



**OFFICE OF THE REGISTRAR : DIBRUGARH UNIVERSITY : DIBRUGARH**

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**NOTIFICATION**

As recommended by the Board of Studies in Civil Engineering of Jorhat Institute of Science and Technology, Jorhat the Hon'ble Vice-Chancellor is pleased to approve the draft of the Course Structure and Syllabi for the Civil Engineering Programme for 3<sup>rd</sup> and 4<sup>th</sup> Semester under report to the Under Graduate Board and Academic Council.

The above syllabi shall come into effect from the Academic Session 2016-2017.

Issued with due approval.

(Dr. B. C. Borah)  
Deputy Registrar (Academic)  
Dibrugarh University

Copy to:

1. The Vice-Chancellor, D.U. for favour of information.
2. The Dean, School of Science and Engineering, Dibrugarh University for favour of information and necessary action.
3. The Registrar, D.U. for favour of information.
4. The Controller of Examinations, DU, for favour of information and necessary action.  
The copy of the Syllabus is enclosed herewith.
5. The Principal, Jorhat Institute of Science and Technology, Jorhat for favour of information and necessary action.
6. Sri Gunadeep Chetia, Programmer, Dibrugarh University for kind information and with a request to upload the Notification along with the syllabus urgently in the University website.
7. File

(Dr. B. C. Borah)  
Deputy Registrar (Academic)  
Dibrugarh University

## **Mathematics- III(BS 301)**

**Total Credit= 3 (1:2:0)**

**Semester: Third Semester**

1. **Vector Calculus:** Vector functions, variable vectors and preliminaries, differentiation, differential operators, identities, gradient, divergence, curl, their physical meaning. Line, surface and volume integrals, Gauss, Green and Stokes Theorem. Simple applications of engineering problems.
2. **Partial differential equations:** First order linear equation, four standard forms of non-linear equation, linear equation with constant coefficient, Solution by separation of variables, Laplace Equation, Wave Equation Heat Equation, and Solution of boundary value problems.
3. **Statistics:** Measure of central tendency (mean, median, mode), measures of dispersions, variance, moments, skewness and Kurtosis' theory of probability-addition law, multiplication law, conditional probability, independent events. Theoretical discrete distribution- binomial, Poisson distribution, Normal distribution, method of least square and curve fitting.
4. **Graph theory:** Definition, Directed and undirected graphs, basic terminologies, finite and infinite graph, incidence and degree of vertex, isolated and pendent vertices, null graph, Handshaking theorem, types of graphs, sub graphs, graphs isomorphism, operations of graphs, connected graph, disconnected graphs and components. Walk, path and circuits, Eulerian graphs, Hamiltonian graphs, Dirac's theorem, Ore's, theorem, Konigsberg's Bridge problem, Representation of graphs, matrix representation of graph, adjacency matrix, Incidence matrix, Linked representation of graphs. Trees, Spanning trees, Minimal spanning tree

### **References**

- [1] A Text book of Engineering Mathematics by N.P. Bali &Dr. Manish Goyal.
- [2] Graph Theory with application to Engineering and computer Science; NarasinghDeo, Prentice Hall of India, New Delhi, 2006. Page 29 of 31
- [3] Graph Theory with Application; C. Vasudev, New Age International Publishers.
- [4] Fundamentals of Mathematical Statistics; V.K. Kapoor, S.C.Gupta, Sultan Chand & Sons.
- [5] Fundamentals of Applied Statistics;V.K. Kapoor, S. C. Gupta, Sultan Chand & Sons TMGH.
- [6] Advance Differential Equation; M D Raisinghanian, S Chand Company.
- [7] Introduction to Partial Differential Equation; K. Sankara Rao, Prentice-Hall of India.
- [8] Advance Engineering Mathematics: Erwin Kreysig(Wiley)
- [9] A text book of vector calculus; Shanti Narayan, J. N. Kapur, S. Chand and Company, N. Delhi.

[10] Theory and Problems of Vector Analysis, Murray R. Spiegel, Schaum's outline series, Mc Graw Hill Book Company.

### **Civil Engineering Drawing (CE 301)**

**Total Credit= 3 (1:2:0)**

**Semester: Third Semester**

1. **Introduction-** Purpose of drawing, requirements of a good drawing, types, symbols.
2. **Detail drawing of various building components:**
  - a. Masonry
  - b. Doors and windows
  - c. Stairs
  - d. Trusses
  - e. Foundation
3. **Building drawing-** Site plan, development of detailed building plan from line diagram, plan, elevation and section of single and multistoried buildings.
4. **Water supply and sanitation:** Water supply layout for domestic building, septic tank and soak pit, drawing of sanitary fittings.
5. **Culvert and bridges:** Types of culvert, drawing of plan, section and elevation of box- culvert, plan section and elevation of a typical RCC bridge.

#### **Reference Books**

- 1) Civil Engineering Drawing by R. S. Malik and G.S. Meo.
- 2) Building Planning and Drawing by S. S. Bhaikatti and M. V. Chitawadagi.

### **Engineering Geology and Rock Mechanics (CE 302)**

**Total Credit= 3 (3:0:0)**

**Semester: Third Semester**

1. **Introduction-** Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

2. **Mineralogy:** Definition of crystal and a mineral, Study of the physical properties, occurrence and use of Silicate (Quartz, Feldspar, Micas, Biotite, Muscovite, Kyanite, Talc, Garnet, Hornblende, Augite, Tourmaline, Opal, Topaz, Epidote); Sulphides (Pyrite, Galena, Realgar, Chalcopyrite ); Oxides (Magnetite, Corundum, Limonite); Carbonates ( Calcite, Dolomite,); Sulphates (Gypsum, Barite); Clay minerals (Kaolinite); Halide (Fluorite); Native(Graphite, Diamond) minerals .
3. **Petrology-Rock forming processes.** Formation and classification of rocks (Igneous, sedimentary and metamorphic), Description of physical properties for constructional purposes of Granite, Pegmatite, Dolerite, Gabbro, Basalt; Sandstone, Conglomerate, Breccia, Limestone, Shale; Schist, Marble, Quartzite, Khondalite, Slate, Gneiss, Andesite, Stratigraphy of India (a general idea), Principles of correlation, Fossils, their preservation and significance
4. **Physical Geology-** Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits.
5. **Structural geology-** Out crops, Strike and dip, Overlaps, Inliers and outliers, Type classification of folds, faults, joints, unconformities, Mountains building
6. **Geological hazards: earthquakes and landslides:** Classification, causes and effects of earthquakes and landslides, Seismic curve, seismographs, seismograms, accelograms, Seismic problems of India, Seismic zones of India, Remedial measures to prevent damage for engineering structures, case histories.
7. **Rock masses as construction material:** Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description.
8. **Geology of dam and reservoir site-** Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.

9. **Geological investigation**-Interpretation of geological maps, Use of aerial maps in geological surveying, Geophysical methods as applied to civil engineering for subsurface analysis (Electrical and Seismic methods).

***Text Books:***

1. Engineering and General Geology, Parbin Singh.
2. A Text book of Geology: P.K. Mukherjee

***Reference Books:***

1. Text Book of Engineering Geology, Kesavvalu, MacMillan India.
2. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press.

**Geology Lab (CE 302L)**

**Total Credit= 1 (0:0:2)**

**Semester: Third Semester**

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.
7. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps. Identification of symbols in Maps.

**Solid Mechanics (CE 303)**

**Total Credit- 4 (3:1:0)**

**Semester: Third Semester**

1. **Simple Stresses and Strains**- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Hooke's law, Young's modulus, Poisson's ratio, stress at a point, stresses and strains in bars subjected to axial loading, Modulus of elasticity, stress produced in compound bars subjected to axial loading. Temperature stress and

strain calculations due to applications of axial loads and variation of temperature in single and compound walls.

2. **Compound Stresses and Strains-** Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.
3. **Bending moment and Shear Force Diagrams-** Bending moment (BM) and shear force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.
4. **Theory of bending stresses-** Assumptions in the simple bending theory, derivation of formula: its application to beams of rectangular, circular and channel sections, Composite beams, bending and shear stresses in composite beams.
5. **Slope and deflection-** Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.
6. **Torsion-** Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity., Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.
7. **Thin Cylinders and Spheres-** Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.
8. **Columns and Struts-** Columns under uni-axial load, Buckling of Columns, Slenderness ratio and conditions. Derivations of Euler's formula for elastic buckling load, equivalent length. RankineGordon's empirical formula.

#### **Text Books/ References**

1. Pytel A H and Singer F L, "*Strength of Materials*", Harper Collins, New Delhi.
2. Beer P F and Johnston (Jr) E R, "*Mechanics of Materials*", SI Version, McGraw Hill, NY.
3. Popov E P, "*Engineering Mechanics of Solids*", SI Version, Prentice Hall, New Delhi.
4. Timoshenko S P and Young D H, "*Elements of Strength of Materials*", East West Press, New Delhi.
5. Shames, I. H., Pitarresi, J. M., "*Introduction to Solid Mechanics*," Prentice-Hall, NJ.

## Engineering Survey I (CE 304)

Total Credit= 4 (3:1:0)

Semester: Third Semester

1. **Fundamental Concepts:** Definition, object and use of surveying, classification, principles of surveying, plan and map, scales and types of scales.
2. **Linear measurements:** Different methods- direct, optical and electromagnetic methods, direct measurement by chaining, sources of errors and corrections, tape measurements and corrections, chain triangulation, survey stations and survey lines,, locating ground features- offsets, plotting in field book, use and adjustment of Auxiliary instruments- cross staff, optical square, prism square etc, obstacles in chaining, Numerical problems.
3. **Angular measurements:** Various Instruments, Bearing and Meridian, designation of bearings- whole circle and Quadrantal bearing system, fore and back bearing, magnetic compass-types, magnetic field and dip, magnetic declination, local attraction, errors in compass surveying, theodolite, types of theodolite, parts of a transit theodolite, adjustment of theodolite, measurement of horizontal and vertical angles by various methods, other uses of theodolite.
4. **Traverse surveying:** Principle, methods of traversing, field works, traverse computations, closing error, methods of balancing a traverse, Gale's traverse table, omitted measurements,- various cases, numerical problems.
5. **Levelling:** Important definitions, classification, leveling instruments, temporary and permanent adjustment of a level, methods of direct leveling, booking and reducing levels, errors in leveling and accuracy.
6. **Contouring:** Definition, characteristics, methods of locating contours, interpolation of contour, use of contour maps.
7. **Plane Table traversing:** Principle, equipments and accessories, working operations, methods of location details- Radiation, Intersection, Traversing and Resection, Advantages and disadvantages.
8. **Tacheometric surveying:** Basic system of Tacheometric measurement, principle of stadia system, tangential system, instruments constants, derivation of distance and elevation for different staff positions, numerical problems.
9. **Computation of area and volume:** Units and conversion factor, calculation of area by mid ordinate, average ordinate, trapezoidal and Simpson's rule, methods of measurement of volume-formulae, numerical problems

**Text books:**

1. R. Subramanian: Surveying and Levelling
2. DUGGAL S. K. Surveying (Vol. I & II)
3. PUNMIA B. C.: Surveying (Vol. I & II)
4. KANETKAR T. P. Surveying and Levelling (Vol. I & II)

**Reference Books:**

1. Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley & Sons.
2. Schofield G. W., Butterworth, "Engineering Surveying", Heinemann, New Delhi.
3. Joseph G., "Fundamentals of Remote Sensing", Universities Press.
4. Chandra A.M. "Higher Surveying", Newage International

**Surveying Lab (CE 304L)**  
**Total Credit= 1 (0:0:2)**  
**Semester: Third Semester**

1. Chain surveying for more than one chain length
2. Closed compass traversing
3. Profile and cross sectional leveling
4. Measurement of horizontal and vertical angle by theodolite
5. Indirect contouring
6. Plane table traversing- three point problem
7. Total station set up and finding slope, horizontal distance and vertical distances.
8. Total station traversing

**Estimation and Costing (CE 305)**  
**Total Credit= 3 (2:1:0)**  
**Semester: Third Semester**

1. **Preliminary:** Purpose, types of estimation, various units of measurements, schedule of rate.
2. **Building estimate:** For various types of building- Assam type, R.C.C. etc.
3. **Water supply and sanitary:** Estimation of septic tank and soak pit, water supply and sanitary fittings.
4. **Road and culvert:** Calculation of earthwork, estimation of a new road and culvert.



### References books

- 1) Estimating and Costing in Civil Engineering by B.N. Dutta
- 2) Estimating and Costing in Civil Engineering by S. C. Rangwala.

### Thermodynamics (ME 301)

Total Credit= 2 (2:0:0)

Semester: Third Semester

1. **Basic Concepts**-Concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.
2. **First Law of Thermodynamics**- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow
3. **Second Law of Thermodynamics**- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady- flow devices, and entropy balance. Energy - a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, energy change of a system, energy transfer by heat, work, and mass, the decrease of energy principle and energy destruction, energy balance: closed systems and control volumes energy balance.
4. **Ideal and Real Gases and Thermodynamic Relations**- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius-Clapeyron equations, Joule –Thomson coefficient.

Text/ Reference Books:

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi.
2. Cengel, „Thermodynamics – An Engineering Approach“ Tata McGraw Hill, New Delhi.
3. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of Engineering Thermodynamics: John Wiley & Sons.
5. Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.
6. Potter, M. C., & Somerton, C. W. Schaum's Outline of Thermodynamics for Engineers, McGraw-Hill.

## **Basic Electronics (ETC 301)**

**Total Credit= 2 (2:0:0)**

**Semester: Third Semester**

1. **Diodes and Applications covering, Semiconductor Diode** - Ideal versus Practical, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode .
2. **Transistor Characteristics covering, Bipolar Junction Transistor (BJT)** – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET.
3. **Transistor Amplifiers and Oscillators**– Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators.
4. **Operational Amplifiers:**covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp,; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.
5. **Data Converters** – Data Converters – Basic Principle of Analogue-to-Digital (ADC) and Digital-to-Analogue (DAC) Conversion, Successive Approximation type ADCs, Resistor Ladder Type DAC, Specifications of ADC and DAC.
6. **Basic Digital Electronics;** Binary Number Systems and Codes; Basic Logic Gates and Truth Tables, Boolean Algebra, De Morgan's Theorems, Logic Circuits, Flip-Flops – SR, JK, D type, Clocked and Master-Slave Configurations; Counters – Asynchronous, Synchronous, Ripple, , BCD Decade types; Registers;
7. **Transformers and AC&DC Machines:** Ideal Transformer, Circuit Model of Transformer, Determination of Parameters of Circuit Model of Transformer, Voltage Regulation, Efficiency, Single Phase Induction Motors, Characteristics and Typical Applications, DC Generator and DC Motor Analysis, Methods of Excitation, Speed Torque Characteristics and Speed control of DC Machines.

**Text/Reference Books:**

1. R. L. Boylestad & Louis Nashlesky (2007), *Electronic Devices & Circuit Theory*, Pearson Education
2. Santiram Kal (2002), *Basic Electronics- Devices, Circuits and IT Fundamentals*, Prentice Hall, India
3. David A. Bell (2008), *Electronic Devices and Circuits*, Oxford University Press
4. Thomas L. Floyd and R. P. Jain (2009), *Digital Fundamentals*, Pearson Education
5. R. S. Sedha (2010), *A Text Book of Electronic Devices and Circuits*, S.Chand & Co.
6. R. T. Paynter (2009), *Introductory Electronic Devices & Circuits – Conventional Flow Version*, Pearson Education.
7. V. Del Toro : *Electrical Engineering Fundamentals*, PHI, 1994

**Mathematics -iv (BS 401)**

**Total Credit= 4 (3:1:0)**

**Semester: Fourth Semester**

1. **Series solution:** Series Solution of ordinary differential equation. Bessel's equation, Bessel's function, Legendre Polynomials.
2. **Fuzzy mathematics:** Introduction to fuzzy set theory: Crisp set and Fuzzy set, Types of fuzzy sets, some basic definitions, Union and intersection of fuzzy sets. Operations on fuzzy sets: Some important theorems, Decomposition theorems, Fuzzy numbers and arithmetic: Fuzzy numbers, triangular fuzzy numbers, Trapezoidal fuzzy numbers, Fuzzy Arithmetic, Arithmetic operation on fuzzy numbers, Fuzzy Equations. Fuzzy Relations: Fuzzy relation and basic definition, Equivalent fuzzy relations, Composition of fuzzy relation (MAX-MIN operation, MAX PRODUCT composition and MAX AVERAGE composition) Fuzzy systems and Fuzzy controlling: Fuzzy rule based system, Fuzzification and Defuzzification (Centre of Area Method, Centre of Sums method, Mean of Maxima Method, Centre of maxima method, weighted average Method) Fuzzy Control, Assumption and Design of fuzzy controllers, some examples (Air conditioner controller, Aircraft Landing Control Problem), Fuzzy Neural networks.
3. **Tensor analysis:** Introduction: Summation convention, Transformation of coordinates. Tensor of order zero. Kronecker delta, contravariant and covariant vectors, contravariant and covariant tensors of order two. Symmetric and skew symmetric tensors, addition of tensors, outer product and inner product of tensors.

Quotient law, Riemannian space, metric tensor, conjugate tensor, Christoffel symbols, Transformation of Christoffel symbols.

4. **Linear programming problem:** LP Model Formulation and Graphical method, Feasible solution, Basic solution of a Linear Programming Problem, Theory of Simplex Algorithm and simplex method; Standard form of an L P Problem; Complimentary slackness theorem, Degeneracy; Fundamental theorem of Duality, Cycling, Transportation Problem, Elements of Dynamic Programming problem.

**Text Books/ Reference books:**

1. Advance Differential Equation; M D Raisinghania, S Chand Company.
2. Fuzzy Sets and Fuzzy Logic, Theory and Applications. ( George J. Klir and Bo Yuan)
3. Fuzzy Set Theory and its application ( H. J. Zimmermann, Boston)
4. Fuzzy Sets and Their Application ( Dr. Sudhir K. Pundir and Dr. Rimple Pundir)
5. A Text Book of Engg. Math.: By N.P. Bali & Dr. Manish Goyal (Laxmi Publication).
6. Linear Programming and Theory of Game; P. M. Karak, New Central Book Agency (P) Ltd.
7. Linear Programming and Game Theory; Dipak Chatterjee, Prentice Hall of India (P) Ltd.
8. Linear Programming; G. Hadley, Narosa Publishing House.
9. Vector Analysis and an Introduction to Tensor Analysis (Schaum Outline Series) by M. R. Spiegel.

**Fluid Mechanics (CE 401)**  
**Total Credit= 5 (4:1:0)**  
**Semester: Fourth Semester**

1. **Introduction:** Fluid- definition, types, physical properties.
2. **Fluid Statics:** Hydrostatic law, pressure, density, height relationship, manometer, pressure on plane, curved and submerged surfaces, Centre of pressure, Buoyancy, Equilibrium of floating bodies, metacentre. Fluid mass subjected to accelerations.
3. **Fluid Kinematics:** Types and states of motion- steady and unsteady, uniform and nonuniform, laminar and turbulent flow, compressible and incompressible flows, one, two & three dimensional flows, streamlines, streak lines and path lines, stream tube, stream function and velocity potential, flow net and its drawing, Free and forced vortices.
4. **Fluid Dynamics:** Continuity equation, Euler's equation, Bernoulli's equation- application. Total energy. Momentum equation, Energy equation.

5. **Flow Through Openings:** Orifices, Mouthpieces, Co-efficient of contraction, velocity and discharge, Nozzles, Flow under sluice gate.
6. **Notches and Weirs:** Rectangular, triangular and trapezoidal notches and weirs, Francis's formula with end contraction, suppressed weir, Cippoletic weir, submerged weir, broad crested weir.
7. **Flow Through Pipes:** Loss of head due to friction, bend and elbows, sudden enlargement, sudden contraction, obstruction and at entrance. Darcy Weisbach formula, coefficient of friction, flow through compound pipes. Siphon.
8. **Flow Measurement:** Venturi meter, orifice meter, Nozzle meter, pitot tube, current meter.
9. **Dimensional and Model Analysis:** Rayleigh's method, Buckingham's pi-theorem, important dimensionless parameter and their significance. Application of dimensional analysis to fluid flow problems. Geometric, Kinematics and dynamic similarities, scale ratio, velocity, force, discharge speed and power of prototype, Distorted model.

**Text book(s):**

1. Hydraulics and Fluid Mechanics : P. N. Modi and S. M. Seth, Standard Book House
2. Fluid Mechanics and Hydraulic machines by R.K. Bansal, Laxmi publication (P) Ltd
3. Fluid Mechanics & machinery – C.P. Kotharaman & R. Rudramoorthy New Age Pub

**Reference Book(s):**

1. Experimental Fluid Mechanics : G. L. Asawa
2. Fluid mechanics and fluid machines: S.K.Som & G.Biswas, Tata McGraw Hill
3. Fluid mechanics: A.K. Mohanty, Prentice Hall of India
4. Fluid mechanics and turbo mechanics: M.M.DAS, PHI
5. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
6. Fluid Mechanics by V.L. Streeter & E.B. Wylie, 1st SI metric, McGraw Hill Book Company.
7. Fluid Mechanics (fundamentals and applications) – Yunus A Cengel, McGraw Hill Book Company.

**Fluid Mechanics Lab (CE 401L)**  
**Total Credit- 1 (0:0:2)**  
**Fourth Semester**

1. Calibration of Venturimeter & Orifice meter
2. Determination: Coefficient of discharge for small orifice/mouthpiece by constant head

method.

3. Calibration of contracted Rectangular Notch and / Triangular Notch
4. Determination of friction factor of a pipe.
5. Determination of Coefficient for minor losses.
6. Verification of Bernoulli's equation.

**Theory of structures-I (CE 406)**  
**Total Credit- 4 (3:1:0)**  
**Fourth Semester**

1. **Introduction to structural mechanics:** The structural model, Simple truss, Solution to simple truss, method of joints, method of sections, graphical method .Bending moment and shear force in three hinged arches .
2. **Cable:** Coplanar cables where loading is a function of x and coplanar cables where loading is the weight of the cable itself .S.F. and B.M. of three hinged suspension bridge, Two hinged suspension bridge.
3. **Elastic strain energy:**Elastic strain energy, Displacements, virtual work Principles. Strain energy and complementary strain energy methods for slope deflection in beam, frames and trusses.Maxwell's and Betti's theorem
4. **Deflection of statically determinate structures:** Deflection of determinate beams by Double integration Macaulay's, Moment area and Conjugate beam methods, Principle of virtual work (unit load method) and Castigliano's theorem, Deflection of determinate pinjointed trusses and rigid jointed frames by principle of virtual work (unit load method)
5. Graphical method for deflection in trusses (Williot- Mohr construction)
6. Statically indeterminate structure: Introduction to static and kinematics indeterminacies, Castigliano's theorem of least work, flexibility methods, consistent deformation method, strain energy method, load influences, co-efficient method for analysis of two hinged and fixed arches.
7. Approximate method of analysis for building frames.

**Text Books/ References:**

1. Basic structural Analysis by C.S. Reddy
2. Theory of structures by R.S Khurmi
3. Theory of Structures by Ramumrutham



## **Building Material (CE 402)**

**Total Credit- 2 (2:0:0)**

### **Fourth Semester**

1. **Building Materials**-Classification of Building materials, requirements of building materials and products, functional, aesthetical and economic. Study of properties of materials: physical, mechanical, chemical, biological, aesthetical and other complex properties like durability, reliability, compatibility, and economic characteristics.
2. **Surface Finishes**-Pointing types, plastering: materials and types, painting, Building facia, Materials and products based on mineral binders, gypsum, lime, plaster of paris, cement, hydraulic lime, mortars and concrete, gypsum-concrete products. Paints and Varnishes: types and uses.
3. **Bricks and Tiles**- Structural Clay products, Classification, Common clay brick, face bricks and tiles, ceramic tiles, paving blocks. Brick masonry, stone masonry and block masonry.
4. **Doors and windows**- Types, materials used, manufacture of doors and windows, fixtures. Grill work – materials used, manufacture. Metal and metal alloys: Products made of ferrous and non ferrous metals, Aluminum alloys, Types and Uses, Anticorrosive treatment. Glass types and uses. Wood varieties and uses, defects in timber, preservative treatments, and wood composites: particle and medium density fibre boards etc.
5. **Floors and roofs**- Floors; types of floors, floor finishes, suitability. Roofs; materials used, types, wooden and steel trusses, roof coverings, roof drainage. Synthetic Polymer resins and resins based materials, floor covering, wall facing, heat insulating and sound proofing plastics, water proofing and sealing resins, adhesives.

### **Text Books / References**

1. Engineering Materials, Rangwala, Charotar Publication
2. Materials of Construction, Ghosh, Tata McGraw Hill Publications.
3. Relevant IS Codes
4. National Building Code 2003, Indian Standards Institution.

## **Construction Technology**

**Total Credit- 2 (2:0:0)**

### **Fourth Semester**

1. **Construction Equipment**-Standard types of equipment , special equipment, cost of owning and operating equipment, depreciation costs, investment and operating costs, economic life, sources of construction equipment, factors affecting selection of construction equipment, balancing of equipment. Study of equipment with reference

to available types and their types and their capacities, factors affecting their performance. Earthmoving Equipment- Tractors and attachments, dozers and rippers, scrapers , shovels, draglines, trenching machines, clamshell, hoes, trucks and wagons, dumpers, rollers and compactors. Drilling and blasting equipments- Bits, jackhammers, drifters, drills, blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives. Pile driving equipment- Types, pile driving hammers, single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory drivers. Pumping equipment- Reciprocating, diaphragm & centrifugal pumps, well point system. Stone crushing equipment- jaw, gyratory and cone crushers, hammer mills, roll crushers, rod and ball crushers, aggregate screens and screening plants, portable plants. Concrete manufacture, transport, placing and compacting equipment, mixers, central batching and mixing plants, pavers, transit mixers, concrete pumps shotcrete. Air Compressor. Equipment for moving materials, builder's hoists, forklifts , cranes, beltconveyors, cableways, ropeways.

2. Tunneling- Geo-technical investigations, selection of alignment, methods of tunneling in soft soils and in hard rock, sequence of operations for drilling and blasting method, mechanical moles, boomers, tunnel boring machines, mucking, ventilation of tunnels, dust control, types of tunnel supports, sequence of lining operation, lining with pneumatic placers and by pump crete method.
3. Bridge Construction- Geo-technical investigation , Site selection , Launching of bridges by incremental launching, using false work, balanced cantilever construction method.
4. Steel Construction- Planning for field operations, selection of equipments and erection tools and method of welding, tools and methods of cutting and joining, safety measures during fabrication and erection.
5. Concrete Construction- Concreting under water, concreting in different weather conditions, mass concreting, vacuum concreting, Self Compacted Concrete, RollerCompacted Concrete.
6. Ground Improvement Techniques- Sand drains, stone column, diaphragm wall, rock anchors, Reinforced earth technology.
7. Special equipment's and their application to Off-shore construction, cofferdams, Foundation grouting.

### **Text Books/ References**

1. Varma Mahesh , Construction Equipment and its Planning & Applications
2. R.L. Purifoy & Ledbetter - Construction Equipment and its Planning , McGraw hill

3. JagdishLal , Construction Equipment
4. Thomas baron , Erection of Steel Structures
5. Stubbs, Handbook of Heavy Construction
6. Dr. P. Purushothama Raj, Ground Improvement Techniques ,Laxmi Publications
7. Punnoswami, Bridge Construction
8. Wadell , Concrete Construction Handbook

**Engineering Surveying-II (CE 404)**  
**Total Credit= 4 (3:1:0)**  
**Fourth Semester**

1. **Curves:** Introduction and characteristics of different types- Simple circular curves, compound and reverse curves, Transition curves, vertical curves, methods of setting out simple circular and combined curves. Field problems.
2. **Triangulation:** Definition, triangulation figures/ systems, classification, station marks, phase of signal, routine triangulation survey- reconnaissance, erection of signal and towers, measurement of base line, satellite stations, measurement of horizontal angle and computations.
3. **Trilateration:** use and advantages of trilateration, check angle, zenith angle and reduction of slope distance from vertical angle and elevations, adjustments in trilateration.
4. **Electromagnetic distance measurement:** Characteristics of electromagnetic waves, measurement of transit times, phase comparison, modulation, types of EDM instruments- microwave, visible light instrument, infrared instruments, introduction to electronic theodolite and total station.
5. **Adjustment of computation:** kinds of errors, important terms and definitions, laws of accidental errors, general principle of least squares, laws of weights, determination of probable error, distribution of errors to the field measurements, determination of most probable values, triangulation adjustments.
6. **Field Astronomy:** definition of astronomical terms, co-ordinate systems, astronomical triangle, star at elongation, star at horizon, star at culmination, circumpolar stars, determination of azimuth, latitude and longitude, Napier's rule of circular paths.
7. **Photogrammetric surveying:** Types of aerial photograph, photo theodolite, aerial Camera, scale of a vertical photograph, horizontal length and direction of a line, tilt and height displacements, flight planning, determination of elevation- method of

relief displacement, parallax in aerial stereoscopic views, principle of floating points, use of stereometer and stereoscope.

8. **Modern Surveying Equipment:** Introduction to total station.
9. **Global Positioning System (GPS):** Introduction, GPS principles, Satellite navigation System, GPS- Space segment, Control segment, User segment, GPS satellite signals, Receivers, Static, Kinematic and Differential GPS.
10. **Remote Sensing:** Principles, EME, sensors and platforms of remote sensing, it's application and scope.

### **Text Books**

1. Punmia B. C., Jain A.K., "Surveying, Vol-I and Vol-II", Laxmi Publication Pvt.
2. Arora K.R., "Surveying (Vol I & II)", Standard Book House
3. R. Subramanian: Surveying and Levelling
4. DUGGAL S K : Surveying Vol I & II

### **References**

1. Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley & Sons.
2. Schofield G. W., Butterworth, "Engineering Surveying", Heinemann, New Delhi.
3. Joseph G., "Fundamentals of Remote Sensing", Universities Press.
4. Kanetkar T. P. and Kulkarni S. V., "Surveying and Levelling, Vol-I and Vol-II", Pune VidyarthiGrihaPrakshan.
5. Chandra A.M. "Higher Surveying", Newage International.

### **Engineering Survey Camp**

**Total credit=1(0:0:1)**

#### **Fourth Semester**

1. To carry out open traverse with theodolite for route alignment
2. To set out simple Circular curve and transition curve
3. Determination of height of an inaccessible point by Trigonometrical Levelling
4. To carryout Open Traverse with Total station
5. Direct contouring

**Environmental Engineering –I (CE-405)**  
**Total Credit- 3 (3:0:0)**  
**Semester: Fifth Semester**

- 1. Public Water Supply Scheme:** Objectives, Planning and Components
- 2. Source of Water:**Surface source - types, selection, storage reservoir – yield and capacity estimation. Sub-surface water - types., Various empirical formula Well, Types of well according to the type of construction, Dug well, sunk well, Driven well, Tube Well. Yield measurement of a well, artesian well gravity well, specific yield. Well test. Infiltration well
- 3. Water Demand:** Population forecasting, design period, estimation of water demand for various uses, factors affecting consumption and fluctuation of water demand.
- 4. Water Quality:**The hydrologic cycle and water quality parameters: physical, chemical and biological; water quality requirements and standards.
- 5. Basic microbiology and chemistry:** Microorganisms in natural water systems, development of dissolved oxygen (DO) sag model, introduction to environmental chemistry.
- 6. Water Purification:**Type – I and Type – II Settling, Design and operation of Sedimentation tanks, Aeration, Coagulation and Flocculation, design and operation of Filtration units, Disinfection, Hardness Removal, Fluoride and Arsenic Removal, Household Water Treatment Systems, Miscellaneous Methods, Flow-sheets for treatment of surface and sub-surface waters.
- 7. Distribution System:**Requirements, Classification, Analysis and Design of distribution systems, Detection and Prevention of leakage.

**Text Books:**

1. *Environmental Engineering*, Peavy H. S., Rowe D. R. and George Tchobanoglous, McGraw-Hill International.
2. *Water Supply and Sewerage*, McGhee T. J ., McGraw-Hill Inc.,

**References:**

1. *Introduction to Environmental Engineering*, Davis M. L and Cornwell D. A McGraw-Hill, Inc.
2. *Wastewater Engineering- Treatment and Reuse*, Metcalf & Eddy (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill.
3. *Chemistry for Environmental Engineers*, Sawyer C. N., McCarty P. L and Parkin G. F., McGraw- Hill.
4. *APHA, Standard Methods Examination of Water and Wastewater*, American Public Health Association, Washington DC, 1995.
5. *Manual for Sewer and Sewerage*, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India, 1993.

6. *Manual for water supply and treatment*, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India, 1999

