

# FIRST YEAR

## FIRST SEMESTER

### Theoretical Papers

#### Ph/T/1B PHYSICS –IB

1. Use of vectors in particle mechanics, Unit vectors in spherical and cylindrical polar coordinates, Conservative vector fields and their potential functions - gravitational and electrostatic examples, Gradient of a scalar field, Equipotentials, States of equilibrium, Work and Energy, Conservation of energy, Motion in a central field and conservation of angular momentum.
2. Angular momentum of a system of particles, Torque, Moment of inertia, Parallel and Perpendicular axes theorem, Calculation of moment of inertia for (i) thin rod, (ii) disc, (iii) cylinder and (iv) sphere. Rotational dynamics of rigid body (simple cases).
3. Motion of fluids, Bernoulli's equation and its applications, motion of viscous fluids - Poiseuille's equation.
4. Simple harmonic motion, Composition of simple harmonic motion, Forced vibration and resonance, Wave equation in one dimension and travelling wave solution, Standing waves, Wave velocity and group velocity.
5. Statistical description of a system of particles, Phase space, Microstates and macrostates, Boltzmann's formula for the entropy, Canonical partition function, Free energy and other thermodynamic quantities in terms of the partition function, Classical ideal gas, Equipartition theorem and its applications.

#### CON/Math/T/112 MATHEMATICS-IE

Functions of a single variable, concept of limit, successive differentiation, Rolle's theorem, Mean value theorem, Taylor's theorem, Maclaurin's infinite series, Indeterminate forms, curvature, Concavity, Convexity, points of inflexion.

Functions of several variables: Limit and continuity, Partial derivatives, Euler's theorem on homogeneous functions Riemann integration: definition and properties, Calculus: Gradient, Divergence, Curl, Vector identities, Directional derivatives, Line, Surface and volume integrals, Stokes theorem of Integral Calculus, Improper integrals, Beta and Gamma functions, Quadrature and rectification, Numerical integration by Trapezoidal and Simpson's one-third rules. analytical function, Cauchy's integral theorem, Taylor's & Laurent Series.

Matrices: Addition and multiplication of matrices, Determinant of a square matrix and its properties, Transpose and inverse, solutions of systems of linear equations, symmetric, skew-symmetric matrices, Rank of a matrix, Cayley-Hamilton theorem (statement only), Eigenvalues and eigenvectors.

#### CON/Math/T/113 NUMERICAL ANALYSIS & COMPUTER PROGRAMMING

Gauss elimination method, Jacobi method, Newton Raphson method, Interpolation method, Eigen solution, Range Kutta method, Newton  $\beta$  method, Cholesky decomposition method, Rayley –ritz method, Introduction to different non-linear method, Single step & multi step methods for differential equation.

Programming language 'C' and Matlab.

**CON/PE/T/114      ENGINEERING MECHANICS-I**

Basic Units and dimensions, Introduction to vector algebra, vector calculus, and directed quantities, Free body diagram, Equilibrium equations, friction forces and application of friction forces, Collar, screw and belt friction, Properties of surfaces, Principle of virtual work, Distributed force and center of gravity. Kinematics of rectilinear motion.

**CON/Chem/T/115      CHEMISTRY**

Manufacture, composition and properties of cements; Common, refractory and fly ash bricks, Porcelain and Glass, Mineral Asphalt, Asphalt substances, Tar and Tar products including filters. Composition and manufacture of limes.

Water for domestic and industrial uses, hard and soft water, softening and treatment of water. Electro-Chemistry for determination of water quality parameters.

Basic composition of mild steel, High yield deformed steel (Tor), Stainless Steel, High tensile steel and TMT steel. Corrosion of steel and lubricant. Welding and soldering of ferrous and non-ferrous metals.

Testing of water including pH value, Basic concepts of chromatography, Spectrometry,

Chemistry related to Polymer, resin, epoxy based compounds.

**CON/PE/T/116      ENGINEERING DRAWING-I**

Introduction to Drawing instruments & aids. Types of lines. Engineering lettering. Geometric drawing & curves. Scales & dimensioning, I.S. Conventions. Orthographic projections, Isometric drawing & Sectional views in detail.

**Sessional Papers****Ph/S/1      PHYSICS LABORATORY**

(Selected Experiments from the following)

1. Determination of Galvanometer resistance by half - deflection method.
2. Determination of Galvanometer resistance by Thomson's method.
3. To find high resistance by Galvanometer deflection method.
4. To measure mechanical equivalent of heat, J by electrical method (Joule's) using copper calorimeter (radiation correction to be done).
5. To compare to low resistance by drop of potential method.
6. To determine resistance per unit length of wire by using Carey Foster bridge.
7. To estimate strength of a current by using copper voltmeter.
8. a) To compare the EMF's of two cells by using a potentiometer b) To measure current by using a potentiometer
9. To measure the horizontal components of earth's magnetic field intensity using deflection and vibrating magnetometers.
10. Determination of co efficient of linear expansion by optical lever method.
11. Determination thermal conductivity of metal by Searle's method.
12. To determine co-efficient of viscosity by Capillary flow method.
13. Determination of Young's modulus by Flexure method.
14. To draw mutual and anode characteristics of triode and hence too fine  $R_p$ ,  $\mu$ , and gm
15. To draw the transistor characteristics (NPN/PNP) in the given configuration and hence

- to find  $h_i$ ,  $hf$
16. Determination of refractive index of the material of the glass prism by prism spectrometer (for at least two  $\lambda$ s)
  17. Study of collisions in one dimension using a linear air track
  18. Use of an air track for obtaining potential energy curves for magnetic interactions.
  19. Study of oscillations under potential wells of various shapes using an air track.
  20. Experiments on diffraction in single slit, double slit and plane grating using He-Ne laser a) To find the wavelength of a monochromatic light by single slit. b) To find slit separation of a double slit. c) To find number of rulings per cm of a plane grating
  21. To find the wavelength of a monochromatic light by Newton rings.
  22. Fabry-Perot interferometry: To find out separation of wavelength of sodium D1 & D2 lines.

### **CON/PE/S/112      WORKSHOP PRACTICE**

Fitting: Introduction to Fitter's tools, gauge & instruments. Different types of fitting work involving various fitting operations such as sawing, marking, chipping, filling, drilling, tapping etc. Carpentry: Introduction to Carpenter's tools. Use of wood-working machines. Different types of joint-making, simple pattern-making.

Introduction to different welding techniques and related shop works, e.g. gas welding, arc welding, Brazing etc.

### **CON/Chem/S/113      CHEMISTRY LABORATORY**

To supplement the theoretical course on "Chemistry".

Determination of Chemical component of cement.

Determination of proportion of cement and sand in hardened plasters.

Determination of pH and hardness of water.

Estimation of Chlorides, Sulphates, Iron, Arsenic, Calcium and Magnesium.

Spectrophotometer analysis. Microscopic analysis

### **CON/CSE/S/114      PC LABORATORY**

Introduction to Computer Programming

1) Writing simple programs in C and Matlab.

2) Demonstration and practice in Application Packages-Word processor, Electronic Spreadsheet, Database Management system.

## **SECOND SEMESTER**

### **Theoretical Papers**

#### **CON/PE/T/121      HYDRAULICS**

Introduction to hydraulics; concept of fluid, continuum, Properties of fluids. Fluid pressure Kinematics of fluid flow. Equation of continuity and their application to different cases; Linear momentum equation. Flow through pipes. Branching of pipes and pipe networks. Uniform and Non-uniform flow in open channels. Hydraulic jumps. Dimensional analysis and method of similitude, Fluid forces on submerged bodies, Waves

forces on off-shore structures. Introduction to pumps and water turbine and their classifications; Flow measurements in close conduit and open channel flows, orifice and venturimeters, weirs and notches.

### **CON/PE/T/122 ENGINEERING MECHANICS-II**

Curvilinear motion, projectile, relative motion, Newton's laws of motions, inertia force, central force motion, momentum and impulse, work, power & energy, impact, undamped free vibration of spring-mass system with single degree of freedom. Natural frequency, damping, Raleigh damping, Introduction to forced vibration, resonance

### **CON/PE/T/123 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING Part – I : ELECTRICAL**

Principles of alternating current, Concept of power and power factor, DC & AC Machines - Principles of Motors, Generators, Transformers, Switchgears, Cables. Measurement of Energy, Power, Current, Voltage, Resistance etc.

#### **PART-II : ELECTRONICS**

Semiconductor, P-N junction diode, DC-AC load lines. Zener diode, Junction diode as a rectifier, Zener diode as voltage regulator, capacitor-input filters. BJT & FET, Biasing of transistor, Q-Point & AC-DC load lines. Hybrid - II model of transistors and small signal low frequency analysis (simplified) of CE & CS configurations. Differential amplifiers. Operational amplifiers, non-inverting & inverting modes. Applications - voltage follower, summing amplifier, difference amplifier, instrumentation amplifier differentiator & integrator. Feedback in amplifiers: Qualitative discussion, topologies, simplified analysis of voltage & current amplifiers using of op.amp. with examples. Introduction to transducers and measurement systems - classification and operating principles.

### **CON/PE/T/124 THERMODYNAMICS AND HEAT POWER**

Units of heat and work; Laws of thermodynamics, Mechanical Equivalent of heat, Laws of perfect gases and analysis of different perfect gas processes, carnot cycle, simple reciprocating air compressor, properties of saturated and superheated steam. Use of steam tables and charts.

Boilers and their types; Boiler mountings and accessories, Chimney draft, Artificial draft, Boiler performance.

Bankine cycle, modified Ranking cycle, Theoretical Indicator dia of steam engine, Mean effective pressure, Indicated and Brake horse power, thermal efficiency. Steam turbine, its basic classification, Function of basic parts, velocity diagram blade efficiency, stage efficiency. IC Engine, basic classification, Air standard cycles, L-C engine performance. Refrigeration, C.O.P. of refrigeration cycle, vapour compression refrigeration system, Refrigerating capacity, Principles of Air conditioning.

### **CON/Math/T/125 MATHEMATICS-III**

#### **Part-I**

Solid geometry and vector algebra: Cartesian coordinates in three dimensions, Position vectors, Addition of vectors, Multiplications of a vector by a scalar, Division of a line segment in a given ratio. Rectangular resolution of vectors, Scalar and Vector product of two vectors, Scalar and Vector equations of straight lines, Shortest distance between two skew lines. Volume of a tetrahedron, Equations of spheres, cylinders and cones.

Partial differential equations: Solutions of one dimensional wave equation and diffusion equations and two dimensional Laplace's equation by the method of separation of variables, Gauss Theorem, Green's theorem, Fourier's transformation

**Part-II :Statistics**

Population, variable and attributes. Statistical data. Frequency distribution. Parameters, Mean, range and standard deviation, Simple random sample. Statistic, Sampling distribution, standard error, Sampling distributions of sample mean and sample proportion Normal distributions. Elementary idea of probability, Poisson, Normal and Binomial Distribution. Acceptance sampling, OC curve, AOQL. Simple and double sampling plans. Consumers and producers risks, LTPD and AQL.

Operations Research – Basic principles. Statement of some typical problems. Linear programming problem and its solution by graphical method. Acquaintance with any one of the following statistical packages : Systal / Minitab / SPSS.

**Hum/T/A HUMANITIES-A**

Part-I : English - 2 Pds/week - 50 Marks

Part-II : Sociology - 2 Pds/week - 50 Marks

**Part-I : ENGLISH**

1. Basic writing skills
2. Report, Covering Letter & Curriculum-Vitae writing
3. Reading and Comprehension
4. Selected Short Stories

Text Book: ENGLISH FOR ALL

**Part-II : SOCIOLOGY**

1. Sociology: Nature and scope of Sociology - Sociology and other Social Sciences - Sociological Perspectives and explanation of Social issues
2. Society and Technology: Impact of Technology on the Society - A case study
3. Social Stratification: Systems of Social Stratification - determinants of Social Stratification - Functionalist, Conflict and Elitist perspectives on Social Stratification
4. Work: Meaning and experience of work: Postindustrial society- Post-Fordism and the Flexible Firm
5. Development - Conceptions of and approaches to development - The Roles of State and the Market in the Development
6. Globalization: The concept of globalization - globalization and the nation state - Development and globalization in post colonial times.
7. Industrial Policy and Technological change in India - The nature and Role of the State in India
8. Technology Transfer: The Concept and Types of Technology Transfer-Dynamics of Technology Transfer
9. Technology Assessment: The Concept - Steps involved in Technology Assessment
10. Environment: Sociological Perspectives on Environment - Environmental Tradition and values in ancient India
11. The Development of Management: Scientific Management - Organic Organization - Net Work organization - Post modern Organization - Debureaucratization - Transformation of Management
12. Technological Problems and the Modern Society: Selected Case Studies - Electric Power Crisis, Industrial and/or Environmental Disaster, or Nuclear Accident.

## **Sessional Papers**

### **CON/PE/S/121      MECHANICAL ENGINEERING LAB**

Air compressor, petrol engine, Diesel Engine. Hydraulic systems. Friction and Hydraulic clutches. Gear Trains. Epicyclic gear.

Introduction to vibration testing of single degree freedom system, forced vibration of a 3-D model, Resonance

### **CON/PE/S/122      HYDRAULICS LABORATORY**

To supplement the theoretical course on "Hydraulics".

### **CON/PE/S/123      ELECTRICAL ENGINEERING LABORATORY**

Experiments to supplement the theoretical course on "Basic Electrical Engineering".

### **CON/PE/S/124      ENGINEERING DRAWING–II**

Advanced problems on projection drawing, sectional views & auxiliary views, screw threaded forms, bolts and nuts, studs & their uses, riveted and welded joints, pulleys, rigid coupling & joints for rods, pipes, etc. various types of lines & their projections, concepts of true length, intersection & development of common surfaces.

## **SECOND YEAR**

### **FIRST SEMESTER**

#### **Theoretical Papers**

##### **CON/Geo/T/211 ENGINEERING GEOLOGY**

Origin of earth. Nature and composition of rocks and minerals. Identification of Rocks, and Minerals. Common varieties of rock forming minerals. Mountains and their genesis, Folding and faulting. Principles of stratigraphy and geochronology, Earthquakes and their causes. Geomorphological process. Origin and nature of soils. Agents of weathering, clay minerals and their identification. Sub-surface water. Ground water investigation. Geological consideration in engineering projects. Geology of sites for construction of Dam, Reservoir, Bridge, tunnels. Stability of hill slopes. Geology of Engineering Materials used for road and railway works, stone masonry.

##### **CON/T/212 SURVEYING**

Linear measurement and corrections, Chain Survey, Prismatic compass survey, Traverse Balancing, Plane table survey, Ordinary levelling and Contouring, Longitudinal section and Cross-section, Area volume measurement, Mass-haul diagram.

Theodolite and its adjustments, theodolite traversing, tacheometry, Modern survey instruments, spherical trigonometry, Geodetic surveying, Triangulation and trilateration, Geodetic leveling. Horizontal and vertical Curves and Grids. Setting out works, Hydrographic survey, Total stations- operation and application.

##### **CON/T/213 STRENGTH OF MATERIALS**

Structural elements, stress and strain, Young's modulus, shear modulus, Bulk modulus, Relation between the moduli, Theory of bending of beams; Bending moment and shear force diagram, bending stress and shear stress distribution. Moment of resistance. Compound beams, Principle stress, Principal planes, Mohr's circle, Plane truss, Simple, Compound and complex trusses. Three pinned arches, Torsion in shafts, Space frames. Unsymmetrical bending.

##### **CON/T/214 MATERIALS OF CONSTRUCTION**

Different construction materials, their properties, acceptance criteria. Brick, stone, lime, cement, stone gravel and sand, Iron and Aluminium -their properties and uses. Iron-Carbon system-thermal and mechanical treatment of iron and its alloys. Timber-common Indian species, classification, Detection Treatment, Seasoning, Plastics, and composite materials. Water for construction. Asbestos, Glass, Tar and Bitumen products Adhesives, paints and Vernishes, Use of local materials in construction. Polymeric materials plastics, Epoxy Resin, polyurethane, Fiberglass, FRP. Non-Ferrous Metals. Copper, Zinc, Non-Ferrous Alloys use in construction.

##### **CON/T/215 BUILDING SERVICES**

Requirements of buildings -residential, institutional and commercial building components Water supply: Sources, procurement, treatment and distribution. Installation in buildings,

consumption standards, storage methods, pipe fittings and plumbing methodologies. Provision for fire fighting and code requirements Drainage and sanitation: Need for sanitation, collection and disposal, storm water drainage and rain water harvesting Electrical : Sources of electricity, generation and distribution, simple circuits and general methods of distribution in buildings ; lighting design and code requirements, diagrammatic representation and house wiring Air conditioning: Definition and principles; system functioning, equipment and accessories - types and mode of functioning Elevators : Types of vertical transportation - lifts and escalators, their use for different purposes, code requirements and installation procedures, safety modes and physical requirements ;Lift machine rooms Acoustics : Sound and its properties, Sound problem in buildings, acoustical treatment, sound insulation construction, other methods of noise control

### **CON/PE/T/216 WATER RESOURCE ENGINEERING**

Water uses; water quality for drinking and constructional uses intake structure; Conveyance of water; Principles of water treatment; Structural features of conventional treatment units; Characteristics of sanitary sewage and storm water runoff, Sewerage system; Sewer appurtenances; Principles of wastewater treatment, Structural features of treatment units. Role of Hydrology in engineering. Hydrologic cycle. Precipitation. Water stage and measurement. Stream flow measurement. Stage-discharge relationship and its significance. Components of runoff. Hydrograph. Ground water hydrology. Principal Indian crops, their seasons and water requirement flow and lift irrigation, Sprinkles irrigation, Minor irrigation schemes.

### **Sessional Papers**

### **CON/S/211 CIVIL ENGINEERING DRAWING**

Architectural details in building; Brick wall foundation details; R.C. Frame structure; structural plan, Reinforced concrete detailing; foundation detailing, Bridges and Special structure; Steel Frame Structure; Steel Detailing, Bar bending schedule

### **CON/Geo/S/212 ENGINEERING GEOLOGY LABORATORY**

This will include study and interpretation of Geological Maps and sections, practical; identification of rocks and minerals etc.

### **CON/S/213 MATERIALS LABORATORY-I**

A course of laboratory experiments of construction materials. The list of experiments are as follows.

1. Grading of coarse and fine aggregates
2. Flakiness and Elongation index of aggregates
3. Los-Angelos Abrasion test
4. Aggregate Impact value
5. Soundness of aggregates
6. Specific gravity and moisture absorption of aggregate.
7. Crushing strength, Moisture absorption and efflorescence of Brick

### **CON/S/214 SURVEY SESSIONAL & CAMP**

Topographical survey, Route survey, Triangulation survey, Use of Total stations.



## **SECOND SEMESTER**

### **Theoretical Papers**

#### **CON/T/221 SOIL MECHANICS-I**

Introduction, Definition of soil, Formation of soil, Types of soil, Weight -Volume relationship, Grain size distribution, Atterberg's Limits, Relative Density of cohesionless soil, Consistency of cohesive soils, Identification of soil, IS Classification. Effective pressure, Neutral pressure, Total pressure, Critical hydraulic gradient, Quick sand condition. Permeability, Darcy' Law, Laboratory determination of permeability, Permeability of stratified deposits. Consolidation, Theory of one dimensional consolidation, e-logp curve, Co-efficient of volume compressibility, Compression index, Determination of field curve, Field curve for normally consolidated and over consolidated clays, Time settlement curve, Degree of consolidation, Time factor. Shear strength: Mohr -Coulomb Failure criteria, Shear tests on granular and cohesive soils, Sensitivity and Thixotropic characteristics of clay, Vane shear test. Compaction of soil: Theory of compaction, Standard and Modified Proctor's compaction test, Field compaction types of Rollers, field compaction control. Stress distribution in voids, Boussinesq theory, Newmark's chart, pressure bulb, contact pressure, 2:1 method.

#### **CON/T/222 THEORY OF STRUCTURE-I**

Deflection of beams, Area-moment theorems, conjugate beam theorems, Reciprocal theorem, Principle of Least work. Virtual work, Unit load, Fixed and Continuous beams. Theorem of three moments, deflection of Trusses, Columns and Struts, buckling, Euler's theorem, Rankine's formulae, Columns with eccentric load, Bi-axial bending, Classification of structural systems, Statically determinate and indeterminate structures, supports and reactions.

#### **CON/T/223 CONCRETE TECHNOLOGY**

Introduction, Composition of concrete, Portland cement: manufacturing process, Chemical composition, Hydration, Physical properties, Acceptance criteria, Storage, Different types of cement. Aggregate -classification, types, physical properties, grading, storage, acceptance criteria. Fresh concrete -workability, slump test, compacting factor test, segregate and bleeding, Strength of concrete, Durability of concrete. Batching, Mixing, Transportation, Placing, Compacting and curing of concrete. Mix design of concrete, Chemical admixtures, Construction quality control.

#### **CON/T/224 PROCESSES OF CONSTRUCTION**

Structures classified by methods materials of construction Timber, Masonry, Steel Framed, R.C. Framed, Prefab, Prestressed, Mass Concrete, etc. Modern structures: Geodesic Dome, Shells, Tension structures. Masonry-Brick and stone Masonry. Bond. Foundation with Lime concrete. Scaffolding, shuttering, Centering Conventional and Modern. Concrete-methods of Pouring. Reinforcement-bending, binding and congestion problems. Structural steel work-Riveting. Welding, Bolting, Black bolts and High Tensile

bolts. Welding-Transformer, Generator, Electrodes, Welders Qualification, accessories. Building Finished-Flooring, Plastering. Stone Facing, Slip form construction, Cantilever construction of bridges. Segmental construction of bridges.

### **CON/T/225 CONSTRUCTION MANAGEMENT-I**

Construction as an industry, Basic concepts of management. Planning Organising, controlling & Motivating. Different schools of management. Introduction to behavioral science, communication skills, leadership Applied psychology, project Formulation technoeconomic study, multidisciplinary approach, budget allotment, Facets of construction Management-General M, personnel M, contract M, contract Labour M, Material M., organisational structure-work Flow and information flow. Two-party and three-party models. In-house and offloading.

### **CON/T/226 ESTIMATING AND PRICING**

Items of work. Method of measurement and documentation, Pricing rules of taking off. Principles of abstracting. Bill of quantities, Analysis of rate. Overhead and profit. Determination of unit rate. Specification of work. Principles of valuation Rental, land and Building method of valuation.

### **Sessional Papers**

#### **CON/S/221 ESTIMATING AND PRICING PROJECT**

Estimation and rate analysis of i) Two storied residential building, ii) Road works. Application of standard software.

#### **CON/S/222 MATERIALS LABORATORY-II**

A course of laboratory experiments of construction materials. The list of experiments are as follows. i) Ductility of Bitumen ii) Penetration of Bitumen iii) Softening Point of Bitumen iv) Consistency of cement v) Initial and Final setting time of cement vi) Fineness of cement vii) Compressive strength of cement viii) Soundness of cement ix) Specific gravity of cement.

#### **CON/S/223 COMPUTER AIDED CIVIL ENGINEERING DRAWING**

Computer Aided Drawing (CAD) same of Civil Engg Drawing. Architectural and structural details of a building

#### **CON/S/224 SOIL MECHANICS LABORATORY**

A course of laboratory experiments in soil mechanics. The list of experiments are as follows.

- i) Sieve analysis
- ii) Hydrometer analysis
- iii) Specific gravity
- iv) Moisture content
- v) Bulk density and Dry density
- vi) Liquid Limit, Plastic Limit & Shrinkage Limit
- vii) Consolidation test viii) Unconfined compression test

- viii) Undrained triaxial test
- ix) Direct shear test
- x) Visual identification.
- xi) Standard Proctor's Compaction test
- xii) Modified Proctor's compaction test
- xiii) Constant head and Falling head permeability test
- xiv) CBR test

## **THIRD YEAR**

### **FIRST SEMESTER**

#### **Theoretical Papers**

##### **CON/T/311 CONSTRUCTION MANAGEMENT-II**

Construction Infrastructure: Power, water, Access, Housing security, storage, plant, Maintenance, communication, Welfare. Enabling Works; personally; progress constroly; safety and Quality control. Planning and Scheduling Gantt chart, Milestone chart, PERT and CPM. Squared networks. Monitoring and updating. control on material consumption. Use of computer packages. Material procurement storage and accountancy. Labour management. Basic concepts in law, related to construction Laws; contract Labour (R&A), Act and rules, payment of wages Act, Minimum Wages Act, workman's compensation Act, Interstate Labour Act, Trade Union Act, Industrial Disputes Act.

##### **CON/T/312 SOIL MECHANICS-II**

Sub-soil investigation: definition, different activities involved, Reconnaissance, Methods of boring and drilling, Collection of disturbed and undisturbed samples, Field tests, Preparation of soil investigation report, Planning of soil investigation work. Stability of slopes Earth pressure theories, Earth pressure at rest, Active and passive earth pressure, Rankine and coulomb's theory of earth pressure, Culman's graphical construction. Seepage : Laplace's equation, Construction of flow nets.

##### **CON/T/313 TRANSPORTATION ENGINEERING**

Principles of transportation. History of Roads and Road development in India, Road and highway classification. Alignment and layout location survey. Elements of cross sections and long sections in roads, traffic volume, speed and delay study, determination of road capacity, level of service, accident analysis, analysis of signalized intersection, highway lighting. Elements of Rail transportation permanent way. Track geometry components and materials. Points and crossings. Yards signaling and interlocking. Track modernisation and high speed tracks. Rapid transit system. Elements of Airport engineering Airport planning and layout, Runway apron taxiway-design considerations drainage.

##### **CON/T/314 THEORY OF STRUCTURE-II**

Indeterminate structures, Slope deflection method - continuous beams and frame problems. Sway of frame moment distribution method - continuous beam & frame problem. Matrix method of analysis. Introduction to finite element method. Use of computers. Influence lines for determinate and indeterminate structures. Rolling loads. Two hinged and fixed arches, portal frame and pitched portal.

##### **CON/T/315 DESIGN OF STRUCTURE-I**

Design of steel structure -General consideration, Advantages & disadvantage of steel structure. Design of axial tensile and compression member. Design of a roof truss, Design of connections -Riveted, Bolted, Welded connection, Eccentric loading for these connection and design. Design of flexural members beams, plate girders, rolled section and building section, Design of column with axial, uniaxial & biaxial moment, Introduction to industrial structures, Design of column bases. Use of IS codes

### **CON/T/316 CONSTRUCTION PLANTS AND EQUIPMENTS:**

Tools & Accessories: Hand Tools-Basic-Power Tools – Pneumatic & Pulley, Gear (Spur, Helical, Bevel, Worm), Chain (Single, Duplex, Silent), Screw (Square, Sawtooth), Springs- Compression, Tension, Leaf, Disc, Fasteners- Bolts, machine: Flexible & Rigid, Shaft, Bearing, Coupling, Clutches, Pulley, Different applications IC Engines, Petrol Engines, Diesel Engines, Diesel Generators Electric Motors, Air Compressors: Pumps, Transformer, Generator, Transporters: Lorry- Pneumatic Tyres, Trucks, Rail , Loaders & Unloaders, Belt Conveyors, Steel wire rope- Grade, Core, Construction, Protection, Winches, Cranes-Mobile, Derrick, Tower Carriage- Wheeled, Dumpers- Tippers, Haulers Excavators, Back Hoe Dozer, Shovel & Grader Rollers- Vibratory, Padfoot Augers Consolidation: Piling-Sheet piles, Precast, In-situ Driven, Casing pipe, Bored, Recirculating bentonite slurry Other methods of consolidation- Stone column, Water jet injection, Sand wick treatment etc. Tunneling: Anchor, Chisel, Blasting Mouse- for horizontal holes thru embankments TBM- Tunnel Boring Machines Automatic, Semi-automatic, Underwater Work: Dredging, Grabbing Concreting: Crushing, Screening, Washing, Mixers-Batching Plant, Transit Mixer Concrete, Pump Rope Concrete Placer, BDC, Vibrators- Needle, Form, Bin, Form Work- Modular, Equipment for prestressing, Test setup Demolition: Drilling, Chisel- Ram Hammer, Controlled Blasting Maintenance.

### **Sessional Papers**

#### **CON/S/311 CONCRETE LABORATORY**

A course of laboratory experiments on properties of concrete and concrete mix design. Use of admixtures

#### **CON/S/312 STRUCTURAL DESIGN SESSIONAL-I**

Analysis and design of a Factory Work shop Building including preparation of design drawing.

#### **CON/S/313 STRUCTURAL LABORATORY**

Stress Strain Behaviour for the tensile test of Mild Steel and HYSD Bar. Load deflection behaviour of a flexural beam member. Buckling and crushing of a compression member.

#### **CON/S/314 PROJECT-I ON CONSTRUCTION MANAGEMENT**

Construction Management: Business-Basics of Computer application. Systems and Package programmes oriented programming, computerisation of PERT/CPM schedules; Resources Levelling monitoring and updating; inventor / control; material; overview of available packages. Use of package. Writing simple programmes.

## **SECOND SEMESTER**

### **Theoretical Papers**

#### **CON/T/321 FOUNDATION SYSTEMS**

Bearing Capacity and Settlement, Immediate and Long term settlement. Total and differential settlement Types of foundations -shallow and deep foundation, Shallow foundations -depth of foundation, isolated footings, strip foundation, raft and basements, combined footings. Selection of depth of foundation, bearing capacity and settlement Deep foundations -Pile foundation: Classification of piles, construction techniques of different type of piles, Static and dynamic formulae for determination of pile load capacity, Lateral load capacity, foundation pile group capacity, settlement of pile groups, Negative skinfrict, Pile caps. Caisson/Well : Types of well, Sinking of wells Tilt & Shift of well and their rectification, Calculation of scour depth.

#### **CON/T/322 DESIGN OF STRUCTURE-II**

Introduction -General principle and method of design. Working stress method, Limit state method of design. Design of reinforced slab, Design of rectangular and flanged beams, Design of column, Beam-Column problem, Design of footing -Isolated, Combined footing, Flat slab design consideration, Design of retaining structures, Concentrated load on slab, Elementary bridge design. Design of retaining structures.

Tall building- Definition. Wind and earthquake forces, Building frames - Portal Method, Kani's method. Introduction to shear wall consideration. Earthquake resistant design, response spectra method, Durability consideration.

Design of formwork, Introduction of machine foundation, Industrial structure – definition and special features, cable trenches, heavy duty floor, pipe supports, etc.

#### **CON/T/323 CONSTRUCTION MANAGEMENT-III**

Contracts objective of contracting parties: Reconciliation of aims. Conflicts and problems, Standard form contracts, Type of contracts, their peculiarities and applications; The tendering process; Role of consultants Measurement, billing and payment; Cash Flow and profit; Escalation; cost control. Rights and obligations of contracting parties; Breach of contract and consequences defects, liability claims. Disputes and dispute resolution; the arbitration process. The Architects Act.

#### **CON/T/324 UNDERGROUND CONSTRUCTION**

Types and classification of underground opening, alignment and location. Braced excavation. Types of bracing system. Stability considerations. Earth pressure and strut load. Ground settlement. Control measures. Dewatering. Field pumping test, common dewatering method. Bulkheads Anchored bulkhead. Soil and rock anchors cellular cofferdams . Tunnels and shafts . Stability considerations . Design of tunnel linings . Construction procedure and instrumentation . Soft ground tunneling. Methods of tunneling control of seepage and ground loss.

### **CON/T/325 HIGHWAY AND AIRPORT ENGINEERING**

Characterisation and evaluation of soil as sub-grade, CBR test & Plate Load tests. Characterisation of coarse aggregate and fine aggregate, Classification of Bitumen including penetration grade, cut-back and emulsified bitumen. Physical and chemical tests on bitumen, Design of bituminous mix.. Design and construction bituminous and concrete pavement . Design of overlay, Elementary idea of pavement design, Analysis of pavement failure. Geometric design of highway: Right of way, super elevation, extra widening at curves-camber, median, horizontal and vertical curves, sight distance, grade separation. Airport planning, design of runway and taxiway, design of airfield pavement.

### **CON/T/326 PRE-CAST & PRE-STRESSED CONCRETE**

Precast elements, Joints and connections. Composite precast elements, methods of prestressing, losses, Analysis and design of determinate and indeterminate structures. Anchorage zone stresses. Partial prestressing, composite construction. Two way prestressing, circular prestressing, prestressed containers. of systems.

### **Sessional Papers**

#### **CON/S/321 INDUSTRIAL TOUR & ON SITE TRAINING**

Training at a construction site followed by a seminar

#### **CON/S/322 STRUCTURAL DESIGN SESSIONAL-II**

Analysis and design of a two-storied residential building and preparation of drawing.

#### **CON/S/323 HIGHWAY LABORATORY**

The related testing of materials and use of different equipment mentioned in Highway engineering syllabus.

#### **CON/S/324 PROJECT-II ON REVIEW OF LITERATURE & SEMINAR**

Project on review of research literature on relevant topics and presentation by individual student

## FOURTH YEAR

### FIRST SEMESTER

#### Theoretical Papers

##### **CON/T/411 BRIDGE ENGINEERING**

Introduction, Different components of a bridge, Classification of bridges, Survey and selection of bridge site and collection of design data for bridge projects, Estimation of design discharge, Scour depth, Linear water way, Bridge loading, Load distribution in bridge decks, Box culvert, Solid slab bridges, Slab and girder bridge, Skew and curved bridge, R.C. continuous bridge, R.C. balanced cantilever bridge, Arch bridges, Steel bridges, Steel-concrete composite bridges, Pre-stressed concrete bridge, Temporary, Low cost and movable bridges, Piers and abutments, Wing wall and retaining wall, Shallow and deep foundation, Bridge bearings, Expansion joints and wearing coarse, River training works, Different techniques of construction of bridges.

##### **CON/T/412 DESIGN OF STRUCTURE-III**

Analysis and design of tall building. Wind load analysis. Earthquake forces, Earthquake resistant design, response spectra method, Building frames - Portal Method, Kani's method. Introduction to shear wall consideration.

Design of formwork, Introduction of machine foundation, Industrial structure - definition and special features etc.

##### **CON/T/413 ECONOMICS AND BOOK KEEPING**

Wealth, capital, production of wealth, Factors of production, division of labour. Law of increasing and constant demand. Law of diminishing return, Demand and supply. Market price. Quality theory of money, Inflation, Deflation, Function of Banks. Book Keeping and Accountancy. Employment practice and record. Elements of Company law and Taxation Law, basic double entry book keeping, Company accounts (Balance sheet- Profit and loss account), Basics of income tax, Cash flow analysis and management of working capital, Basics of taxation.

##### **CON/T/414 ELECTIVE-I**

##### **CON/T/414A Advance Concrete technology**

Microstructure of concrete, Structure of hydrated cement phase, Dimensional stability, Creep and shrinkage, Chemical properties of cement, Chemical and mineral admixtures. High performance concrete, Fiber reinforced concrete, Mass concrete, Roller compacted concrete, Self compacting concrete, Cold and Hot weather concrete, Durability of concrete.

##### **CON/T/414B Environmental Engineering**

Definition of pollution. Types of pollution i.e. water, air, noise and land. Water pollution: Sources of pollution and name of pollutants with limits (MINAS). Their effects on living and non-living elements. Flow sheets for treatment of ground water, surface water and flow sheets for conventional primary and secondary treatment methods.

Conventional methods of waste water treatment like sedimentation tank, activated sludge, trickling filter, grit and chlorination method.



Air pollution: Name of contaminants and their (MINAS) threshold limits. Different types of air vortex due to change of vertical temperature and their derivations. EIA report preparation for highway. Thermal power plant etc.  
Hazardous wastes and its characteristics as per EPA Noise pollution, its limiting values (MINAS) and units, effects and remedial measures.

### **Sessional Papers**

#### **CON/S/411 COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN**

Matrix and finite element method of analysis, RC frame structure, steel truss, use of structural engineering software packages

#### **CON/S/412 PROJECT-III ON STRUCTURAL DESIGN**

Structural Design project- Analysis, design of a multi-storeyed building

### **SECOND SEMESTER**

### **Theoretical Papers**

#### **CON/T/421**

#### **REPAIR, REHABILITATION AND MAINTENANCE OF STRUCTURE**

Definitions, Causes of deterioration, Investigation, Repair materials & technique, Surface preparation, Treatment of corroded reinforcements, Grouting Structural strengthening, Underpinning, Water proofing treatment, case studies.

#### **CON/T/422 ELECTIVE-II**

#### **CON/T/422A Structural Dynamics & Earthquake Engineering**

Free vibration, forced vibration, damping, single degree of freedom system, natural frequency, time period, mode shape, resonance, transient vibration, dynamic load factor, vibration isolation, earthquake motion, application of structural dynamics to earthquake engineering.

#### **CON/T/422B Advance Foundation Technique**

Soil stabilization, Foundations in difficult ground, Foundations of expansive soil. Preloading and sand drains, sand wicks, band drains, Vibroflotation, Stone columns, Geosynthetics and their application.

**CON/T/423 ELECTIVE-III**

**CON/T/423A Advance Transportation Engineering**

**CON/T/423B Fabrication Technology**

Introduction -importance of fabrication technology, Fabrication procedure, Shop and site fabrication, sequence of activities -surface cleaning, cutting & machining, punching & drilling, straightening, fitting & reaming, fastening, rivetting, bolting, welding, radiographic and ultrasonic testing of welds, quality control, erection planing, surface treatment against corrosion.

**CON/T/423C Quality Management in Construction**

Storing of materials with identifiable batch lot, documentation of incoming certificates, in-house checking and documentation of input materials, semi processed materials, finished materials. Quality assurance plan, Documentation and Management Issues, Statistical aspects of acceptance criteria

**Sessional Papers**

**CON/S/421 PROJECT-IV ON CONSTRUCTION ASPECT OF DESIGNED STRUCTURE (CONTINUED FROM PROJECT - III**

Preparation of Construction drawing, Bar-bending schedule, Construction aspect and project management of the Multi-storeyed building project (Continuation of Project-III). An exercise in planning and scheduling of the entire construction infrastructure and process interaction with client consultant and contractor, covering facilities. Plant, material and personnel for a specific project. Cost and Progress control winding up site.

**CON/S/422 GRAND VIVA**

Based on theoretical and sessional subjects