

**CONSTRUCTION ENGINEERING DEPARTMENT
JADAVPUR UNIVERSITY**

SECOND YEAR

FIRST SEMESTER

FET/BS/B/Math/T/211

MATHEMATICS III

Contact Hours: 2L–1T – 0P

Credits: 3

Probability and Statistics: Definition of probability; Conditional probability and independence; Bayes' theorem; Collection and Representation of Statistical data: Measures of Central Tendency & Dispersion; Correlation and Regression; Expectation and Variance; Random variables; Discrete and Continuous distribution; Poisson, Normal and Binomial distribution; Chebysheffs inequality.

Vector Algebra: Basics of vector algebra; Dot and Cross products of two vectors; Product of three or more vectors; volume of tetrahedron; Work done; Moment; Angular velocity. Applications to mechanics;

Vector Calculus: Vector functions of a scalar variable; Limit; Continuity and Derivative of vector functions; Applications to mechanics; Partial derivatives of vector function of more than one variables; Directional derivative; Gradient; Divergence and Curl; Vector Integration; Line integrals; Surface integrals and volume integrals; Green's theorem in the plane; Gauss's Theorem; Stokes' Theorem and their application; Tangent Normal and Binormal of space curve; Serret-Frenet formulae; Normal plane, Rectifying plane and osculating plane.

Ordinary Differential Equations: First order differential equations - exact, linear and Bernoulli's form, second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, Euler's equations, system of differential equations.

Partial Differential Equations: First order PDE; Lagrange method; Second order PDE with constant coefficients and their classification to Elliptic, Parabolic and Hyperbolic type. Solution of PDE by method of separation of variables; Solution of one-dimensional wave and diffusion equation; Laplace equation of two dimensions.

Content Delivery Method

- Class room lecture (chalk and board)
- Tutorial
- Discussion

CON/PC/B/T/212

STRENGTH OF MATERIALS

Contact Hours: 3L–0T – 0P

Credits: 3

Structural elements, stress and strain; Tension, compression and shear; Young's modulus, Shear modulus, Bulk modulus, Relation between the moduli; Stress – strain diagram of structural materials; Brittle and ductile material; Stress concentration, Strain energy in tension and compression.

Statically indeterminate problems in tension and compression.

Stresses in thin walled pressure vessel. Analysis of biaxial stresses. Principal stress, Principal planes, Mohr's circle for biaxial stresses, Pure shear.

Torsion in circular shafts,

Theory of bending of beams; Bending moment and shearing force in statically determinate beams; Moment of resistance. Bending moment and shear force diagram, bending stress in beam. shear stress in bending. Compound beams, Unsymmetrical bending. Three hinged arch.

CON/PC/B/T/213 MATERIALS OF CONSTRUCTION

Contact Hours: 3L–0T – 0P

Credits: 3

Different construction materials, their properties, acceptance criteria. Use of local materials in construction; Characterization of aggregates.

Brick, Bonding of bricks; Fly ash, stone, Classification of lime and lime mortar,

Aluminium -their properties and uses.

Iron- Carbon system-thermal and mechanical treatment of iron and its alloys. Structural steel - composition, material properties and behaviour;

Timber-common Indian species, classification, Seasoning;

Water for construction.

Characterization of bitumen, classification of hot mix, warm mix and cold mix asphalt;

Adhesives, paints and Varnishes;

Polymeric materials, Plastics, and composite materials. Epoxy Resin, Polyurethane, Fiberglass, FRP. Geogrid, Geotextile

CON/PC/B/TS/214 SURVEYING

Contact Hours: 3L–0T – 2P

Credits: 4

Linear measurement and corrections, Chain Survey, Prismatic compass survey, Traverse Balancing, Plane table survey, Ordinary levelling and Contouring.

Theodolite and its adjustments, Theodolite traversing, Tachometry, Spherical trigonometry, Geodetic surveying, Triangulation and trilateration, Horizontal and vertical Curves and Grids. Setting out works, Photogrammetry—scale, flying height, Remote sensing—basis, platform & sensors, visual image interpretation. Basics of Geographical Information System (GIS) & Geographical Positioning System (GPS).

Sessional class based on the above topic and include

- i) Chain survey
- ii) Contouring
- iii) Curve setting
- iv) Theodolite traversing

CON/ES/B/PE/TS/215

HYDRAULICS

Contact Hours: 3L–0T – 2P

Credits: 4

Introduction to Hydraulics, fluid continuum, properties of fluids, classification; Continuity, momentum, energy and corresponding equations.

Fluid Statics: pressure at a point, measurement of pressure with manometer, piezometer etc.

Different types of flow – steady and unsteady flow, uniform and non-uniform flow, one, two and three dimensional flow, rotational and irrotational flow, laminar and turbulent flow; stream line, streak line and path line.

Principle of conservation of mass momentum and energy. Euler's equation of motion along a stream line, physical significance of different terms and application of Bernoulli's equation. Fluid flow measurement by pitot tube, venturi meter, orifice meter, triangular and rectangular weir. Applications of momentum and energy equations: linear momentum equation.

Characteristics of laminar and turbulent Flow, critical Reynold's number; laminar flow through pipe – Hazen Poiseuille equation.

Flow through pipes, branching of pipes and pipe networks, uniform and non-uniform flow in open channels, Darcy Weisbach equation and open channel flows, Chezy's equation, Manning's equation, economical cross section, Hydraulic jumps.

Dimensional analysis and hydraulic similitude.

Basics of hydraulic machines; Introduction to centrifugal and reciprocating pumps and water turbine and their classifications.

Laboratory experiments based on above topic and include

- i) Reynold's Experiment
- ii) Stoke's law verification
- iii) Calibration of venturimeter, orifice meter, V and rectangular notches
- iv) Performance study of centrifugal and reciprocating pumps, various types of hydraulic turbines

CON/BS/B/GEO/TS/216 ENGINEERING GEOLOGY**Contact Hours: 2L-0T – 2P****Credits: 3**

Origin of earth, Geological time scale and major events in the stratigraphic column, Internal structure of Earth.

Identification of rocks and minerals: Crustal structure of minerals, Major rock forming processes, Characteristics of Igneous, Sedimentary and Metamorphic rocks.

Physiographic features of continents and oceans. Mountains and their genesis, major crustal features and plate tectonics. Elementary concept on structural Geology, folds, faults, joints and unconformities. Earthquakes and their causes. Geomorphological process.

Origin and nature of soils. Sub-surface water. Ground water systems.

Concept of Engineering Geology and its application in different 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.

Laboratory experiments based on above topic and include

- i) study and interpretation of Geological Maps
- ii) identification of rocks and minerals

CON/PC/B/S/211 CIVIL ENGINEERING DRAWING

Contact Hours: 0L-0T – 4P

Credits: 2

Architectural details in building, Brick wall foundation details, R.C. Frame structure; structural plan. Reinforced concrete detailing, foundation detailing for shallow and deep foundations. Steel truss and connection details.

CON/PS/B/S/212 SURVEY SESSIONAL & CAMP

Contact Hours: 0L-0T – 3P

Credits: 1.5

Topographical survey, Route survey, Triangulation survey, Total stations- operation and application.

SECOND SEMESTER

CON/PC/B/T/221 THEORY OF STRUCTURE-I

Contact Hours: 3L–0T – 0P

Credits: 3

Classification of structural systems, Statically determinate and indeterminate structures, supports and reactions.

Deflection of beams and trusses: Area-moment theorems, conjugate beam theorems, Strain energy principle, Castigliano's theorem, unit load method. Principle of Least work. Virtual work.

Fixed and Continuous beams: Theorem of three moments.

Columns and Struts: Buckling, Euler's theorem, Rankine's formulae, Columns with eccentric load, Bi-axial bending.

CON/PC/B/T/222 Design of Structure-I (Steel)

Contact Hours: 3L–0T – 0P

Credits: 3

Design of steel structure - General consideration, advantages and disadvantage of steel structure.

Rolled steel sections

Working stress and Limit state design concepts;

Design of tension and compression members, beams and beam- columns, column bases;

Design of connections -rivetted, bolted and welded connection, eccentric and moment connections, beam-column connections,

Plate girders and trusses;

Plastic analysis of beams and frames.

Use of IS codes

CON/PC/B/T/223 SOIL MECHANICS-I

Contact Hours: 3L–0T – 0P

Credits: 3

Introduction, Definition of soil, Formation of soil, Types of soil,

Three phase system and soil phase 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-log p 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 soils - Boussinesq's and Westergaard's theories, Pressure bulbs; Newmark's chart, Contact pressure, 2:1 method.

CON/PC/B/T/224 CONCRETE TECHNOLOGY

Contact Hours: 3L-0T – 0P

Credits: 3

Introduction, Types and composition of concrete, Grades 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. Use of Chemical admixtures in concrete, Fresh concrete -Workability, Slump test, Compacting factor test, Segregation and bleeding, Hardened concrete - Strength and Durability of concrete. Batching, Mixing, Transportation, Placing, Compaction and Curing of concrete. Construction quality control. Mix design of Concrete.

CON/HS/B/T/225 CONSTRUCTION MANAGEMENT-I

Contact Hours: 3L-0T – 0P

Credits: 3

Construction industry: Basic concepts of management. Planning Organising, Controlling & Motivating. Different schools of management. Introduction to behavioural science, Communication skills, Leadership, Applied psychology, Project Formulation, Technoeconomic study, Multidisciplinary approach, Budget allotment, Elements of accounting and finance Organisational structure, Information flow, Two-party and three-party models. In-house and off loading, Construction workflow: Types of contracts, Standard methods of works in PWD and elsewhere

CON/PC/B/T/226 CONSTRUCTION PLANTS & PROCESS

Contact Hours: 4L-0T – 0P

Credits: 4

Classification of structures based on methods and materials of construction : Timber, Masonry, Steel Framed, R.C. Framed, Prefabricated, Prestressed concrete structures, Geodesic Dome, Shells, Tension structures.

Activities related to concreting - Scaffolding, Shuttering, Centering - Conventional and Modern. Reinforcement- bending and binding. Methods of mixing, Transportation and Placing of concrete - mixers, batching plant, transit mixer, concrete pump.

Structural steel work - riveting, welding, bolting, black bolts and high tensile bolts.

Construction Techniques - Cantilever construction of bridges, Segmental construction of bridges, Slip-form construction of chimneys, Pipe pushing, Diaphragm wall, Box pushing, Well Foundation and Installation of piles

Power Transmission - Pulley, Gear (Spur, helical, bevel, worm), Chain (single, duplex, triplex, silent), Belt (flat, V, toothed), Screw (square, saw tooth, buttress), Couplings (flexible, rigid), Clutch (mechanical jaw, friction)

Steel Wire Ropes: - Grade, Construction, Core, Protection etc.,

Machineries handling soil: - Dumpers, Dozers, Shovels, Tippers, Excavators, Mini Excavators, Back hoe, Graders.

Cranes: - Mobile, Derrick, Tower, Winches, Haulers,
Pre-stressing- Cables and Anchorages, Equipment for Pre-stressing.

CON/PC/B/S/221 MATERIAL LABORATORY

Contact Hours: 0L–0T – 3P

Credits: 1.5

A course of laboratory experiments on 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-Angeles Abrasion test
4. Aggregate Impact value
5. Soundness of aggregates
6. Specific gravity and moisture absorption of aggregate.
7. Bulk Density of cement, coarse and fine aggregate
8. Crushing strength, Moisture absorption and efflorescence of Brick
9. Specific Gravity of Cement

CON/PC/B/S/222 COMPUTER AIDED CIVIL ENGG DRAWING

Contact Hours: 0L–0T – 3P

Credits: 1.5

Computer Aided Drawing (CAD). Architectural and structural details of a building. R.C. Frame structure; structural plan, Reinforced concrete detailing.

CON/PC/B/S/223 STRUCTURAL LABORATORY

Contact Hours: 0L–0T – 3P

Credits: 1.5

A course of laboratory experiments on materials used to construct structures. The list of experiments are as follows

1. Stress Strain Behaviour for the tensile test of Mild Steel
2. Stress Strain Behaviour HYSD Reinforcement Bar.
3. Load deflection behaviour of a Steel beam.
4. Structural behaviour of a flexural concrete member
5. Buckling and crushing of compression members.

THIRD YEAR

FIRST SEMESTER

CON/PC/B/T/311 THEORY OF STRUCTURE-II

Contact Hours: 3L–1T – 0P

Credits: 4

Indeterminate structures: Advantage of Indeterminate structures, compatibility equations.

Slope deflection method - Derivation of the method, Solution of different continuous beams and frame problems by slope deflection method, Consideration of support settlements, Sway of frame. Moment distribution method - Derivation of the method, Solution of different continuous beams and frame problems.

Matrix method of analysis, Derivation of the elemental stiffness matrix, transformation matrix and global stiffness matrix. Solution of truss problems by matrix method of analysis, Computation of member forces by matrix method, Introduction to finite element method. Demonstration of the method by hand computation compatible with the process by standard structural analysis computer software.

Influence lines for determinate structures, application of rolling loads.

Influence lines for indeterminate structures: Muller-Breslau's principle, Computation of different problems of influenced lines.

Two hinged arches

CON/PC/B/T/312 DESIGN OF STRUCTURE-II (CONCRETE)

Contact Hours: 3L–0T – 0P

Credits: 3

Introduction: General principle and method of design. Working stress method and Limit state method of design. IS codal stipulations

Design of Reinforced concrete slab and detailing of reinforcement,

Design of rectangular and flanged beams,

Design of columns, Significance and design of Beam-Column problems,

Design of footing: Isolated footings, Combined footing.

Design of Retaining structures,

Flat slab design consideration, Concentrated load on slab.

CON/PC/B/T/313 SOIL MECHANICS-II

Contact Hours: 3L–0T – 0P

Credits: 3

Sub-soil investigation: definition, different activities involved, Reconnaissance, Methods of boring and drilling, Collection of disturbed and undisturbed samples, Field tests like Standard Penetration Test, Plate load test, Cone Penetration test; Preparation of soil investigation report, Planning of soil investigation work.

Stability of slopes - finite and infinite slopes, method of slices and Bishop's method, Taylor's stability chart;

Earth pressure theories, Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's theory of earth pressure, Culmann's graphical construction, estimation of lateral earth pressure for point load, line load, strip load. Estimation of lateral pressure on retaining wall during earthquake

Seepage : Laplace's equation, Construction and properties of flow nets. Construction of phreatic line through earth dam. Case studies on failure of slopes and earth dam due to seepage.

CON/PC/B/T/314 TRANSPORTATION ENGINEERING

Contact Hours: 3L-0T – 0P

Credits: 3

Principles of transportation. Jayakar committee report, saturation system, Highway economics, vehicle operating cost, road development plans in India. Road and highway classification.

Geometric design of road section, Elements of cross sections and long sections in roads, sight distances, design of vertical and horizontal curves, traffic volume, speed and delay study, determination of road capacity, level of service, accident analysis, analysis of signalized intersection,

Elements of Rail transportation permanent way. Classification of rail routes and gauges, rail section, ballast, sleepers, rail embankments. Cant deficit, cant excess, equilibrium cant Design of railway curves, Points and crossings, Elementary idea of multimodal transportation network.

CON/PC/B/T/315 WATER RESOURCES & IRRIGATION ENGG

Contact Hours: 3L-0T – 0P

Credits: 3

Water uses: Quantity, requirements, potable water quality; source of water, development of surface sources; reservoir volume; transmission of water. Water distribution system including typical flow sheet. Treatment of water: typical flowsheets for surface and underground sources; sedimentation; coagulation, flocculation; filtration, disinfections, hardness and chemical softening; rudiment and ion-exchange; elements of rural water supply.

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. Types of Irrigation systems and their detailed descriptions, soil water crop relationship, types of soil, water requirement of crops: Delta and Base Period, Duty.

Classification of river; River regime theory, river training works. Irrigation canals: design principles of irrigation canals.

CON/PC/B/T/316 ENVIRONMENTAL ENGINEERING

Contact Hours: 3L-0T – 0P

Credits: 3

Sanitary wastewater and storm water run off; quantity estimate; sewerage systems and their design principles; sewer construction materials; sewer appurtenances; estimating design sewerage discharge, design period & future forecast, estimating peak drainage discharge, hydraulic design of sewer system; characteristics of domestic waste water; Quality & Characteristics of sanitary sewage and storm water runoff; typical flow sheet for primary and secondary treatment; design principles for screen; Conventional methods of wastewater treatment like sedimentation,

coagulation, flocculation, grit removal, bio-filter, activated sludge process, trickling filter and septic tank; elements of rural sanitation;

CON/PC/B/S/311 CONCRETE LABORATORY

Contact Hours: 0L–0T – 3P

Credits: 1.5

A course of laboratory experiments on properties of cement and concrete mix design. The following tests / design to be performed

- i) Consistency of cement
- ii) Initial and Final setting time of cement
- iii) Fineness of cement
- iv) Compressive strength of cement
- v) Mix design of concrete
- vi) Slump test
- vii) Compacting Factor test
- viii) Cube compressive strength of concrete

CON/PS/B/S/312 STRUCTURAL DESIGN PROJECT-I (STEEL)

Contact Hours: 0L–0T – 4P

Credits: 2

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

CON/PC/B/S/313 SOIL MECHANICS LABORATORY

Contact Hours: 0L–0T – 3P

Credits: 1.5

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

- i) Visual identification
- ii) Sieve analysis
- iii) Hydrometer analysis
- iv) Specific gravity
- v) Moisture content
- vi) Bulk and Dry density
- vii) Liquid Limit, Plastic Limit & Shrinkage Limit
- viii) Consolidation test
- ix) Unconfined compression test
- x) Undrained triaxial test
- xi) Direct shear test
- xii) Standard Proctor's Compaction test
- xiii) Modified Proctor's compaction test
- xiv) Constant head and Falling head permeability test

SECOND SEMESTER

CON/PC/B/T/321 BRIDGE ENGINEERING

Contact Hours: 3L–0T – 0P

Credits: 3

Introduction: Different components of a bridge, Survey and selection of bridge site and collection of design data for bridge projects, Different techniques of construction of bridges.

Classification of bridges: 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, movable bridges, Estimation of design discharge, Scour depth, Linear water way,

Bridge loading, IRC codes and stipulations, Load distribution in bridge decks, Design of culvert or slab type bridge,

Design of different component of Girder type Bridges
Design of Piers and abutments, Wing wall and retaining wall,

Shallow and Deep foundation of bridges,
Bridge bearings, Expansion joints and wearing coarse, River training works.

CON/PC/B/T/322 FOUNDATION ENGINEERING

Contact Hours: 3L–0T – 0P

Credits: 3

Analysis of bearing capacity and settlement of foundation from mechanistic approach; 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. Empirical relationship for determination of bearing capacity and settlement from field test data. 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, pile group capacity, settlement of pile groups, Pile load test, Negative skin friction, pile caps.

Cassion /Well : Types of well, Sinking of wells, Tilt and Shift of well and their rectification, Calculation of scour depth.

CON/PC/B/T/323 DESIGN OF STRUCTURE-III (HIGH RISE)

Contact Hours: 3L–0T – 0P

Credits: 3

Analysis and design of tall building. structural components.

Wind load analysis for buildings, Stipulations of IS: 875 for wind load,

Earthquake forces, Stipulations of IS: 1893 for seismic load,

Earthquake resistant design: Equivalent static method & introduction to response spectra method,

Analysis of building frames by Portal Method and cantilever method.

Introduction to shear wall consideration.

Analysis and design of formwork,

Introduction of machine foundation,

Introduction of Industrial structure – definition and special features etc.

CON/PC/B/T/324 ESTIMATING & PRICING

Contact Hours: 3L–0T – 0P

Credits: 3

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.

CON/PC/B/T/325 HIGHWAY ENGINEERING

Contact Hours: 3L–0T – 0P

Credits: 3

Characterization of soil as sub-grade by DCPT, CBR, Plate Load tests and FWD test. Characterization of coarse aggregate and fine aggregate,

Classification of Bitumen including penetration grade, cut-back and emulsified bitumen. Physical and chemical tests on bitumen.

Characterization of bituminous mix including HMA, WMA and CMA. Elementary idea of pavement design using two layered and three layer theory using stress based and strain based approach, Burmister method based on surface deflection, Huang's method based on interface deflection, Empirical methods of pavement design,

Design of bituminous mix. Design and construction flexible and rigid pavement. Design of overlay.

Different forms of distress in pavement, Elements of airport planning. Design of runway and taxiway.

CON/PC/B/T/326 PRE-CAST & PRE-STRESSED CONCRETE

Contact Hours: 3L–0T – 0P

Credits: 3

Precast concrete: Advantages and Limitations, different types of pre-cast elements, Joints and connections of pre-cast elements, composite elements.

Pre-stressed concrete: Principle of pre-stressing, methods of pre-stressing, partial pre-stressing, two way pre-stressing, circular pre-stressing.

Pre-stress losses: slip, shrinkage, creep, relaxation, elastic shortening of concrete,

Evaluation of extreme fibre stresses at different stages of pre-stressing.

Lever Arm Concept: Pressure line and cable profile of pre-stressing, efficiency of pre-stressed section, Anchorage zone stresses.

Design of pre-stressed beams. Composite construction with pre-stressing.

CON/PS/B/S/321 STRUCTURAL DESIGN PROJECT-II (CONCRETE)

Contact Hours: 0L–0T – 4P

Credits: 2

Analysis and design of a multi-storied residential building and preparation of general arrangement and reinforcement drawing.

CON/PC/B/S/322 HIGHWAY LABORATORY

Contact Hours: 0L–0T – 3P

Credits: 1.5

A course of laboratory experiments on Highway engineering. The list of experiments are as follows.

- i) Ductility of bitumen
- ii) Penetration of bitumen
- iii) Softening point of bitumen
- iv) Mix design by Marshal method
- v) CBR test
- vi) Moisture susceptibility of HMA
- vii) Indirect tensile test
- viii) Skid resistance

CON/PS/B/S/323 LITERATURE REVIEW & SEMINAR PRESENTATION

Contact Hours: 0L–0T – 3P

Credits: 1.5

Review of literature on relevant topics and presentation by individual students

FOURTH YEAR

FIRST SEMESTER

CON/PC/B/T/411 CONSTRUCTION MANAGEMENT-II

Contact Hours: 3L-0T – 0P

Credits: 3

Construction Infrastructure: power, water, access, housing, security, storage, plant, maintenance, communication, welfare.

Enabling Works: Progress control; safety and Quality control, Planning and Scheduling like Gantt chart, Milestone chart, PERT and CPM. Construction sustainability, Monitoring and updating, Material procurement, storage and inventory control, Elements of accounting

Labour management: Basic concepts in law, construction Acts like Contract Labour, Payment of Wages, Minimum Wages, Workman's Compensation, Interstate Labour, Trade Union, Industrial Disputes etc.

CON/PC/B/T/412 UNDERGROUND CONSTRUCTION

Contact Hours: 3L-0T – 0P

Credits: 3

Types and classification of underground opening, alignment and location.

Braced excavation. Types of bracing system. Stability considerations. Earth pressure and strut load.

Dewatering. Field pumping test, common dewatering methods.

Bulkheads and anchored bulkhead. Cellular cofferdams. Soil and rock anchors

Ground settlement and control measures.

Tunnels and shafts: Stability considerations. Design of tunnel linings. Construction procedure and instrumentation. Soft ground tunnelling. Methods of tunnelling control of seepage and ground loss.

CON/PC/H/T/413 EARTHQUAKE ENGINEERING AND DYNAMIC ANALYSIS

Contact Hours: 3L-1T – 0P

Credits: 4

Elements of Earthquake and its effect on structures.

Characteristics of earthquake. Earthquake Resistance philosophy. Near field & Far field effect.

Structural dynamics: Single degree of freedom system - Free vibration: natural frequency, time period, damped vibration. Forced vibration: Resonance, transient vibration, dynamic load factor.

Free vibration of Multiple degree of freedom system, Fundamental and higher mode frequencies, mode shape. Vibration isolation, earthquake motion, application of structural dynamics to earthquake engineering.

HONOURS ELECTIVE - I

CON/PE/H/T/414A : ADVANCED FOUNDATION TECHNIQUE (HONOURS ELECTIVE – I)

Contact Hours: 3L–1T – 0P

Credits: 4

Soil stabilization, Foundations in difficult ground, Foundations of expansive soil. Preloading and sand drains, sand wicks, band drains, PVDs, Vibroflotation, Stone columns, Geosynthetics and their application; Stress path and its applications; Introduction to Geotechnical Earthquake Engineering including Liquefaction analysis.

CON/PE/H/T/414B Advance Transportation Engineering (HONOURS ELECTIVE – I)

Contact Hours: 3L–1T – 0P

Credits: 4

Design of flexible and rigid pavement using IRC guidelines for high volume road pavements including fatigue analysis, design of contraction and expansion joints, design of dowel bars, Design of pavement by AASTHO method. Design of overlay using Falling weight deflectometer . Prediction of remaining life of pavement. Design of airfield pavement by ACN-PCN method. Condition monitoring of pavement by Bump integrator. Skid resistance of pavement. Causes of damage and distress in flexible and rigid pavement. Repair of pavements. Repair materials.

HONOURS ELECTIVE - II

CON/PE/H/T/415A Fabrication Technology (HONOURS ELECTIVE – II)

Contact Hours: 3L–1T – 0P

Credits: 4

Introduction: Fabrication, Erection and Alignment. Importance of fabrication technology.

Fabrication procedure, Shop and site fabrication, sequence of activities: surface cleaning, cutting and machining, punching and drilling, straightening, fitting and reaming. Fastening: riveting, bolting, welding.

Welding Technology: Weldability, Different processes of weld, Fillet and Butt weld, Weld defects and acceptance criterion, Residual stress and distortion, Inspection & quality control of welding,

Non-destructive test, radiographic and ultrasonic testing of welds.

Erection planning,

Treatment against corrosion.

CON/PE/H/T/415B ADVANCED CONCRETE TECHNOLOGY (HONOURS ELECTIVE – II)

Contact Hours: 3L–1T – 0P

Credits: 4

Chemical properties of cement, hydration of cement, structure of hydrated cement phase, microstructure of concrete,

Properties of concrete in fresh and hardened state

Stress-strain curve of concrete, dimensional stability, creep and shrinkage,

Chemical and mineral admixtures, high performance concrete, self compacting concrete, fiber reinforced concrete, mass concrete, roller compacted concrete,

Cold and hot weather concrete,

Concrete mix design

Durability of concrete.

OPEN ELECTIVE I**Contact Hours: 3L–0T – 0P****Credits: 3**

To be selected by individual students from available common basket of elective subjects.

CON/PS/B/S/411 STRUCTURAL DESIGN PROJECT III (HIGH RISE)**Contact Hours: 0L–0T – 4P****Credits: 2**

Structural Design project- Analysis and design of a multi-storeyed building considering dead load, live load, wind load, seismic load and combinations. Ductile detailing. Preparation of design basis report, design document and working drawings.

CON/PS/B/S/412 ESTIMATING & PRICING PROJECT**Contact Hours: 0L–0T – 3P****Credits: 1.5**

Preparation of item of works, quantity estimate and rate analysis for i) Residential building, ii) Road works.

CON/PC/H/T/421 CONSTRUCTION QUALITY & SAFETY MANAGEMENT**Contact Hours: 3L–1T – 0P****Credits: 4**

Definition of quality as given by Deming, Juran, Crosby etc; Quality Assurance (QA/QC); Total quality control; Total Quality Management, TQM in construction industry. Quality manual, responsibility matrix, monitoring, PDCA Cycle, Quality aspects of Construction project, Introduction to Health, Safety and Environment, Enforcement of Health and Safety Laws, Personal Protective Equipment, Safety Training, Construction hazards and Prevention, Safety Policies, Safety laws and standards. Safety Reliability and Safety Information

BASIC ELECTIVE -I

CON/PE/B/T/422A REPAIR REHABILITATION AND MAINTENANCE OF STRUCTURE (BASIC ELECTIVE –I)

Contact Hours: 3L–0T – 0P

Credits: 3

Definitions, Causes of defects, damage and deterioration, Investigation of distress through Non-destructive tests, Type of repair materials and its selection. Repair and retrofitting technique: Surface preparation, treatment of corroded reinforcements, patch repair, grouting, structural strengthening, water proofing treatment, underpinning, case studies.

CON/PE/B/T/422B DISASTER MITIGATION ENGINEERING (BASIC ELECTIVE – I)

Contact Hours: 3L–0T – 0P

Credits: 3

Different types of disasters and history. Natural and man-made disaster. Hazard and Risk due to various disasters: Earthquake, Flood, Wind and Storms, Blast and Explosion, etc. Effect of disasters on structural safety and durability. Introduction to vulnerability mapping and loss computation. Engineering Mitigation approaches: Prevention, Prediction and Preparedness. Mandate for Disaster Management and Disaster Mitigation. Approach to reduce vulnerability, Performance enhancement of Structures against earthquake and storms. Rehabilitation methodology Cyclone shelter, Flood control, Holistic approach for multi-faced disaster mitigation.

HONOURS ELECTIVE – III

CON/PE/H/T/423A ADVANCED ENVIRONMENTAL ENGINEERING (HONOURS ELECTIVE – III)

Contact Hours: 3L–1T – 0P

Credits: 4

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. Chlorination, Alkalinity, Bar diagram; Flow sheets for treatment of ground water, surface water and flow sheets for conventional primary and secondary treatment methods. 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, its limiting values (MINAS) and units, effects and remedial measures.

Community Solid Wastes, Sources, Quantity & Characteristics, Collection & transfer methods, methods of disposal, reuse & recycling

CON/PE/H/T/423B ALTERNATIVE MATERIALS & SUSTAINABLE CONSTRUCTION (HONOURS ELECTIVE – III)

Contact Hours: 3L–1T – 0P

Credits: 4

An Introduction to sustainability concepts and Life Cycle analysis, Sustainability and Construction Engineering.

Environmental concerns - Energy use and global warming, Greenhouse gas emissions and climate change, surface run off.

Sustainability issues for concrete; Minimization of natural resource utilization. Concrete with alternative material for sustainability, Recycled aggregates.

Role of Material: Carbon from cement, role of cement in climate change, alternative fuel for cements for reduction in carbon emission, alternative cements and cementitious material, role of supplementary cementitious material, high volume fly ash concrete, Geo-polymer concrete, Pervious concrete, Roller compacted concrete.

Minimization of use of water in construction. Chemical admixtures in concrete and sustainability, Recycled and alternative material in road construction

Sandwiched panel for affordable sustainable construction

Role of repair and rehabilitation in sustainable construction.

Paints, Adhesive and sealants for use in building, Volatile organic content (VOC) emission, Issues and indoor air quality for Sustainability and Health hazard

Energy codes ECBC requirement, Concepts of OTTV, Green Performance rating, requirement of ECBC, LEED, GRIHA etc. Concept of Green Building.

BASIC ELECTIVE -II

CON/PE/B/TS/424A COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN (BASIC ELECTIVE –II)

Contact Hours: 2L–0T – 4P

Credits: 4

Matrix and finite element method of analysis. Use of structural engineering software packages for analysis and design of RC frame structure, steel truss.

CON/PE/B/TS/424B COMPUTER AIDED CONSTRUCTION MANAGEMENT (BASIC ELECTIVE –II)

Contact Hours: 2L–0T – 4P

Credits: 4

Fundamentals and practical use of information technologies in the construction industry; basic concepts of building information modelling (BIM); Introduction to planning, scheduling and

estimating in common software systems, Linking CAD and drawing software with site control systems, Information collection, storage, dissemination, management and maintenance in cloud environment.

OPEN ELECTIVE II

Contact Hours: 3L-0T – 0P

Credits: 3

To be selected by individual students from available common basket of elective subjects.

CON/PS/B/S/421 PROJECT ON CONSTRUCTION MANAGEMENT

Contact Hours: 0L-0T – 4P

Credits: 2

Students shall be introduced to the construction documentations. Hands on experiences on items like contract, tender, work order, earnest money, performance guarantee, varieties of registers, measurement books, inspection registers, payment procedures etc. shall be provided. Other issues related to departmental materials, time extensions and general guidance to CPWD contract clauses shall be also presented. CPWD works manual shall be mainly used as the standard.

CON/PS/B/T/422 GRAND VIVA

Contact Hours: 0L-2T – 0P

Credits: 2

Grand Viva based on entire curriculum