis and demand analysis, Kinds of Demand, Law of Demand and Law of Supply, Elasticity of Demand: Types and Measurement, Scope of Economics including economics of environment and e-commerce.

Market forms-Perfect and Imperfect markets, Features of Perfect competition, Monopoly and Monopolistic competition. Price and output determination under Perfect Competition, Monopoly, Monopolistic and Oligopoly etc., Concept of Production function, Cost Analysis, Estimation of cost function-Profit and Break Even Analysis.

National Income, GNP and NNP, Per-Capita Income, Source of Public Revenue-Tax Revenue and Non-Tax Revenue, Direct and Indirect Tax. Inflation and Deflation. Banking-Definition - Types of Banks. Concept of Investment Analysis

Features of Indian Economy, Planning in India, Objectives. Economic Reforms in India-Concept of Economic Liberalization, Privatization and Globalization. Unemployment Problem in India-Types, Causes and remedial measures.

International Trade, Gains from International Trade, The World Trading Environment and Multinational Corporations, BPO etc., Function and Role of IMF, World Bank and WTO. Concept of Stock Exchange Market and Market for Securities.

**Reference Book:**

1. *M.L. Jhingan—Micro Economic Theory*
2. *Sumitra Paul-Managerial Economics*
3. *Joel Dean—Managerial Economics*

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**HU501: INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP**

**Code: HU501**

**Credits: 03**

**L-T-P: 3-0-0**

Meaning and Concept of Management, Principles and function of Management, Concept of Organizational Behaviour, Function of a Manager—Planning, Organizing, Coordinating and Controlling. Motivation—implication of Managers and application.

Leadership and Decision Making : Qualities and Styles of Leadership, Decision making process.

Individual Process in Organizations-Perception, attitude and personality, Factors that affect them, How they influence people. Group Process in Organizations, Group formation, Group effectiveness, Group Conflict.

Evolution, Role and Status of Human Resource Management in India. Recruitment and Selection Process in Organization, Job Analysis, Job Specification, Selection Process-Test and Interview. Trade Union and Collective Bargaining

Entrepreneurship-Meaning, Types of entrepreneur, Qualities of an entrepreneur, Role of Entrepreneur, Factors affecting entrepreneurial growth. Entrepreneurship Development Programme-Concept, Objective and Importance, Engineer Entrepreneurship Training Programme Scheme

Small Scale Industry-Definition, Types of Small Scale Industry, How to Set up Small Scale Industry, Role and Problem of Small Scale Industry. Concept of Joint Stock Company, Private and Public Limited Company. Source of Finance for Entrepreneur-Bank, Government and Financial Institutions etc.

Reference Books:

1. *S.S. Khanka-Organisational Behaviour.*
2. *S.S. Sarkar, R.K.Sharma and S.K.Gupta – Business Organisation and Entrepreneurship Development.*
3. *Cynthia L. Greene – Entrepreneurship.*

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**HU601: PROFESSIONAL COMMUNICATION**

**Code: HU601**

**Credits: 02**

**L-T-P: 2-0-0**

Oral Communication: Aims at improving the oral communication skills. Public speaking skills, features of effective speech – verbal – non-verbal, Presentation skills, Group discussion. Mock Interviews.

Written Communication: Focuses on improving the writing skills. A review of grammar, transformation of sentences; reading comprehension; Precis-writing, skills to express ideas through various kinds of essays; business administrative and E-correspondence, business reports, technical documentation & project proposal writing and CVs/ resumes; Application letters, Notices, Agenda, Minutes & Memos. Case Analysis.

Organization Communication: Attempts to acquaint students with the process and requirements of communication in organizations. It includes the objectives of communication, Channels of communication, Barriers in Communication, Non-verbal & Cross-cultural communication, Meetings, Conferences, Press Conference and Press release. Business Communication Technology: Audio-Visual aids, Internet, e-mail. Creative Communication: Slogan-writing, Advertisement.

**Texts / References:**

1. *Wren & Martin., English Grammar*
2. *John Metchell., How to write Reports*
3. *Mark McCormack., Communication*
4. *Rajendra Pal & J.S. Korlahalli, Essentials of Business Communication*

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## **PROGRAMME CORE COURSES**

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**3rd Semester**

**CE 301: Surveying-I**

**Code: CE 301**  
**Credit: 04**  
**L-T-P: 3-1-0**

**Introduction to Surveying**

Classification, principles, types, propagation of errors.

**Chain and Tape Survey**

Distance measurement, errors and corrections.

**Compass Survey**

Instruments, adjustment, angular measurement, latitude and departure, compass traversing.

**Elevation Measurement**

Instruments, adjustments, levelling – principles, long section, cross section, reciprocal levelling, trigonometric levelling, effect of curvature and refraction.

**Theodolite**

Details of instrument, adjustments, angular measurement – horizontal and vertical, Traversing.

**Contouring**

Characteristics, methods & uses.

**Plane Table Surveying**

Equipments, principles, operation, methods, errors, advantages and disadvantages.

**Reference Books:**

1. *Surveying (Vol I & II) by B.C. Punmia, Laxmi Publications.*
2. *Surveying by Dr. A. M. Chandra.*
3. *Surveying (Vol I & II) by P.B. Shahani.*
4. *Surveying and Levelling (Vol I & II) by T.P. Karnatkar*
5. *Surveying by Arrora, Standard Book House.*
6. *Surveying by Kulkarni*

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**CE 302: Strength of Materials**

**Code: CE 302**

**Credit: 04**

**L-T-P: 3-1-0**

**Simple stresses and Strains**

Stress, strain, type of stresses, stress-strain curve, elastic limit, Hooke's law, factor of safety, elastic constants, bars of varying sections, bars of composite sections, elongation due to self weight, bars of uniform strength, complementary shear stresses.

**Complex stresses**

Stresses on inclined plane, stresses on inclined plane due to two perpendicular stresses, ellipse of stresses, Mohr's circle, stresses on inclined plane due to normal and shear stresses, principal plane, principal stresses and strains.

**Bending moments and Shear forces**

Beam – deflection, type of loads, type of supports, SF and BM, sign convention, SF and BM diagrams for cantilever, simply supported and overhanging beams, relationship between rate of loading, SF and BM.

**Stresses in beams**

Theory of bending, assumptions, neutral axis and moment of resistance, bending stresses in symmetrical sections, section modulus, composite beams, shear stresses in beams.

**Torsional stresses in shafts**

Analysis of torsional stresses, power transmitted, combined bending and torsion, equivalent bending moment and torque.

**Combined Bending and Direct Stresses**

Combined bending and direct Stresses, resultant stresses for rectangular column subjected to eccentric load, limit of eccentricity for no tension.

**Cylindrical Shells**

Thin cylinders and spherical shells, stresses, strains and volumetric changes.

**Column and Struts**

Failure of columns, slenderness ratio, short and long columns, crippling load, Euler's theory, Rankine's formula, Straight line and parabolic formula.

**Deflection of beams**

Relationship among curvature, slope and deflections, slope and deflection for cantilever and simply supported beams, Macaulay's method.

**Reference Books:**

1. *Strength of Materials by G.H.Ryder, ELBS & Macmilan.*
2. *Strength of Materials by R. S. Khurmi*
3. *Strength of Materials by Bansal*
4. *Strength of Materials by Ramamruthm*

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**CE 303: Fluid Mechanics**

**Code: CE 303**

**Credit: 04**

**L-T-P: 3-1-0**

**Basic Concepts**

Continuum Approach, Important physical properties: density, specific weight, viscosity, surface tension, capillarity, compressibility, vapour pressure, Classification of fluids-ideal and real fluid, non-Newtonian fluids.

**Fluid Statics**

Pressure at a point-Pascal's Law, pressure variation in a static fluid. Scales of Pressure-absolute and gauge pressure, Measurement of pressure-manometers, Forces on submerged plane and curved surfaces, Buoyant Force-centre of buoyancy, metacentre, determination of metacentric height, Equilibrium of floating and submerged bodies, relative equilibrium-translation and rotation of fluid masses.

**Kinematics of Fluids**

Study of fluid motion-Lagrangian and Eulerian methods, Classification of flow-steady and unsteady flow, uniform and non-uniform flow, rotational and irrotational flow, laminar and turbulent flow, 1,2,&3 D flow, Concept of streamlines, pathlines and streakline, streamtube, Continuity equation. Circulation, vorticity, stream function, velocity potential, Flownet.

**Dynamics of Fluid Flow**

Euler's equation of motion, Bernoulli's equation and its application-venturimeter, orificemeter, pitot tube, Momentum equation and its application to simple problems.

**Orifice and Mouthpiece**

Classification, discharge through a free orifice, orifice coefficients-experimental determination, External and internal mouthpiece, mouthpiece running full and free.

**Notches and Weirs**

Classification, Velocity of Approach, Broad crested weir.

**Flow through Pipes**

Losses in pipe flow-major loss (Loss due to friction)-Darcy Weisbach equation, minor losses, Hydraulic gradient lines, Total Energy lines. Pipes in series, pipes in parallel, equivalent pipe, Siphon.

**Dimensional Analysis**

Dimensions-fundamental and derived qualities, dimensional homogeneity, methods of dimensional analysis-Rayleigh's method and Buckingham's  $\pi$  theorem.

**Reference Books:**

1. *Fluid Mechanics* by A.K. Jain, Khanna Publisher.
2. *Fluid Mechanics* by K.L. Kumar, S. Chand & Co.
3. *Fluid Mechanics* by Streeter & Wily, McGraw Hill.
4. *Fluid Mechanics and Hydraulic Machines* by R.K. Bansal, Laxmi Publisher.

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**CE 304: Building Materials and Construction**

**Code: CE 304**

**Credit: 04**

**L-T-P: 3-1-0**

**Construction materials**

Rock: Classification, quarrying and dressing, Bricks: Manufacturing processes, classification and tests, Flooring and roofing tiles, Production, properties and uses of lime, cement and sand-mortar, Concrete: Plain and reinforced, Timber: types and methods of preservation, plywood, Iron and structural steel, Types and uses of paints, varnishes and distemper, Sound and heat insulating materials, Glasses, plastics and asphaltic materials.

**Building and Its Types**

Principles of planning, Orientation, Functional requirements, Building Bye-Laws, Dead and Live loads. Types of foundation and their suitability, Bonds in Brick work, Cavity wall, Lintels and Arches, scaffolding.

**Roofs**

Classification and coverings, Roof terracing, Types of roof trusses.

**Floors**

Ground and upper floors; Cement, concrete and mosaic floors.

**Stair Case**

Types, Planning of stair.

**Doors & Windows**

Types, Construction details, Fixing Ventilators.

**Miscellaneous**

Damp proofing, Protective and Decorative finishes.

**Reference Books:**

1. *Civil Engineering Materials, TTTI, Chandigarh, Tata McGraw Hill, New Delhi, 1992.*
2. *Engineering Materials, Sushil Kumar, Metropolitan Publishers, New Delhi, 1983.*
3. *Engineering Materials, Rangwala, S.C., Charotar Publishing House, Anand, India, 2000.*
4. *Engineering Materials, K P Roy Chowdhury, Oxford & IBH, New Delhi, 1977.*
5. *Building Construction by B.C. Punmia, Laxmi Publication.*
6. *Element of Building Construction by S.C. Rangwala, Charotar Publication, Pune.*
7. *A Text Book of Building Construction by S.K. Sharma, S. Chand Publication*
8. *Building Planning, Design and Scheduling by Gurucharan Singh. Standard Publication*
9. *Distributors, Delhi*
10. *Building Bye Laws*



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**CE 305: Engineering Geology**

**Code: CE 305**

**Credit: 03**

**L-T-P: 3-0-0**

Solar system and the earth. Origin age and interior of the earth. Crystallography and mineralogy. Weathering including geological action and wind, running water and glacier. Different types of rocks their classification, texture and structure. Earth Quake, structures in rocks (folds, faults, joints and unconformities).

Ground water. Stability of slopes landslides, selection of sites for bridges dams and tunnels. Building stones, engineering properties of rocks. Geophysical exploration. Geological time scale Indian rocks groups. Processes of formation of economic mineral deposits, distribution of economic minerals in India.

**Reference Books:**

1. *Engineering and General Geology* by Prabin Singh, S.K. Kataria and Sons, New Delhi.
2. *A text Book of Geology* by P.K. Mukherjee., The world Press Private Limited, 37 'A' College Street, Calcutta.
3. *Physical and Engineering Geology* by S.K. Garg, Khanna Publishers Delhi..
4. *Introduction to Physical Geology* by A.K. Dutta, H.R. Dutta '68' Circular Road, Ranchi , Bihar.
5. *A Test Book of Mineralogy* by E.S. Dana, Wiley Eastern Ltd., New Delhi.
6. *Geology of Indian and Barma* by M.S. Krishnan, College Book Store – 1701, Nai Sarak, Delhi.
7. *A Text Book of Engineering Geology* by N. Chenna Kasavulu, Macmilan India Ltd. 2/10 an sari Road, Daryagan, New Delhi.

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**3<sup>rd</sup> Semester Practicals**

**CE 371: Surveying-I**

**Code: CE 371**

**Credit: 02**

**L-T-P: 0-0-2**

Chain Surveying; Compass: Traversing; Levelling: Observation using Dumpy level and staff, Fly levelling, Reciprocal levelling; Theodolite: measurement of angles, traversing; Plane Table Surveying.

**CE 372: Civil Engineering drawing**

**Code: CE 372**

**Credit: 02**

**L-T-P: 0-0-2**

Residential Buildings, Industrial building, Public building, Signs and symbols of building materials, Single Storied Residential Buildings (pitched roof) -Type II, Double Storied Residential Building with Flat Roof -Type III  
Bond in Brick Masonry (orthographic and isometric), Bonds in Stone Masonry.  
Doors, windows and ventilators; Arches and Lintels; Timber joints and Trusses.  
Stair cases.  
Simple drawings of above topics on computer Graphics.

**CE 373: Material testing Lab**

**Code: CE 373**

**Credit: 02**

**L-T-P: 0-0-2**

**Tests on aggregate for concrete** (a) Grain size distribution (b) Specific gravity (c) Density (d) Voids (e) Bulking (f) Aggregate crushing value (g) Aggregate impact value

**Tests on cement** (a) Fineness (b) Normal consistency (c) Setting time (d) Compressive strength

**Test on bricks** – Crushing strength, water absorption and efflorescence

**Test on metals** – Hardness test and impact test

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**4<sup>th</sup> Semester**

**CE 401: Surveying-II**

**Code: CE 401**  
**Credit: 04**  
**L-T-P: 3-1-0**

**Tacheometry**

Principles, Stadia and Tangential methods, Error and Precision in Tacheometry.

**Curves:** Classification, setting out of circular curve and transition curve.

**Triangulation**

Triangulation systems, Intervisibility, Signals, satellite stations, computations and adjustments.

**Calculation of Area and Volumes:** Different methods, Trapezoidal, Prismoidal rules.

**Photogrammetry:** Principles, application, types, relief, Flight planning.

**Remote Sensing:** Introduction, definitions, Remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics

**GIS & GPS:** Introduction to GIS, Components of GIS, advantages, function of GIS, Raster and vector data, advantages and disadvantages, global positioning system.(GPS), Introduction, definitions, GPS receivers, antenna, advantages of GPS.

**Reference Books:**

1. *Surveying (Vol II & III) by B.C. Punmia , Laxmi Publication.*
2. *Surveying (Vol I & II) by K.R. Arora , Standard Book House.*
3. *Plane Surveying by A.M. Chandra , Newage International.*
4. *Higher Surveying by A.M. Chandra ,Newage International*
5. *Fundamentals of Remote Sensing by G. Joseph, Universities Press, 2003.*
6. *GIS – A Computing Perspective by Michael W. CRC Press, 2004.*
7. *Geographic Information Analysis by O'sullivan David, John Wiley & Sons, 2003.*

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**CE 402: Structural Analysis-I**

**Code: CE 402**

**Credit: 04**

**L-T-P: 3-1-0**

**Introduction to Structural analysis**

Forms of structures, Loads and Forces, Free body diagram, conditions of equilibrium of forces, support and connections – reactions, Difference between determinate and indeterminate structures.

**Statically Determinate Beams**

Axial Thrust, Bending moment, Torsion & Shear Force in beams with concentrated load and distributed load. Points of contra flexures.

**Deflection in Beams**

Computation of slope and deflection by double integration, moment area method, conjugate beam method, applications to simply supported, overhang and cantilever beams.

**Strain Energy and Virtual work**

Strain energy for axial force, bending, shear and torsion. Castigliano's theorems and their applications to find deflection and redundant forces in simple cases.

**Analysis of Pin-Jointed Structure**

Method of joints and sections, Graphical method, Deflection of joints, Truss with single redundancy, Maxwell's reciprocal theorem, Betti's theorem and their applications. Arches (Three hinge and Two hinge arch). Cables, Three hinge stiffening Girder.

**Introduction**

Indeterminate structures, Static and Kinetic indeterminacy and their calculation.

**Indeterminate Beams**

Propped cantilever, Fixed Beam, Continuous beams, Sinking of support, temperature effect, three moment equation.

**Classical Displacement Method:** Slope deflection method, Moment distribution method, Kanis Method – application to analysis of indeterminate Beams and Building frames.

**Reference Books:**

1. *Theory of Structural Analysis – Timoshenko & Young.*
2. *Structures – Marshall.*
3. *Structural analysis –Wilbur & Norris*
4. *Basic Structural analysis – Reddy*
5. *Solid Mechanics – E.P. Popov.*

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**CE 403: Geotechnical Engineering**

**Code: CE 403**

**Credit: 04**

**L-T-P: 3-1-0**

**Soil**

Origin and types, Identification and classification of soils, Index properties, phase relationship, consistency, sensitivity, clay mineralogy.

**Seepage**

Darcy's law of permeability, Determination of Coefficient of permeability, Equivalent permeability for stratified soil, Flow nets – principles, construction and application, Effective stress analysis, quick sand condition, piping, filtration criteria.

**Compaction**

Principle of compaction, Light and heavy compaction, field compaction control, factors affecting compaction.

**Compressibility and Consolidation:** Terzaghi's theory of one-dimensional consolidation, Secondary Consolidation, estimation of consolidation settlement.

**Shear Strength of Soil**

Strength envelope, total and effective stress paths, pore pressure, evaluation of shear strength parameters, direct shear, triaxial shear, vane shear, unconfined compression test.

**Lateral Earth Pressure: Earth**

pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, Graphical Solutions.

**Stability of Slope**

Stability of infinite slope, stability of finite slope, slope protection.

**Reference Books:**

1. *Introduction to Soil Mechanics by BM Das, Galgotia Publication*
2. *Soil Mechanics and Foundation Engg. by BC Punmia, Dhanpat Rai & Sons.*
3. *Soil Mechanics by Gopal Ranjan & Rao, Dhanpat Rai & Sons.*
4. *Soil Mecanics by Whitman & Lambe, John Willey.*
5. *Soil Mechanics & Foundation Engg by VNS Murthy, Dhanpat Rai & Sons.*

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**CE 404: Environmental Engineering-I**

**Code: CE 401**

**Credit: 04**

**L-T-P: 3-1-0**

**Public Water Supply Scheme**

Objectives, Planning and Components

**Source of Water**

Surface source - types, selection, storage reservoir – yield and capacity estimation. Sub-surface water - types, selection, well hydraulics.

**Intakes:** Intake Structure- site selection, types; pumps-types, selection.

**Water Quality**

Impurities – types and their effects, sampling & analysis, water borne diseases and their control, water quality standard – potable and industrial.

**Water Demand**

Population forecasting, design period, estimation of water demand for various uses, factors affecting consumption and fluctuation of demand.

**Water Purification**

Sedimentation, Coagulation and Flocculation, Filtration, Disinfection, Miscellaneous Methods.

**Distribution System**

Requirements, Classification, Layout and Design, Analysis, Detection and Prevention of Wastage of Water. Distribution Pipe – types, selection, laying, jointing, testing, maintenance.

**Ecology**

Ecological Chain and balance.

**Reference Books:**

1. *Environmental Engg. (Vol. I) by B.C. Punmia, Laxmi Publications.*
2. *Water Supply Engg. (Vol. I) by S.K. Garg, Khanna Publications.*
3. *Environmental Engg. by Peavy & Raow, McGraw Hill Publications.*
4. *Environmental Chemistry by Sewear, McGraw Hill Publications.*
5. *Water Supply by G.S. Birdi.*

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**4<sup>th</sup> Semester Practicals**

**CE 471: Surveying-II**

**Code: CE 471**

**Credit: 02**

**L-T-P: 0-0-2**

**Levelling Practices:** Profile levelling, Cross-sectioning; Contouring; Tacheometric surveying; Setting out of Circular curves;

**Total station:** Measurement of Angles and Distances.

**CE 472: Geotechnical Engineering**

**Code: CE 472**

**Credit: 02**

**L-T-P: 0-0-2**

Specific gravity, water content, particle size distribution, liquid limit, plastic limit, shrinkage limit, core cutter method, sand replacement method, permeability of Soil, procter Compaction test (Standard/Modified), direct shear test, unconfined Compression Test, triaxial Test, one Dimensional Consolidation Test

**CE 473: Environmental Engineering-I**

**Code: CE 473**

**Credit: 02**

**L-T-P: 0-0-2**

Solid determination, Dissolved oxygen determination, Iron Concentration, determination, Chloride determination, Hardness determination, Acidity determination, Alkalinity determination, Sulphate determination, Jar test to determine optimum coagulant, PH. value determination, Turbidity determination,

**CE 474: Survey Camp**

**Code: CE 474**

**Credit: 04**

Locating Highway alignment or preparing topographic map using Total Station. Use GPS to collect coordinates of station point. Use any computer package to show the final layout.

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**5<sup>th</sup> Semester**

**CE 501: Design of Structures-I**

**Code: CE 501**

**Credit: 04**

**L-T-P: 3-1-0**

Properties of Concrete and reinforcing steel. Limit State Design philosophy. Durability, serviceability, shear, bond, flexure and deflection consideration. Singly reinforced, doubly reinforced and Tee beams. Continuous Beams. Simple and Continuous slab. Columns – centric and eccentric loading, long and short columns. Footings – isolated and combined. Retaining walls. Introduction to working stress method of design.

**Reference Books:**

1. *Limit State Design of Reinforced Concrete* by P.C. Varghese, Prentice Hall of India, New Delhi
2. *Reinforced Concrete* by S.K Mallick and A.P. Gupta, Oxford and IBH
3. *Reinforced Concrete Design* by S.N. Sinha, Tata Mc Graw Hill
4. *Reinforced Concrete* by A.K. Jain, Nemchand Brothers, Roorkee
5. *Reinforced Concrete Fundamental* by Farguson, Beru and Jarsa, John Wiley and Sons, N.Y
6. *Reinforced Concrete Fundamental* by C.K. Wang and C.G. salmon, Harpur International Edition
7. *IS:456-2000* by BIS, BIS
8. *IS:875* by BIS, BIS
9. *SP.16 (Design Aid)* by BIS, BIS
10. *SP.34 (Detailing)* by BIS, BIS
11. *SP.24 (Explanation of IS: 456)* by BIS, BIS
12. *SP.22 (Mix Design)* by BIS, BIS



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**CE 502: Transportation Engineering-I**

**Code: CE 502**

**Credit: 04**

**L-T-P: 3-1-0**

**Introduction**

Development & Planning, Road transport Characteristics, Historical development of road, Classification of roads, development plants, network patterns, Highway planning in India,

**Highway Planning and Surveying:** Highway alignment, engineering survey for highway alignment

**Geometric Design:**

Elements, Specifications and Design principles. Road, road user & road vehicle characteristics, Factors affecting design standards. Cross Section elements, stopping & overtaking sight distance overtaking zones. Horizontal alignment-Curves, design of superelevation, widening, transition curves, vertical alignments, Design of summit & Valley Curves, I.R.C. standards for Geometric Design, Geometrics of Hill Roads

**Highway Materials:** Properties of Subgrade, Aggregates & Binding materials, various tests and specifications. Proportioning of aggregate, Marshall Mix Design.

**Pavement Design:** Types and Functions of Pavement Components, Design factors, Tyre Pressure and Contact Pressure, ESWL, EWLF and Stresses in Pavement. Design of Flexible and Rigid Pavements (IRC method)

**Traffic Engineering:** Traffic studies & their uses, Controls, Intersections.

Traffic Engineering: 3E's of, traffic characteristics, Surveys, Intersection (Using IRC)-types, layouts, design principles, Urban traffic, parking, lighting, Accidents, Traffic control Devices-marking, Signs, Signals, Regulations Motor Vehicle Act & Rule.

**Reference Books:**

1. *Highway Engineering* by S.K. Khanna & CEG Justo, Nemchand Bros.
2. *Principles of Pavement Design* by E.J Yoder & M.W. Wittezal, John Willey & Sons.
3. *J. Khisty and B. K. Lall, Transportation Engineering: An Introduction, Prentice-Hall India, 2003.*
4. *P. Chakroborty and A. Das, Principles of Transportation Engineering, Prentice Hall of India Pvt. Ltd., 2003.*
5. *Relevant IRC Codes by IRC, Indian Roads Congress, Delhi.*

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**CE 503: Structural Analysis-II**

**Code: CE 503**

**Credit: 04**

**L-T-P: 3-1-0**

**Introduction**

Indeterminate structures, Static and Kinetic indeterminacy and their calculation.

**Indeterminate Beams:**

Propped cantilever, Fixed Beam, Continuous beams, Sinking of support, temperature effect, three moment equation.

**Classical Displacement Method**

Slope deflection method, Moment distribution method, Kanis Method – application to analysis of indeterminate Beams and Building frames.

**Classical Force Method**

Trusses and rigid frames by consistent deformation method Column analogy method and elastic centre method. Masonry Dams and Retaining Walls, Condition for No tension. Chimneys, piers and Abutments. Introduction to Fatigue, creep and stress Concentration.

**Reference Books:**

1. *Basic Structural Mechanics* by C.S. Reddy, Tata Mc. Grew Hill
2. *Indeterminate Structural Analysis* by C.K. Wang, Tata Mc. Grew Hill
3. *Theory of Structures* by G.S. Pundit, S.P. Gupta & R. Gupta, Tata Mc. Grew Hill
4. *Analysis of Structures Vol. – I & II*, by V.N. Vazirani & M.M. Ratwani, Khanna Pub.

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**CE 504: Concrete Technology**

**Code: CE 504**

**Credit: 04**

**L-T-P: 3-1-0**

**Cement and Admixtures**

Types of Portland cement, hydration, setting and hardening process, special hydraulic cements, Admixtures, accelerators, and retarders, air-entraining agents, plasticizer and super-plasticizers.

**Aggregates**

Shape & texture, bond, strength, specific gravity, bulk-density and moisture content of aggregates, bulking of sand, deleterious substances in aggregates, alkali-aggregate reaction, sieve-analysis and grading curves, fineness modulus, practical grading, gap grades aggregates.

**Fresh Concrete**

Rheological aspects such as workability-flow ability, compatibility & mobility of concrete, factors affecting workability and lab determination, segregation, bleeding & laitance.

**Strength of Concrete**

Compressive strength and factors affecting it, behaviours of concrete under various stress states, testing of hardened concrete-cube and cylinder test, Platen effect, flexure test, non-destructive testing such as rebound hammer, USPV, core-cutting stress-strain relation and modulus of elasticity, shrinkage, creep of concrete and its effect.

**Durability of Concrete**

Corrosion of reinforcing bars, sulphate attack, frost action, deterioration by fire, concrete in seawater, acid attack, carbonation.

**Mix Design**

Basic consideration-cost, workability, strength and durability grading, method of mix design, acceptance criteria for concrete.

**Advances in Construction Materials**

Higher strength concrete, fibre-reinforced concrete, concrete containing polymers, heavy weight and light weight concrete, mass concrete, blended concrete, Ferro-cements & its applications.

**Reference Books:**

1. *Concrete, Structure, Properties and Materials* by P.K. Mehta , Prentices-Hall, Inc., New Jersey, USA.
2. *Properties of Concrete* by A.M. Neville, Longman U.K.
3. *Concrete Technology* by M.L. Gambhir , Tata McGraw Hill.
4. *Testing of Concrete in Structures* by J.H. Bungey, Surrey Univ Press, New York.
5. *Polymers in Civil Engg.* by L. Hollaway, Thomas Telford Ltd., London.
6. *Special Techniques & Materials for Concrete* by Dhir, Thomas Telford Ltd., London.

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**5<sup>th</sup> Semester Practicals**

**CE 571: Transportation Engineering-I**

**Code: CE 571**  
**Credit: 02**  
**L-T-P: 0-0-2**

**Test on Road Aggregates:** Aggregates Crushing test, Aggregates Impact test, Los Angeles Abrasion test, Flakiness Index, Elongation Index, Sp. Gravity & Water absorption test.

**Test on Bitumen:** Penetration test, Softening test, Ductility test, Sp. Gravity test. Bituminous Mix Design by Marshall Method.

**CE 572: Concrete technology**

**Code: CE 572**  
**Credit: 02**  
**L-T-P: 0-0-2**

**Testing of Cement**

Normal consistency of cement, fineness of cement by sieving, initial and final setting of cement, specific Surface Test on cement, soundness of cement, compressive strength of cement.

**Testing of Aggregates**

Sp. Gr. and water absorption of fine aggregate, Sp. Gr. and water absorption of coarse aggregate, Particle size distribution and fineness modulus, Bulking of Fine Aggregates, Bulk Density, Silt Content, Flakiness Index, Elongation Index, Percentage Elongation

**Test on Concrete**

Workability Tests, Slump, Compaction Factor, Vee Bee

**Test for Strength**

Compressive Test, Flexural Test, Split Test and Tensile Test.

**CE 573: CAD**

**Code: CE 573**  
**Credit: 02**  
**L-T-P: 0-0-2**

**Setting up Commands :** Limits, units, Grid, Snap, Osnap.

**Standard tool bars :** Match properties, pan, zoom.

**Draw :** Line, Pline, mline, Rectangle, polygard, Arc, Circle, Donut, Spline, Ellipse, Boundary, Hatch, Text, mtext.

**Modify/Edit :** Erase, copy, Mirror, offset, array, move, rotate, scale, stretch, lengthen, trim, Extend, Break, Chamfer, fillet, Explode.

**Dimensioning :** linear, aligned, Baseline, Continue, Radius, diameter, Angular, Style.

**Layer :** New layer, current layer, freeze, lock, colour, line type, line weight, delete.

**View :** UCS, view, View ports.

**3-D :** Solid editing, Shade, render, 3d – orbit.

Preparation of a Building Plan, elevation and Section in Detail.

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**6<sup>th</sup> Semester**

**CE 601: Design of Structures-II**

**Code: CE 601**

**Credit: 04**

**L-T-P: 3-1-0**

Structural Steel Sections and their Properties. Methods of design. Revetted, Bolted and Welded connections. Design of Tension Members. Design of Compression members – laced and battened Columns. Column Bases. Design of Beams - single and built-up sections. Plate Girders. Structural Connections. Roof Truss Design.

***Reference Books:***

1. *Design of Steel Structures by Ramchandra, Standard Book House, New Delhi*
2. *Design of Steel Structures by L.S. Negi, Tata Mc Graw Hill*
3. *Design of Steel Structures by A.S. Arya and J.L. Azmani, Nemchand Brothers, Roorkee*
4. *Steel Structural Design and Behaviour by Salmon and Johnson, Harper & Row N.Y.*
5. *IS-800 by BIS, BIS*
6. *IS-816 by BIS, BIS*

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**CE 602: Environmental Engineering-II**

**Code: CE 602**

**Credit: 04**

**L-T-P: 3-1-0**

**Sanitary Engineering**

Important terms, sewage treatment system and waste water management.

**Collection and Conveyance of Sewage**

Conservancy and water carriage system, comparison, classification of water carriage system.

**Waste Water Flow**

Estimation of Dry Weather Flow and Storm Water, Variation of flow, Estimation of design discharge.

**Sewer Design, Construction and Maintenance**

Sewer-types, materials, shapes, hydraulic design, minimum & maximum flow. Planning of sewerage system, testing and maintenance.

**Waste Water Characteristics**

Constituent of sewage – physical & chemical, oxygen demand, BOD, COD, Relative Stability, population equivalent, Biological characteristics.

**Waste Water Disposal**

Dilution, self-purification, land disposal, sewage sickness, comparison of disposal methods.

**Waste Water Treatment**

Flow diagram of conventional sewage, treatment plant, Primary treatment – screens, Grit Chambers, detritus tank, skimming tank, sedimentation – Plain & Chemical. Secondary treatment – Trickling fitters, Biological contractor, Activated sludge process, oxidation pond and ditches, aerated lagoon.

Septic tank – design consideration, soak pit and soak trench.

**Treatment and Disposal of Sludge**

Aerobic and anaerobic digestion, disposal of sludge.

**Reference Books:**

1. *Environmental Engineering (Vol -2) by B.C. Purmia, Laxmi Publication.*
2. *Environmental Engineering (Vol -2) by S.K. Garg, Khanna Publication.*
3. *Environmental Engineering by McGhee, McGraw Hill.*

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**CE 603: Transportation Engineering-II**

**Code: CE 603**

**Credit: 04**

**L-T-P: 3-1-0**

**Railway Engineering**

Introduction – Advantages, classification, gauges. Railway Track. - Components & their functions, Cross-section, Stresses, coning of wheels, Wear & Creep of Rails, Failure, Joints, Fittings and fixtures, Ballast, Sleepers and Drainage. Geometric Design – Alignments, Gradient & Grade Compensation, Super elevation & negative super elevation, equilibrium cant & cant deficiency, Horizontal curves, and transition curves. Points and Crossing. Stations and Yards. Signalling and interlocking. Tractions and Tractive Resistance. Construction and Maintenance.

**Airport Engineering**

Airport Planning – Aircraft characteristics, Airport site selection and planning. Airport obstructions – Zoning laws, Imaginary surfaces, Approach Zone, Turning Zone. Runway and Taxiway Design – Runway Orientation, Runway length & corrections, Configurations, Geometric elements of Taxiway, Exit Taxiway, Fillets, Separation clearance, ICAO & FAA specifications. Airport layout – Holding aprons, Hangers, Parking, Terminal Building. Visual aids and Traffic Control – Airport marking & lighting, Air traffic control aids, Heliports, Developments of airports in India.

**Reference Books:**

1. *A Text Book of Railway Engg. by Saxena S.C. & Arora S.P., Dhanpat Rain & Sons, New Delhi*
2. *Indian Railway Track by Agarwal M.M., Sachdeva Press, New Delhi*
3. *Airport Planning & Design by Khanna S.K. & Arora MG & Jain SS, Nemchand Bros., Roorkee.*
4. *Planning & Design of Airports by Hernjeff R & Makelvey, Mc. Graw Hill, New York.*

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**CE 604: Foundation Engineering**

**Code: CE 604**

**Credit: 04**

**L-T-P: 3-1-0**

**Soil Exploration and Site Investigation**

Planning of subsurface exploration, methods, sampling and samplers, In situ tests – plate load test, standard penetration test, static and dynamic cone test, Vane shear test, Sub soil investigation report.

**Foundation**

Classification, Shallow and Deep foundations.

**Shallow Foundations**

Bearing Capacity, Terzaghi, Meyerhoff, IS code methods for determination of bearing capacity, Effect of depth of water table, eccentricity and inclination of load. Bearing capacity in slopes and layered soil. Bearing capacity from in situ tests. Immediate and consolidation settlement. Correction for pore pressure, depth and rigidity. Settlement from field tests.

**Stresses in Soil**

Bossiness Equation, Newmark's Chart, computation of stresses in horizontal direction as well as in vertical direction.

**Deep Foundations**

Pile load capacity, group action, settlement, negative skin friction, lateral load capacity, pile load tests.

**Cassion Foundations**

Types and selection, forces and moments, fitting of caisson, depth determination.

**Ground Improvement Techniques**

Methods, compaction stabilisation using Admixtures, stone columns, sand drains, grouting.

**Soil Dynamics and Machine Foundation**

Concept of modulus of sub grade reaction, elastic half space theory, dynamic soil parameters, Design Criteria for machine foundation, natural frequency determination.

**Reference Books:**

1. *Introduction to Soil Mechanics* by B.M. Das, Galgotia Publication.
2. *Soil Mechanics and Foundation Engg.* by B.C. Punmia, Dhanpat Rai & Sons.
3. *Basic and Applied Soil Mechanics* by Gopal Ranjan and AVS Rao, Dhanpat Rai & Sons.
4. *Soil Mechanics* by Whitman & Lambe, John Willey.
5. *Soil Mechanics and Foundation Engg.* by VNS Murthy, Dhanpat Rai & Sons.



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**CE 605: Hydraulic Engineering**

**Code: CE 605**

**Credit: 04**

**L-T-P: 3-1-0**

**Boundary Layer Theory**

Boundary layer growth - its thickness, Momentum equation for boundary layer along a flat plate, Laminar and turbulent boundary layers, Boundary layer separation.

**Flow Past Submerged Bodies**

Drag and lift - types of drag, Dimensional analysis of drag and lift, Drag on flat plate, sphere and cylinder, Karman vortex trail, Circulation, Lift on a cylinder with circulation –Magnus effect.

**Turbulent Flow in Pipes**

Prandtl's mixing length theory, Shear stress in turbulent flow, Hydraulically smooth and rough pipes, Velocity distribution, Flow resistance in smooth and rough pipes, Moody diagram –its use for simple pipe flow problems, Pipe network –Hardy Cross method.

**Water Hammer and Surge Tanks**

Hammer blow in pipes, Pressure rise due gradual and instantaneous valve closure -Rigid and elastic theories, Surge tanks – their types and location, Dynamic equation of mass oscillation.

**Open Channel flow**

Open channel its types, Uniform flow in open channel – Chezy formula, Manning's formula, Specific energy, Gradually varied flow (GVF), Computation of flow profile – back water and drawdown curves, Hydraulic jump.

**Hydraulic Similitude and Model Studies**

Similarity laws, Dimensionless numbers, Model techniques, Distorted models, Movable bed models.

**Fluid Machines**

Principles of fluid machines (impact of jets), Euler's equation of turbo machines, Classification of fluid machines – simple cases.

**Reference Books:**

1. *Fluid Mechanics* by R.K. Bansal, Laxmi Publications, New Delhi
2. *Fluid Mechanics* by A.K. Jain, Khanna Publishers, New Delhi
3. *Fluid Mechanics and Fluid Machines* by Som and Biswas, Tata McGraw Hill, New Delhi
4. *Fluid Mechanics* by Streeter and Wyle, McGraw Hill, New York
5. *Mechanics of Fluids* by Massey, ELBS

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**6<sup>th</sup> Semester Practicals**

**CE 671: Environmental Engineering-II**

**Code: CE 671**

**Credit: 02**

**L-T-P: 0-0-2**

BOD determination, COD determination, membrane filter technique, solids in water and waste water, air quality monitoring.

**CE 672: Transportation Engineering-II**

**Code: CE 672**

**Credit: 02**

**L-T-P: 0-0-2**

Functional and Structural Evaluation of Pavements: Merlin roughness test, Benkelman Beam, and iii) Falling Weight Deflectometer. Traffic engineering studies: Spot speed study using Enoscope and Radar Gun, Moving observer method, Measuring traffic volume, speed and density using video camera. Parking studies, Origin destination studies

**CE 673: Hydraulic Engineering**

**Code: CE 673**

**Credit: 02**

**L-T-P: 0-0-2**

Orifice and notches, Reynold's experiment, Hydraulic jump, Velocity distribution/ current meter, pipe friction, electrical analogy and infiltration experiment.

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7<sup>th</sup> Semester

**CE 701: Estimation and Costing**

**Code: CE 701**

**Credit: 05**

**L-T-P: 4-1-0**

**Procedure of Estimating**

Methods of Estimating, items of works, long-wall, short wall method of estimate, centre-line method, Types of estimate-preliminary, approximate, plinth area estimate, detailed estimate, revised estimate, supplementary estimate, Building Cost Index, Administration Approval, Expenditure sanction, Technical sanction, Schedule of rates & Measurement Book.

**Estimate of Building**

Different items of works as per CPWD/APWD schedule such as earthwork, brickwork, cement-concrete, RCC-floors, roofs, openings, painting, white & colour washing, plastering etc.

**RCC Works & structures**

Different items of RCC work – RCC, shuttering, measurement of reinforcing bars, standard hooks & bends, Bar-bending schedule, Estimate of RCC beam, slab column, footing & staircase.

**Roads & Bridges**

Introduction to the different items as per CPWD/APWD schedule, estimate of earthwork of road, estimate of metalled road, estimate of RCC slab culvert, T-beam decking, Pier & well foundation, Pipe Culvert.

**Analysis of Rates**

Analysis of Rates of Building works-RCC, PCC, Brickwork, Plastering, flooring, colour wash, Distempering, cement painting, woodwork, DPC, Doors & Windows, Roofing.

**Specifications**

General specifications for building works-RCC, Brickwork, Plastering, Flooring, Painting, white & colour wash, Woodworks, Doors & windows, DPC, terracing, rainwater exclusion, specifications for Roadwork.

**Valuations:** The mathematics of valuation, valuation of freehold & leasehold properties, Fixation of Rent, Methods of valuation, Investment Method, Comparison Method, Residual Method, rein-statement Method, Contractors Method. Methods of valuation of land-comparative method, abstractive method & belting method.

**Reference Books:**

1. *Estimating & Costing* by M. Chakraborty, M. Chakraborty, Calcutta.
2. *Estimating & Costing* by B.N. Dutta, Kalyani Publication, Calcutta.
3. *Valuation of Real Properties* by S.C. Rangwala, Charoter Publisher, Pune.
4. *Civil Engg. Contracts & Estimates* by B.S. Patil, orient-Longman Ltd., New Delhi.
5. *CPWD specifications Vol-I, II, III, &IV* by CPWD, Join Book Agency, New Delhi.
6. *CPWD Analysis of Rates* by CPWD, Join Book Agency, New Delhi.

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**CE 702: Structural Analysis-III**

**Code: CE 702**  
**Credit: 05**  
**L-T-P: 4-1-0**

**Analysis of Building Frame:**

Approximate Method of Analysis of Building frame subjected to gravity loads and lateral loads, Portal Method and Cantilever method.

**Moving loads and Influence lines:**

Application to determinate Structures, Beams, trusses, ILD for B.M., shear force and Normal Thrust in three hinged arches, suspension bridges, Muller, Breslau's Principle for indeterminate Structures.

**Matrix Methods of Structural Analysis:**

Introduction to Matrix Methods-Flexibility Method and displacement method as applied to beams, plane trusses and plane rigid frames.

**Plastic Method of Structural Analysis:**

Concept of Redistribution of internal forces. Shape factor, combined mechanism methods for Plastic Collapse Load of beams, plastic moment distribution, deflection at point of collapse. Brief introduction to finite element method with its principles.

**Reference Books:**

1. *Matrix Method of Structural Analysis* by W. Weaver and J.M. Gere CBS Publication.
2. *Matrix, Finite Element Computer and Structural Analysis* by M. Mukhopadhyay, Oxford and I.B.H.
3. *Plastic methods of Structural Analysis* by B.G. Neal, Chapman and Hall.
4. *Strength of Materials* by S. Timoshenko, McGraw Hill.
5. *All books referred for the course of "Structural Analysis-II"*

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**8<sup>th</sup> Semester**

**CE 801: Design of Structures-III**

**Code: CE 801**

**Credit: 03**

**L-T-P: 3-0-0**

**Introduction**

Review of Limit state method of Design and comparison of limit state method with other method.

**Building**

Staircase, Lateral load analysis – portal and cantilever method, Transfer of load from slab to beams equivalent load, continuous beams.

**Water Tanks**

Circular, rectangular, overhead and underground tanks including intake tank, staging, IS code method.

**Prestressed Concrete**

Concept, IS code requirements (IS:1343) systems of prestressing, losses, simple design. Concept of Design of end block Magnate and Battens method .

**Steel & Timber**

Steel Bridges – pedestrian truss bridge. Industrial Building – Trusses, Portal, Knee braces. Water tank- pressed steel tank and staging. Timber structures – IS Code requirements, classification of timber, Beams, columns, lamination, joints. Crane girder and gantry girder.

**Reference Books:**

1. *Adv. Reinforced Concrete Design* by N. Krishna Raju, CBS Publishers and Distributors, Delhi.
2. *Prestressed Concrete* by Krishna Raju, Tata McGraw Hill, New Delhi.
3. *Design of Steel Structures (Vol. I & II)* by Ram Chandra, Standard Book House, Delhi.
4. *Masonry & Timber Structures* by A.s. Arya, Nem Chand & Brothers, Roorkee.

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## **ELECTIVE COURSES**

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**Elective-I (Any one)**

**CE 711: Hydrology**

**Code: CE 711**  
**Credit: 04**  
**L-T-P: 3-1-0**

**Precipitation**

Formation and types, forms; measurement, estimating missing precipitation data, average precipitation over area, depth-area-duration analysis.

**Stream Flow**

Water stage and its measurements, discharge current meter and current-meter measurements, stage-discharge relations, extension of rating curves.

**Runoff**

The component of runoff, hydrograph, hydrograph separation, factors affecting runoff, unit hydrograph concept, derivation of unit hydrograph, Estimation of peak discharge by Rational Method, Isochrones synthetic unit hydrograph, Definition of IUFC. Design flood.

**Groundwater**

Aquifers, movement of ground water, discharge of groundwater, equilibrium hydraulics of wells.

**Flood Routing**

Definition, storage equation, routing in a simple reservoir, routing in gated reservoir, stream flow routing.

**Sediment transport**

Origin and formation of sediments, stream erosion and deposition, definition of regime of flow, plane bed, ripple and dune regime, transition regime, anti-dune regime, introduction to bed loads, saltation, suspended load and wash load.

Classification rivers on alluvial plains – degrading, aggrading and meandering.

**River Training and Bank Protection**

Objectives, groynes, Spurs, Dikes, Pitched island, cut off, Revetment for bank protection, Guide banks, butter panelling, design of launching apron.

**Flood Damage Mitigation**

Reduction of peak flow, confinement of flow, reduction of peak stage, diversion of floodwater, flood proofing, reduction of flood runoff, temporary evaluation of flood prone, flood insurance.

**Reference Books:**

1. *Hydrology* by H.M. Raghunath, New Age International, Delhi
2. *Hydrology for Engineers* by Linsley, Kohlew Paulhors, Mc Graw Hill.
3. *Hand Book of Applied Hydrology* by V.T. Chow, Mc Graw Hill
4. *Engineering Hydrology* by K subramanya, Mc Graw Hill.

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**CE 712: Soil stabilization and Ground Improvement Technique**

**Code: CE 712**

**Credit: 03**

**L-T-P: 3-0-0**

**Soil Compaction**

Laboratory methods, field methods, compaction control.

**Soil Stabilization**

Using additives, sand drains, stone column.

**Grouting**

Types of grout, method of grouting.

**Soil Reinforcement**

Using strips, geogrids, geotextiles, geomembrane.

**Miscellaneous**

Dewatering methods, soil nailing, underpinning, tunneling.

**Reference Books:**

1. *Foundation Engineering* by J. Bowles, McGraw Hills International.
2. *Principles of grouting* by Shah and Shroff.
3. *Designing with Geosynthetics* by Koerner.
4. *Foundation Engineering* by Leonard, McGraw Hill Book 10. New York.
5. *Ground Improvement Technique* by Purushothams Raj.



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**CE 713: Highway Construction Practice**

**Code: CE 713**

**Credit: 03**

**L-T-P: 3-0-0**

Embankment, formation cutting in soil and hard rock, sub grade;

Ground improvement; retaining walls on hill roads; granular & stabilized sub bases/bases;

Bituminous surfacing; recycled pavements; concrete roads; non conventional pavements;

Road construction equipments.

***Reference Books:***

1. *MOST, Specifications for Road and Bridge Work (4th Revision), Ministry of Road*
1. *Transport and Highways, 2001.*
2. *C. A. O' Flaherty, Highways – The Location, Design, Construction, & Maintenance of*
3. *Pavements, Butterworth Heinemann, 2002.*
4. *R. N. Hunter, Bituminous Mixtures in Road Construction, Thomas Telford Services Ltd., 1995.*

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**CE 714: Open Channel Flow**

**Code: CE 714**

**Credit: 03**

**L-T-P: 3-0-0**

**Basic Flow Concepts**

Types of channels, Classification of flow, Basic equations, Velocity distribution-velocity coefficients, Pressure distribution in a vertical.

**Energy and Momentum Principles**

Specific energy, Critical flow, Section factor for critical flow computation, First hydraulic exponent, Computation of critical flow, Specific force, Simple channel transitions.

**Uniform Flow in Rigid-Boundary Channels**

Shear stress on boundary, Velocity distribution in turbulent flow, Chezy's equation, Manning's equation, Conveyance of a channel section, Section factor for uniform flow computation, Second hydraulic exponent, Computation of uniform flow.

**Uniform flow in mobile-Boundary Channels**

Incipient motion condition – Shield's analysis, Regimes of flow, Prediction of regimes, Flow resistance.

**Design of Channels**

Rigid boundary channels, Non-scouring erodible boundary channels, Alluvial channels.

**Gradually Varied Flow**

Differential equation of GVF, Classification of flow profiles, Analysis of flow profiles, Computation of GVF – direct integration, simple numerical integration for prismatic and non-prismatic channels.

**Hydraulic Jump**

Types of jump, Characteristics of jump, General equation for jumps in prismatic channels, Jump in horizontal and sloping rectangular channels.

**Rapidly Varied Flow**

Flow over sharp crested weirs, broad crested weirs, spillways, Flow under sluice gate, Brink depth.

**Unsteady Flow**

Waves – celerity of small gravity wave, GVUF – St. Venant's equations, Method of characteristics, RVUF – surges in open channels.

**Reference Books:**

1. *Flow in Open Channel* by S. Subramanya, Tata McGraw Hill, New Delhi.
2. *Open Channel Hydraulics* by V.T. Chow, McGraw Hill, New York.
3. *Open Channel Hydraulics* by R.H. French, McGraw Hill, New York.
4. *Open Channel Flow* by M.H. Chaudhry, Prentice-Hall of India, New Delhi.
5. *Flow through Open Channels* by K.G. Ranga Raju, Tata McGraw Hill, New De

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**Elective-II (any one)**

**CE 715 Pavement Analysis and Design**

**Code: CE 715**  
**Credit: 03**  
**L-T-P: 3-0-0**

**Philosophy of design**

Philosophy of design of flexible and rigid pavements.

**Analysis of Pavement**

Analysis of pavements using different analytical methods.

**Design of Pavement**

Selection of pavement design input parameters – traffic loading and volume, material characterization, drainage, failure criteria, reliability. Design of flexible and rigid pavements using different methods, comparison of different pavement design approaches, design of overlays and drainage system.

**Reference Books:**

1. *Yang H. Huang, Pavement Analysis and Design, Pearson Prentice Hall, 2004.*
2. *Yoder and Witzech, Pavement Design, McGraw-Hill, 1982.*

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**CE 716: Irrigation Engineering**

**Code: CE 716**

**Credit: 04**

**L-T-P: 3-1-0**

**Introduction**

Definition, necessity, types, advantages and disadvantages of irrigation.

**Soil Water-plant Relationship**

Soil-water plant relationship, soil-fertility and crop rotation, crop-water relationship, manure and fertilizers for improving soil characteristics, principal crops in India.

**Water-requirements of Crops**

Factors affecting water-requirement of crops, consumptive use of water, determination of irrigation water requirement, command area, delta, duty, base period, relation between delta, duty and base period, Kor depth and Kor period.

**Flow Irrigation**

(a) Unlined canal-Lacey's theory, design of canal based on silt theory. (b) Lined canal-necessity of lining, selection of lining, types of canal lining and their brief description, design consideration for line canal, maintenance of irrigation canals, Economical considerations of lining a canal.

**Water-logging** – Definition, adverse effects of water-logging, causes of water-logging, anti-water logging measures, Drainage system design.

**Canal Head Works**

Definition of diversion works and storage weirs and barrages, general layout and the components of head-works, Application of Khosla's theory of independent variables.

**Canal Fall**

Necessity and location, types of fall, component of fall, design of fall with hydraulic consideration-vertical drop fall and glacis fall.

**Cross Drainage Works**

Necessity, types of cross drainage work, selection of suitable type of cross drainage works. Design principles only.

**Reference Books:**

1. *Irrigation and Water power Engg. by Punmia, Pande & Lal Laxmi Pub. (P) Ltd, New Delhi.*
2. *Irrigation & Water Power Engg. by P.N. Modi & S.M. Smith.*
3. *Irrigation Engg. & Hydraulic by S.K. Garg , Khanna Pub., Delhi.*
4. *Structures Irrigation Engg. by GL Asawa, Willey Eastern Ltd.*

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**CE 717: Design of Water Supply and Treatment Systems**

**Code: CE 717**  
**Credit: 03**  
**L-T-P: 3-0-0**

Planning of urban water supply systems.

Planning of urban wastewater systems.

Basics of hydraulics.

Design of water supply network.

Wastewater collection systems

***Reference Books:***

1. *Environmental Engineering* by S.K.Garg.

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**CE 718: Optimization Techniques in Engineering**

**Code: CE 718**

**Credit: 03**

**L-T-P: 3-0-0**

**Introduction to optimization**

Definitions, classification, overview of topics. Single variable optimisation algorithms – optimality criteria, bracketing methods, region elimination methods, point estimation methods, gradient based methods, root finding using optimisation techniques.

**Multivariable optimisation algorithms**

optimality criteria, direct search methods, gradient based methods.

**Constrained optimisation algorithms**

Kuhn-Tucker conditions, algorithms for solving Non-linear programming problems, LPP.

Introduction to Genetic algorithms.

**Reference Books:**

1. *Introduction to Linear and Nonlinear Programming* by DG Luenberger, Addison Wesley.
2. *Non-linear Programming Theory and Algorithms* by MS Bazarra, HD Sherali & CM Shetty, John Wiley & Sons.
3. *Optimization for Engineering Design: Algorithms and Examples* by K. Deb., PHI Pvt Ltd., 1998.

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**Bodoland Territorial Council, Kokrajhar, Assam-783370**  
**(B.Tech Syllabus in Civil Engg/Construction Technology)**

**Elective-I (Any one)**

**CE 811:Traffic Engineering**

**Code: CE 811**  
**Credit: 03**  
**L-T-P: 3-0-0**

Driver behaviour, traffic information and control systems.

Traffic studies- volume, speed and delay studies, elements of traffic flow theory, characteristics of uninterrupted traffic, capacity and LOS of Uninterrupted facilities, characteristics of interrupted traffic, traffic characteristics at unsignalised intersections,

Design of signalized intersections, capacity and LOS of signalized intersections, actuated signal control, signal coordination,

Design of parking, lighting and terminal facilities, simulation of traffic systems, statistics and probability in traffic engineering.

***Reference Books:***

1. *Roger P. Roess, William R. McShane & Elena S. Prassas, Traffic Engineering, Prentice-Hall, 1990.*
2. *Pignataro L. J., Traffic Engineering – Theory and Practice, Prentice Hall, 1973.*

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**CE 812: Construction Management**

**Code: CE 812**

**Credit: 03**

**L-T-P: 3-0-0**

Principles of project contracts, types of contract documents, types of contracts, tender & agreements, acceptance of tenders, earnest money & security deposits, breach of contracts and arbitration.

Project Management through network, critical path method, early & late time calculations, Float, resource allocation.

Programme evaluation & Review technique, expected times and slack, critical path, probability of completion time of a project.

Competitive bidding in construction industry, bidding strategy, Freidman's model, Gate's model, Fine's model, effect of estimating inaccuracy, margin lost in competition, effect of estimating accuracy, No. of bidders, success rate sensitivity analysis, Risk analysis & decision trees, Lime of balancing, network compression, Prefabrication, modular co-ordination and standardization.

Concrete production plants, batching, mixing and compaction of concrete, pumping of concrete, curing methods, concreting in hot and cold weather, concreting under water. Guniting and shortcreting , shoring and underpinning, formwork, building bye laws.

**Reference Books:**

1. *Construction Engg. & Management* by S. Seetharaman, Umesh Publication, 3b Nath Market, Nar Sarak, New Delhi-6.
2. *Construction Equipment its Planning land Application* by Mahesh Verma, Metropolitan Book Co. Ltd., 1, Netaji Subash Marg, New Delhi-2.
3. *Contract & Estimates* by B.S. Patil.
4. *Construction Equipments & Methods* by S. Peurofoy, McGraw Hill International.
5. *Optimization Theory & Application* by S.S. Rao, Wiley Eastern Ltd., New Delhi.



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**CE 813: Finite Element Methods in Engineering**

**Code: CE 813**

**Credit: 03**

**L-T-P: 3-0-0**

**Introduction**

Basic theory of finite Element method, application of finite element method, Advantages and disadvantages.

**Elasticity**

Elasticity Theory, displacements and strains, stress transformations, strain transformation, Equilibrium, Compatibility, constitutive law, boundary conditions, Plane stress, plane strain, Saint Venant's principle.

**Energy Variational Principles and Ritz techniques**

Work, energy and their complementary counterparts, Principle of virtual work, Energy principles, Rayleigh-Ritz method, Galerkin's method, Matrix algebra and Gaussian elimination.

**Element properties**

Displacement models, convergence requirements, shape functions, element strains and stresses, element stiffness matrix.

**Isoparametric Elements**

Two dimensional isoparametric elements, computation of stiffness matrix, Convergence Criteria.

**One dimensional Problems**

Finite element modelling, co-ordinates and shape functions, the potential energy approach, Galerkin approach, Global stiffness, Load vectors, Boundary conditions, quadratic shape functions, Temperature effects.

**Two Dimensional Stress Analysis**

Structural idealization, Triangular elements, rectangular element, displacements in terms of nodal displacements, strains in terms of displacements, constitutive relations, nodal forces using equilibrium, Element stiffness, Introduction to boundary conditions, Solution of equations for nodal displacements.

**dimensional pin-jointed Truss**

Structure, displacement co-ordinates, degree of freedom, coordinate system, Topology of structures, support conditions, element stiffness, element assembly into Global stiffness matrix, introduction to boundary conditions, calculation of stresses in members.

**Reference Books:**

1. *Introduction to finite Elements in Engineering* by T.K. Chandrupatia and A.D. Belegundu, Prentice Hall of India Pvt. Ltd.
2. *Finite Element analysis (Theory & Programming)* by C.S. Krishnamurthy, Tata McGraw Hill Publishing Co. Ltd.
3. *Finite Element analysis in Engineering Design-* S. Rajasekharan, Wheeler Publishing, Allababad.
4. *Finite Element methods* by K.S. Bathe and E.L. Wilson, Prentice Hall of India.
5. *Finite Element Methods in Engineering Sciences*-by O.C. Zeinkiewicz, McGraw Hill Book Co.

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**CE 814: Earthquake Resistant Structures**

**Code: CE 814**  
**Credit: 03**  
**L-T-P: 3-0-0**

Introduction to structural dynamics; Seismic instruments.

Earthquakes; Response of structures to earthquake, elastic earthquake spectra.

Nonlinear behaviour and response of multistorey structures under seismic excitation; Inelastic spectra.

Results of analytical and experimental studies on the behaviour of RC members and structures; Behaviour of RC connections.

Current practices in design for earthquake excitation; Alternatives to aseismic design by building codes.

Design of some structures like multistoreyed building, water tanks, chimneys, dams, bridges.

***Reference Books:***

1. *Elements of Earthquake Engineering, Jai Krishna*
2. *Dynamics of Structures, Anil K. Chopra, Prentice Hall of India, New Delhi, 2000.*
3. *Dynamics of Structures, Clough and Penzien, McGraw Hill International, New York, 1993.*
4. *Design of Earthquake Resistant Structures, A S Arya & J L Azmani*
5. *IS: 4326*
6. *IS: 13920, BIS Publications*
7. *IS:1893*

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**Elective-II (Any one)**

**CE 815: Bridge Engineering**

**Code: CE 815**

**Credit: 03**

**L-T-P: 3-0-0**

Introduction to various types of bridges, prestressed bridge, Fly-overs, different types of steel bridges.

Introduction to IRC codes for loading, specifications, MOST specifications, I for the guide line of design of minor bridges.

Analysis & design of small bridges and culvert, structural details of minor bridges and culverts.

Analysis & design of RCC T-beam, I-beam and prestressed bridges using various shapes of girders, plate girder etc Temporary analysis of girder. Various types of bearings and their design concept.

Abutment and pier design for minor bridges, depth of bridge foundation, length of clear span & nos. of spans and the effect of contraction on the normal scour depth, return wall, wing wall.

Construction of superstructures for temporary bridges, semi-permanent bridges, submergible bridges, low-cost bridges, steel-arch bridges, RCC bridges and cable stayed bridges, wearing course, expansion joint, approach road, approach slab, protection works for shallow foundation for minor bridges, and special precautions during construction. Failure and restoration of bridge super-structure, sub-structure and its maintenance. Bridge Project Management, specifications of materials & workmanship.

**Reference Books:**

1. *A Text Book of Bridge Engg.* by K.S. Rakshit, Oxford & IBH Publishing Company.
2. *Essentials of Bridge Engg.* by Johnson Victor, Oxford & IBH Pub. Co.
3. *Design, Construction & Practice in Bridge Engg.* by S. Ponnaswamy, Tata McGraw Hill Publishing Co. Ltd.

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**CE 816: Advanced Foundation Engineering**

**Code: CE 816**

**Credit: 03**

**L-T-P: 3-0-0**

**Soil Explanation**

Planning, Concept of significant depth, spacing and number of boreholes, types of samples and samplers, SPT, CPT – plate load test, vane shear test, geophysical investigations.

**Shallow Foundations**

Concept of allowable bearing capacity, contact pressure and settlement diagram for flexible and rigid footings, footings on slopes, inclined footings, footings on layered soil, footings subjected to uplift. Design of strap footing, combined footing, rafts, floating rafts.

**Pile Foundations**

Bearing capacity and settlement of axially loaded piles, pile group, laterally loaded piles.

**Sheet Piling**

Uses, common types, design of cantilever sheet pile in granular and cohesive soils, Anchored bulkheads, methods of reducing lateral pressure.

**Soil Dynamics**

Determination of dynamic soil properties, natural frequency, design of foundations for reciprocating and impact type machines, vibration isolation.

**Reference books:**

1. *Foundation Engg. by S.P. Brahma, Tata McGraw Hills, New Delhi.*
2. *Foundation Engg. by J. Bowles, McGraw Hills International*
3. *Designing with Geosynthetics by Koerner*
4. *Soil Dynamics by Barkan*
5. *Hand book of machine foundation by Srinivasulu, Tata McGraw Hill, New Delhi.*

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**CE 817: Geometric Design of Transportation Facilities**

**Code: CE 817**

**Credit: 03**

**L-T-P: 3-0-0**

Geometric design provisions for various transportation facilities as per AASHTO, IRC and other guidelines; discussion of controls governing geometric design, route layout and selection,

Elements of design – sight distances, horizontal alignment, transition curves, super elevation and side friction; vertical alignment: - grades, crest and sag curves;

Highway cross-sectional elements and their design for rural highways, urban streets and hill roads; at-grade inter-sections – sight distance consideration and principles of design,

Channelisation, mini round-abouts, layout of round-abouts, Inter-changes:

Major and minor interchanges, entrance and exit ramps, acceleration and deceleration lanes, bicycle and pedestrian facility design; parking layout and design; terminal layout and design.

***Reference Books:***

1. *M. Rogers, Highway Engineering, Blackwell Publishing, 2003.*
2. *P. H. Wright, Highway Engineering, John Wiley & Sons, 1996.*

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**CE 818: Environmental Impact Assessment**

**Code: CE 818**

**Credit: 03**

**L-T-P: 3-0-0**

Concepts and organization of ecosystems;

Predicting impact

Procedures for environmental impact assessment.

Integration with development planning procedures.

Impact assessment of water resources.

Transportation, power production mining, and other relevant projects.

Urbanization, industrialization, and resource conservation considerations.

Design concepts and alternative strategies for impact reduction; monitoring.

**Reference Books:**

1. *Canter, L. (1995). Environmental Impact Assessment, 2nd edition, McGraw hill, New York, USA. Colombo, A.G (ed.) (1992)*
2. *Environmental Impact Assessment, Kluwer Academic Publishers, Dordrecht, The Netherlands.*
3. *Environmental Impact Assessment, Training Resource Manual, UNEP 2001. Gilpin A (1995).*
4. *Environmental Impact assessment- Cutting edge for the twenty first century, Cambridge University Press, Cambridge, UK. Norman Lee and Clive George (2000).*
5. *Environmental Assessment in Developing and transitional countries. John Wiley & Sons, Sussex, UK. Prasad Modak & Asit, K. Biswas (1999).*
6. *Conducting EIA for developing countries. Oxford University Press. Robert, G. H. Turnbull (1991).*
7. *Environmental and Health Impact Assessment of developmental projects, Handbook for practitioners.*
8. *Environmental impact analysis handbook. NewYork: McGraw-Hill;Wood C M (1995).*
9. *Environmental Impact Assessment. A comparative review, Longman higher education, Harlow, Essex, UK. Wathern, Peter (1992).*
10. *Environmental impact Assessment: Theory and Practice, Unwin hyman, London*