Civil Engineering Department

Syllabus of MST I, II and III

Index

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Syllabus of MST
Semester 4th

BTCE-401 Geomatics Engineering

MST-I	1. **Photogrammetry** Introduction, Basic Principles, Photo-Theodolite, Elevation of a Point by Photographic Measurement, Aerial Camera, Vertical Photograph, Tilted Photograph, Scale, Crab and Drift, Flight Planning for Aerial Photography, Ground Control for Photogrammetry, Photomaps and Mosaics, Stereoscopic Vision, Stereoscopic parallax, Stereoscopic Plotting Instruments, Applications. 2. **Global Positioning System (GPS)** Introduction, Fundamental concepts, GPS system elements and signals, GPS measurements and accuracy of GPS, Satellite Movement, GPS Satellites, Co-ordinate systems - Geoids, Ellipsoid and Datum, Spheroid, Customised Local Reference Ellipsoids, National Reference Systems, Worldwide Reference Ellipsoid, WGS 84, Differential-GPS, Classification of GPS receivers, GPS Applications. 3. **Electromagnetic Distance Measurement (EDM)** Electromagnetic Waves, Carrier Waves, Black body radiation, Laws of radiation Modulation, Types of EDM Instruments
MST-II	1. **Remote Sensing** Introduction, Basic Principles, Electromagnetic (EM) Energy Spectrum, EM Radiations and the Atmosphere, Interaction of EM radiations with Earth's Surface, Types of remote sensing systems, Remote Sensing Observation Platforms, Satellites and their characteristics – Geostationary and sun-synchronous, Earth Resources Satellites, Meteorological satellites, Sensors, Types and their characteristics, Across track and Along track scanning, Applications of Remote Sensing. 2. **Electromagnetic Distance Measurement (EDM)** Electro-optical, Infrared, and Microwave EDM Instruments, Effect of Atmospheric Conditions, The Geodimeter, The Tellurometer, Wild Distomats, Electronic Total Station
MST-III	Complete Syllabus

BTCE-402 Construction Machinery and Works Management

MST-I	1. **INTRODUCTION:** Need for project planning & management, time, activity & event, bar chart, Milestone chart, uses & draw backs. 2. **PERT :**Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project, numerical problems. 3. **CPM:** Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control, numerical problems.
MST-II	1. **COST ANALYSIS AND CONTRACT:** Type of costs, cost time relationships, cost slopes, conducting a crash programme, determining the minimum total cost of project, numerical problems. updating a project, when to update, time grid diagram, resource scheduling. planning of different components of civil engineering projects such as a house, workshop, dam, tunnel. 2. **CONSTRUCTION EQUIPMENT AND MACHINERY:** Tractors, bull dozers, rippers, scrappers, power shovels, dragline, hoes. Line diagram of each, sizes, output, uses, factors affecting selection of each equipment, economic life of equipment,maintenance and repair cost. Hoisting & Transporting Equipments: Hosts, Winches, Cranes, Belt conveyors, Ropeways, trucks & Wagons. 3. Plants for grading, batching, mixing, types of mixers, concrete pumps, bitumen plants.
MST-III	Complete Syllabus

BTCE-403 Design of Concrete Structures-I

MST-I	1. CEMENTS & ADMIXTURES: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different Grades of cement – Admixtures – Mineral and chemical admixtures. 2. AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size. 3. Properties of Concrete: Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water, Abram's Law , Factors affecting strength; Characteristics strength of concrete, Target strength, Modulus of elasticity, Modulus of rupture 4. MIX DESIGN: Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.
MST-II	1. Objectives and Methods of Analysis and Design 2. Properties of Concrete and Steel 3. Design Philosophies of Working Stress Method and Limit State Method 4. Limit State of Collapse – Flexure 5. Computation of Parameters of Governing Equations 6. Determination of Neutral Axis Depth and Computation of Moment of Resistance 7. Numerical Problems on Singly Reinforced Rectangular Beams 8. Doubly Reinforced Beams – Theory and Problems 9. Flanged Beams – Theory and Numerical Problems 10. Shear
MST-III	Complete Syllabus

BTCE-404 Fluid Mechanics-II

MST-I	1. **Laminar Flow:** Navier-stokes equations in Cartesian coordinates (no derivation), meaning of terms ,Flow through circular section pipe, flow between parallel plates, stokes law. Flow through porous media,. Transition from laminar to turbulent, Critical velocity and critical Reynolds Number 2. **Turbulent Flow:** Turbulent flows and flow losses in pipes, Darcy equation minor head losses in pipe fittings, hydraulic and energy gradient lines. Definition of turbulence, scale and intensity, Effects of turbulent flow in pipes. Equation for velocity distribution in smooth and rough pipes (no derivation). Resistance diagram.
MST-II	1. **Boundary Layer Analysis:** Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. 2. **Uniform flow in open Channels:** Flow classifications, basic resistance Equation for open channel flow. Chezy, Manning, Bazin and Kutter formulae. Variation of roughness coefficient, conveyance and normal depth. Velocity Distribution. Most efficient flow sections; rectangular, trapezoidal and circular. 3. **Energy and Momentum principles and critical flow:** Energy and specific Energy in an open channel; critical depth for rectangular and trapezoidal channels. Alternate depths
MST-III	Complete Syllabus

BTCE-405 Irrigation Engineering-I

MST-I	1. **INTRODUCTION**:Importance of Irrigation Engineering, purposes of Irrigation, objectives of Irrigation, Benefits of Irrigation, Advantages of various techniques of irrigation- - Furrow Irrigation, Boarder strip Irrigation, Basin Irrigation, Sprinkler Irrigation , Drip Irrigation. 2. **METHODS OF IRRIGATION**:Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta , Duty of water, Base Period, relation between delta, duty and base period, Soil crop relation-ship and soil fertility. 3. **CANAL IRRIGATION**:Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories.
MST-II	1. **LINED CANALS**:Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining. 2. **LOSSES IN CANALS, WATER LOGGING AND DRAINAGE**:Losses in canalsEvaporation and seepage, water logging, causes and ill effects of water logging anti wter logging measures. Drainage of land, classification of drains - surface and subsurface drains, Design considerations for surface drains, Advantages and maintenance of tile drains. 3. **TUBE - WELL IRRIGATION** :Types of tube wells - strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability,transmissibility and storage. Yield or discharge of a tube well, Assumptions , Theim's & Dupuit's formulae, Limitations of Theim's and Dupuit's formulae. Interference of tube wells with canal or adjoining tube-wells, causes of failure of tubewells, optimum capacity, Duty and delta of a tube well. Rehabilitation of tubewell.
MST-III	Complete Syllabus

BTCE-406 Structural Analysis - I

MST-I	1. **Displacements:** Concept; Governing differential equation for deflection of straight beams; Following methods for determination of structural displacements: 1. Geometric Methods: Double integration; Macaulays method; Moment area method; Conjugate beam method. 2. Energy Methods: Strain energy in members, , Betti's and Maxwell's Laws of reciprocal deflections, Concept of Virtual work and its applications, Castigliano's theorems, unit load method, deflections of trusses and 2D-frames.
MST-II	1. **Moving Loads and Influence Line Diagrams:** Concept of influence line diagram, rolling loads; Bending moment and shear force diagrams due to single and multiple concentrated rolling loads, uniformly distributed moving loads; Equivalent UDL; Muller Breslau principle; Influence lines for beams, girders with floor beams and frames; calculation of the maximum and absolute maximum shear force and bending moment; Concept of envelopes; Influence line for displacements; Influence line for bar force in trusses. 2. **Trusses**
MST-III	Complete Syllabus

Syllabus of MST
Semester 6th

BTCE-601 Design of Concrete Structures-II

MST-I	1. Compression Members: Definitions, Classifications, Guidelines and Assumptions, Design of Short Axially Loaded Compression Members, 2. Foundations - Theory and Design: Isolated Footing (Square, Rectangular), Combined Footing(Rectangular, Trapezoidal, Strap), Raft Footing
MST-II	1. Design of Short Compression Members under Axial Load with Uniaxial and biaxial Bending, Preparation of Design Charts, Design of Slender Columns 2. Design of Retaining walls: Cantilever type retaining wall, Counterfort type retaining wall. 3. Design of Continuous beams and curved beam
MST-III	Complete Syllabus

BTCE-602 Elements of Earthquake Engineering

MST-I	1. Introduction to Earthquakes, Causes of Earthquakes, Basic Terminology, Magnitude, Intensity, Peak ground motion parameters. 2. Past Earthquakes and Lessons learnt, Various Types of Damages to Buildings.
MST-II	1. Introduction to theory of Vibrations, Sources of Vibrations, Types of Vibrations, Degree of Freedom, Spring action and damping, Equation of motion of S.D.O.F. systems, Undamped, Damped system subjected to transient forces, general solution, green's function. 2. Lateral Force analysis, Floor Diaphragm action, moment resisting frames, shear walls.
MST-III	Complete Syllabus

BTCE-603 Foundation Engineering

MST-I	1. **Soil Investigation**: Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance. Essential features and application of the following types of samplesOpen Drive samples, Stationery piston sampler, Rotary sampler, Geophysical exploration by seismic and resistivity methods. Bore Hole log for S.P.T. 2. **Shallow Foundation**: Type of shallow foundations, Depth and factors affecting it.Definition of ultimate bearing capacity, safe bearing capacity and allowable bearing capacity. Rankine's analysis and Terzaghi's analysis.Types of failures. Factors affecting bearing capacity. Skemptons equation. B.I.S.recommendations for shape, depth and inclination factors. Plate Load test and standard penetrationTest. Bosussinesq equation for a point load, uniformly loaded circular and rectangular area, pressure distribution diagrams. Newmarks chart and its construction. 2:1 method of load distribution. Comparison of Bosussinesq and Westerguard analysis for a point load. Causes of settlement of structures, Comparison of immediate and consolidation settlement, calculation of settlement by plate load Test and Static Cone penetration test data. Allowable settlement of various structures according to I.S. Code. Situation most suitable for provision of rafts, Proportioning of rafts,Methods of designing raft, Floating foundation.
MST-II	1. **Pile Foundations**: Necessity and uses of piles, Classification of piles, Merits and demerits of different types based on composition. Types of pile driving hammers & their comparison. Effect of pile driving on adjacent ground. Use of Engineering News Formula and Hiley's Formula for determination of allowable load. Limitations of pile driving formulae. Cyclic Pile Load Test, Separation of skin friction and point resistance using cyclic pile load test. Determination of point resistance and frictional resistance of a single pile by Static formulas. Piles in Clay, Safe load on a Friction and point Bearing pile. Pile in sand, Spacing of piles in a group, Factors affecting capacity of a pile group, Efficiency of pile group by converse - Labare formula and feeds formulas. Bearing capacity of a pile group in clay by block failure and individual action approach. Calculation of settlement of friction pile group in clay. Related Numerical problems. Settlement of pile groups in sand, Negative skin friction.Related numerical problem 2. **Caissons and Wells**: Major areas of use of caissons, advantages and disadvantages of open box and pneumatic caissons. Essential part of a pneumatic caisson. Components of a well foundation.Calculation of allowable bearing pressure. Conditions for stability of a well, Forces acting on a well foundation. Computation of scour depth.
MST-III	Complete Syllabus

BTCE-604 Numerical Methods in Civil Engineering

MST-I	1. **Equation**: Roots of algebraic transcendental equation, Solution of linear simultaneous equations by different methods using Elimination, Iteration, Inversion, Gauss-Jordan and method. Homogeneous and Eigen Value problem, Nonlinear equations, Interpolation.
MST-II	1. **Finite Difference Technique**: Initial and Boundary value problems of ordinary and partial differential equations, Solution of Various types of plates and other civil engineering related problems 2. **New Marks Methods**: Solution of determinate and indeterminate structures using Newmarks Procedure (Beam)
MST-III	1. **Statistical Methods**: Method of correlation and Regression analysis for fitting a polynomial equation by least square 2. **Initial Value problem**: Galerkin's method of least square, Initial Value problem by collocation points, Rungekutta Method 3. **New Marks Method:** Implicit and explicit solution, solution for nonlinear problems and convergence criteria

BTCE-605 Professional Practice

MST-I	1. **Specifications**- For different classes of building and Civil engineering works. 2. Method of building estimates, types, site plan index plan, layout plan, plinth area, floor area, Technical sanction, administrative approval, estimate of buildings
MST-II	1. **Schedule of Rates, analysis of rates**- For earthwork, concrete work, D.P.C., stone masonry, plastering, pointing, roadwork 2. Rules and measurements for different types of Civil engineering works. 3. **Estimates**- roads, earthwork, R.C.C. works, sloped roof, roof truss, masonry platform, complete set of estimate.
MST-III	Complete Syllabus

BTCE-606 Environmental Engineering- II

MST-I	1. **Introduction:** Terms & definitions, systems of sanitation and their merits and demerits, system of sewerage, choice of sewerage system and suitability to Indian conditions. 2. **Sewerage System:** Generation and estimation of community Sewage, flow variations, storm water flow, types of sewers. Design of sewers and storm water sewers, construction & maintenance of sewers, sewer appurtenances, sewage pumping and pumping stations. 3. **Characteristics of Sewage:** Composition of domestic and industrial sewage, sampling, physical, chemical and microbiological analysis of sewage, biological decomposition of sewage, BOD and BOD kinetics, effluent disposal limits.
MST-II	1. **Treatment of Sewage:** Introduction to unit operations and processes - Primary treatment; screening (theory), grit chamber (theory and design), floatation units, sedimentation tanks (theory and design), Secondary treatment units; ASP (theory and design), Sequencing batch reactors (theory and design), Trickling filters (theory and design) Anaerobic systems; Anaerobic filters (theory), UASB (theory), Anaerobic lagoons, Sludge Handling and disposal; thickening, stabilization, dewatering, drying and disposal.
MST-III	Complete Syllabus

Syllabus of MST
Semester 8th

BTCE-801 Design of Steel Structures- II

MST-I	1. Elements of a plate girder, design of a plate girder, curtailment of flanges, various type of stiffeners.
MST-II	1. Design of steel foot bridge with parallel booms and carrying wooden decking, using welded joints. 2. Complete design of an industrial shed including: i) Gantry girder ii) Column bracket iii) Mill bent with constant moment of inertia iv) Lateral and longitudinal bracing for column bent
MST-III	Complete Syllabus

BTCE-802 Disaster Management

MST-I	1. **Introduction to Disaster Management**: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle. 2. **Disaster Mitigation and Preparedness:** *Natural Hazards*: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. *Man-made hazards*: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas. 3. **Hazard and Risk Assessment: A**ssessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.
MST-II	1. **Emergency Management Systems (EMS):** Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation. 2. **Capacity Building:** Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.
MST-III	Complete Syllabus

BTCE-803 Irrigation Engineering - II

MST-I	1. **Head Works**: Types of head works, Functions and investigations of a diversion head work: component parts of a diversion head work and their design considerations, silt control devices. 2. **Theories of Seepage**: Seepage force and exit gradient, assumptions and salient features of Bligh's Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness. 3. **Design of Weirs**: Weirs versus barrage, types of weirs, main components of weir, causes of failure of weir and design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.
MST-II	1. **Energy Dissipation Devices**: Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipators and their hydraulic design. 2. **Canal Regulators**: Offtake alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape. 3. **Canal Falls**: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.
MST-III	Complete Syllabus

BTCE-804 Transportation Engineering - II

MST-I	1. **Introduction to Railway Engineering**: History of Railways, Development of Indian Railway, Organisation of Indian Railway, Important Statistics of Indian Railways. Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge. 2. **Railway Track**: Requirements of a Good Track, Track Specifications on Indian Railways, Detailed Cross-Section of Single/Double Track on Indian Railways. Components of Railway Track: Rails, Sleepers, Ballast, Subgrade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails. 3. **Geometric Design of Railway Track**: Alignment, Gradients, Horizontal Curve, Super elevation, Equilibrium Cant, Cant Deficiency, Transition Curves.
MST-II	1. **Points and Crossings**: Functions, Working of Turnout, Various types of Track Junctions and their layouts, Level-crossing. 2. **Railway Stations & Yards**: Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations & Yards 3. **Signaling and Interlocking**: Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signaling, Principal of Interlocking. 4. **Introduction to Airport Engineering**: Air Transport Scenario in India and Stages of Development, National and International Organizations. 5. **Airport Planning**: Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport. Obstructions and Zoning Laws, Imaginary Surfaces, Approach Zones and Turning Zones.
MST-III	Complete Syllabus

BTCE-809 Pre-stressed Concrete

MST-I	1. **Materials for prestressed concrete and prestressing systems** High strength concrete and high tensile steel – tensioning devices – pretensioning systems – post tensioning systems. 2. **Analysis of prestress and bending stresses** Analysis of prestress – resultant stresses at a sector – pressure line or thrust line and internal resisting couple – concept of load balancing – losses of prestress 3. **Strength of prestressed concrete sections in flexure, shear and torsion** Types of flexural failure – strain compatibility method
MST-II	1. Deflection of beams. 2. IS: 1343 code procedure – design for limit state of shear and torsion.
MST-III	Complete Syllabus

BTCE-810 Ground Improvement Techniques

MST-I	1. **Introduction to soil improvement without the addition of materials** - dynamic compaction equipment used - application to granular soils - cohesive soils - depth of improvement – environmental considerations - induced settlements - compaction using vibratory probes - vibro techniques vibro equipment - the vibro compaction and replacement process - control of verification of vibro techniques- vibro systems and liquefaction - soil improvement by thermal treatment - preloading techniques surface compaction introduction to bio technical stabilization 2. **Introduction to soil improvement with the addition of materials** - lime stabilization - lime column method - stabilization of soft clay or silt with lime - bearing capacity of lime treated soils - settlement of lime treated soils - improvement in slope stability - control methods
MST-II	1. **Soil improvement using reinforcing elements** - introduction to reinforced earth - load transfer mechanism and strength development - soil types and reinforced earth - anchored earth nailing reticulated micro piles - soil dowels - soil anchors - reinforced earth retaining walls 2. **Geotextiles** - Behaviour of soils on reinforcing with geotextiles - effect on strength, bearing capacity, compaction and permeability - design aspects - slopes - clay embankments - retaining walls – pavements 3. Chemical grouting - commonly used chemicals - grouting systems - grouting operations - applications - compaction grouting introduction - application and limitations - plant for preparing grouting materials - jet grouting - jet grouting process - geometry and properties of treated soils - applications - slab jacking - gravel - sand stone columns
MST-III	

BTCE-817 Hydrology and Dams

MST-I	1. Introduction, Precipitation: Importance of hydrological data in water resources planning. The hydrologic cycle. Mechanics of precipitation, types and causes, measurement by rain gauges, Gauge net-works, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves, depth area-duration curves. 2. a) Interception, Evapo-transptration and Infiltration: Factors affecting interception, evaporation from free water surfaces and from land surfaces, transpiration, Evapo-transpiration. b) Infiltration Factors affecting infiltration, rate, Infiltration capacity and its determination.
MST-II	1. Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Synder's synthetic unit hydrograph. 2. Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph. 3. Gravity Dams-Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, elementary profile of a dam.
MST-III	Complete Syllabus

BTCE-818 Pavement Design

MST-I	1. **Introduction:** Types of pavement structure. Functions of pavement components, Factors affecting pavement design, Design wheel load, Strength characteristics of pavement materials. Comparison of flexible and rigid pavements. 2. **Design of Flexible Pavements:** General design considerations, Methods for design of flexible pavements – Group Index Method
MST-II	1. **Design of Flexible Pavements:** Triaxial Test Method, Hveem Stabilometer Method, McLeod's Method, Indian Roads Congress Method. 2. **Design of Rigid Pavements:** General design considerations, Westergard's Analysis, Methods for design of rigid pavements - PCA method, AASHTO Method, Indian Roads Congress Method, Types and design of Joints in cement concrete pavements.
MST-III	Complete Syllabus