COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In
Civil

Course Structure

First Year

First Semester

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<td>Numerical Methods in Civil Engineering</td>
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<td>MFC2</td>
<td>Applied Elasticity &amp; Plasticity</td>
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<td>MFC3</td>
<td>Behaviour &amp; Design of reinforced Concrete Structure</td>
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<td>MFC4</td>
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Syllabus

MFC1 : NUMERICAL METHODS IN CIVIL ENGINEERING

1. INTRODUCTION TO NUMERICAL COMPUTING

2. INTRODUCTION TO COMPUTERS AND COMPUTING CONCEPTS

3. COMPUTER CODES & ARITHMETICS
Introduction, Objective, Decimal System, Binary Systems, Hexadecimal System, Conversion Of Numbers, Representation Of Number, Octal Hexadecimal Conversion, Computer Arithmatic, Errors In Arithmetic, Laws Of Arithmatic, Summary

4. APPROXIMATIONS AND ERRORS IN COMPUTING
Introduction, Objective, Inherent Errors, Numerical Errors, Truncation Error, Blunders, Absolute And Relative Errors, Error Propogation, Polynomial Functions, Conditioning And Stability, Convergence Of Iterative Process, Error Estimation, Minimisation The Total Error, Summary

5. ROOTS OF NON-LINEAR EQUATIONS
6. DIRECT SOLUTION OF LINEAR EQUATION

7. ITERATIVE SOLUTION OF LINEAR EQUATIONS
Need And Scope, Jacobi Iteration Method, Gauss – Seidel Method, Method Of Relaxation, Convergence Of Iteration Methods

8. NUMERICAL DIFFERENTIATION
Introduction, Objective, Forward Difference Quotient, Central Difference Quotient, Error Analysis, Higher Order Derivatives, Differentiating Tabulated Function, Summary

9. NUMERICAL INTEGRATION
Introduction, Objective, Newton-Cotes Integration Formulae, Numerical Integration, Simpson’s 1/3-Rule, Simpson’s 3/8-Rule, Romberg Integration,

10. NUMERICAL SOLUTION OF ORDINARYDIFFERENTIAL EQUATION
Introduction, Solution By Taylor’s Series, Picard’s Method Of Successive Approximation, Euler’s Method, Error Estimates For The Euler Method, Runge-Kutta Methods, Predictor-Corrector Methods, Summary

11. BOUNDRY VALUE AND EIGEN VALUE PROBLEMS
Introduction, Objective, Shooting Method, Finite Difference Method, Solving Eigenvalue Problems, Evaluating The Eigenvalue, Power Method

12. SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
Need and Scope, Deriving Difference Equations, Elliptic Equations, Parabolic Equations, Hyperbolic Equations, Summary

MFC2 APPLIED ELASTICITY & PLASTICITY

1. BASIC EQUATIONS OF ELASTICITY

2. TWO-DIMENSIONAL PROBLEMS IN CARTESIAN CO-ORDINATES
Introduction, Airy’s Stress Function – Polynomials: Bending of a cantilever loaded at the end; Bending of a beam by uniform load, Direct method for determining Airy polynomial: Cantilever having Udl and concentrated load of the free end; Simply supported rectangular beam under a triangular load, Fourier Series, Complex Potentials, Cauchy Integral Method, Fourier Transform Method, Real Potential Methods.

3. TWO-DIMENSIONAL PROBLEMS IN POLAR CO-ORDINATES
Basic equations, Biharmonic equation, Solution of Biharmonic Equation for Axial Symmetry, General Solution of Biharmonic Equation, Saint Venant’s Principle, Thick Cylinder, Rotating Disc on cylinder, Stress-concentration due to a Circular Hole in a Stressed Plate (Kirsch Problem), Saint Venant’s Principle, Bending of a Curved Bar by a Force at the End.

4. TORSION OF PRISMATIC BARS
Introduction, St. Venant’s Theory, Torsion of Hollow Cross-sections, Torsion of thin-walled tubes, Torsion of Hollow Bars, Analogous Methods, Torsion of Bars of Variable Diameter.

5. BENDING OF PRISMATIC BASE
Introduction, Simple Bending, Unsymmetrical Bending, Shear Centre, Solution of Bending of Bars by Harmonic Functions, Solution of Bending Problems by Soap-Film Method.

6. BENDING OF PLATES
Introduction, Cylindrical Bending of Rectangular Plates, Slope and Curvatures, Lagrange Equilibrium Equation, Determination of Bending and Twisting Moments on any plane, Membrane Analogy for Bending of a Plate, Symmetrical Bending of a Circular Plate, Navier’s Solution for simply supported Rectangular Plates, Combined Bending and Stretching of Rectangular Plates.

7. THIN SHELLS

8. NUMERICAL AND ENERGY METHODS

9. HERTZ’S CONTACT STRESSES
Introduction, Pressure between Two-Bodies in contact, Pressure between two-Spherical Bodies in contact, Contact Pressure between two parallel cylinders, Stresses along the load axis, Stresses for two Bodies in line contact Exercises.

10. STRESS CONCENTRATION PROBLEMS
Introduction, Stress-Concentration Factor, Fatigue Stress-Concentration Factors.

MFC3 : BEHAVIOUR & DESIGN OF CONCRETE STRUCTURES

1. REINFORCED CONCRETE MATERIALS
Introduction, Cement – Chemical Composition of Cement; Types of Cement; Physical Properties of Cement, Aggregate – Classification of Aggregates; Physical Properties of Aggregates, Water, Admixtures, Concrete – Plastic Concrete; Hardened Concrete, Concrete Mix Design – Nominal Concrete Mix; Designed Concrete Mix, Reinforcing Steel.

2. DESIGN CONCEPTS

3. FLEXURE
Introduction, Behaviour of Beam Under Load, Design Methods, Working Stress Method – Assumptions; Distribution of Stresses and Transformed Area; Analysis and Design of Beam Sections; Analysis and Design of Rectangular Beam Sections; Analysis and Design of Flanged Beam Section, Limit State
Method – Assumptions; Analysis and Design of Beam Sections; Analysis and Design of Rectangular Beam Sections; Analysis and Design of Flanged Beam Section.

4. SHEAR, TORSION AND BOND
Shear – Introduction; Shear Stress; Behaviour of Beam without Shear Reinforcement; Shear Strength of Concrete in Beam; Mechanism of Shear Resistance with Shear Reinforcement; Shear Strength of Shear Reinforcement; Design of Beam for Shear, Torsion – Introduction; Torsional Stresses; Strength of Plain Concrete Beam in Torsion; Strength of Reinforced Concrete Beams in Torsion; Interaction of Torsion with Flexure and Shear; Design for Torsion Combined with Flexure and Shear, Bond – Introduction; Mechanism of Bond Failure; Bond Stress; Development Length; Curtailment of Reinforcement; Splices.

5. BEAMS
Introduction, Rectangular and Flanged Beams, Analysis of Beams, Design of Beams – Design for Serviceability Requirements; Design for Strength Requirements, Reinforcement Detailing for Beams – Flexural Reinforcement Detailing; Shear Reinforcement Detailing; Torsion Reinforcement Detailing, Lintels, Deep Beams.

6. SLABS
Introduction, Edge Supported Slabs – Introduction; Behaviour of Edge Supported Slabs; Analysis of Edge Supported Slabs; Design of Edge Supported Slabs; Reinforcement Detailing for Edge Supported Slabs, Flat Slab – Introduction; Behaviour of Flat Slab; Analysis of a Flat Slab; Design of a Flat Slab; Reinforcement Detailing for Flat Slab; Waffle Slabs.

7. COLUMNS

MFC4 PAVEMENT MATERIAL

1. STONES
Sources, Composition of Stones, Classification of Stones, Choice and Uses of Stones, Characteristics of Good Stones, Testing Stones, Stone Destroying Agents, Preservation of Stones, Stone Quarrying, Dressing and Polishing of Stones, Stone Quarries in India, Commonly Used Stones, Composition; Characteristics and Use of Various Stones, Artificial Stones.

2. BRICKS
Introduction, Classification of Bricks, Uses of Bricks, Composition of Brick Earth, Classification of Brick Earth, Useful and Harmful Ingredients in Brick Earth, Properties of Good Brick Earth, Analysis of a Few Brick Earths, Test of Brick Earth, Brick Field, Manufacture of Bricks, Strength of Bricks, Sizes and Weights of Bricks, Tests for Good Bricks, Special Forms of Bricks, Fire Clay and Fire Bricks, Classification of Refractory Bricks, Strength of Refractory Bricks, Colour of Bricks.

3. TILES, TERRA –COTTA, EARTHENWARE AND STONEWARE
Tiles, Terra –Cotta, Earthenware and Stonewares.

4. LIME, CEMENT, SAND AND SURKI
Lime, Cement, sand, Surki
5. MORTAR AND CONCRETE
Mortar, Properties of a Good Mortar, Uses of mortars, Function of Sand and Surki in Mortar, Effect of Clay in Mortar, Effect of Quantity of Water in Mortar, Composition of Mortar, Specifications of Ingredients for Mortar, Classification of Mortar, Comparative Strength of Lime and Cement Mortars, Addition of Small Quantities of Cement to a Lime Mortar, Addition of Small Quantities of Lime to a Cement Mortar, Use of Molasses in Mortar, Gauged Mortar, Light-Weight Mortar, Fire-Resisting Mortar, Water-Resisting Mortar, Mud Mortar, Precautions in Using Mortar, Introduction to Concrete, Historical Review in Brief, Uses of Concrete, Materials for Concrete, Classification of Concrete, Proportioning Ingredients for Concrete, Mix Design Computations, Mixing of Ingredients for Lime Concrete, Laying Lime Concrete, Mixing of Ingredients for Cement Concrete, Laying Cement Concrete, Placing Concrete Under Water, Consolidating Concrete, Construction Joints in Concrete, Finishing Concrete, Special Types of Concrete, Strength and Properties of Concrete, Curing of Concrete, Water-Cement Ratio, Consistency of Concrete, Maximum Allowable Slumps for Various Concrete Works, Strength of Concrete with Age, Shrinkage of Concrete, Temperature Effect on Concrete.

6. TIMBER
Definition, Classification and growth of Trees, Structure of a Timber Tree, Time for Felling a Timber Tree, Characteristics of Good Timber, Defects in Timber, Diseases of Timber, Decay in Timber, Destruction of Timber By Insects and Worms, Seasoning of Timber, Preservation of Timber, Protection of Timber From Fire, Market Forms of Timber, Conversion of Timber, Timber Beams and Floor Boards, Advantages of Timber Construction, Disadvantages of Timber Construction, Timbers Suitable for Various Uses, Veneers; Lamin Boards, Batten Boards; Plywoods and Fibre Boards, Destruction of Plants and shrubs Growing on Buildings, Protection of Timber against Worms and Insects.

7. PAINTS AND VARNISHES

8. IRON AND STEEL

9. NON-FERROUS METALS AND VARIOUS ALLOYS
Aluminium, Copper, Zinc, Lead, Tin, Cadmium, Nickel, Cobalt, Antimony, Bismuth, Magnesium, Manganese, Chromium, Molybdenum, Tungsten, Vanadium, Titanium, Tantalum, Zirconium, Sodium, Potassium, Barium, Calcium, Mercury, Silver, Gold, Platinum, Brass, Bronze, Gun Metal, Bell-Metal, Phosphor-Bronze, Aluminium-Bronze, Aluminium-Brass, Partinium, German Silver, Monel Metal, White Metal, Babbitt’s Metal, Pewter.

10. WATER
11. MISCELLANEOUS MATERIALS

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First Year

Second Semester

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<td>MFC6</td>
<td>Geotechnical Engineering</td>
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<td>MFC7</td>
<td>Finite Element Method in Engg.</td>
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<td>MFC8</td>
<td>Highway Engineering</td>
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Syllabus

MFC5 ADVANCED STRUCTURAL ANALYSIS

1. BEAMS ON ELASTIC FOUNDATION:
   Introduction, Elastic curve equation, Classification of beams on elastic foundations, Long beams subjected to concentrated load per unit width, More than one loads, Long beams subjected to moment M₀. (a) Long beam carrying triangular load on portion of the beam, (b) Long beam carrying parabolic load on portion of the beam, (c) Long beam subjected to varying load on portion of the beam.

2. CURVED BEAMS:
   Beams with small initial curvature, Beams with large initial curvature i.e. curved beams Axial and bending loads combined, Limitations on the Winkel Batch formula, (a) Equivalent area method, Circumferential stress in curved beams having I, T or similar cross- sections, Deflection of curved beams, Close ring subjected to a concentrated load.

3. BEAMS CURVED IN PLAN AND SPACE STRUCTURES:
   Introduction, Circular beams loaded uniformly and supported on symmetrically placed columns, Semi-Circular beams simply supported on three supports equally spaced, Quarter circle beam fixed at one end and free at other carrying a load at the free end, Transversely loaded circular beam.

4. FLEXIBILITY METHOD:
   Introduction, Method of consistent deformation, Application of flexibility method to pin-jointed, frames, Effects of temperature and prestrain, Displacements and forces in members of indeterminate structures, Flexibility matrix of a plane member.
5. STIFFNESS METHOD:
Relation between slope deflection method and stiffness method, Stiffness method of analysis, Choice between flexibility and stiffness methods, Applications of stiffness method of problems involving relative displacement of supports, Forces in members of indeterminate structures by stiffness method, (a) Application of Stiffness methods to pin-jointed frames

6. ELEMENTS OF THEORY OF ELASTICITY:

7. STRUCTURAL DYNAMICS:

8. SANDWICH STRUCTURES:

9. STRESS ANALYSIS OF CRACKS:
Introduction, Griffith Theory, Stress Intensity Factor, Crack Growth Under Fixed Grip vs Fixed Load, Crack Tip Stresses and Displacements, Stress Intensity Factors for Through – the – thickness Cracks in a Sheet, Stress Intensity Factors for Cracks at Holes, Stress Intensity Factors for Through – the –Thickness Cracks in Cylindrical and Spherical Shells.

10. FRACTURE MECHANICS:
Plane Strain and Plane – Stress, Fracture Modes, Plane –Strain Fracture Toughness KIC, Role of Plasticity in Fracture, Crack Opening Displacement, Dugdale Model, Plane Strain Plastic Zone, Shape of Plastic Zone.

MFC6 GEOTECHNICAL ENGINEERING

1 INTRODUCTION
Soil as a three phase system, water content, density and unit weights, specific gravity, voids ratio, porosity and degree of saturation, density index

2 CLASSIFICATION OF SOILS
General, compaction, standard proctor test, equivalent for standard proctor test. [ is : 2720 a (part vii) : 1965 : light compaction], water-density relationship, modified proctor test, modified proctor test curve, jodhpur mini-compactor test, typical comparison of the standard proctor test and jodhpur mini-compactor test, jodhpur mini-compactor, field compaction methods, field compaction control, proctor needle, calibration curve, factors affecting compaction, effect of compactive effort on compaction, obtained by the jodhpur mini-compactor, shear strength

3 STRESS DISTRIBUTION
Introduction, concentrated force: Boussinesq equations, concentrated load: Boussinesq analysis, pressure distribution diagrams, variation of $\sigma z$ with $r$ at constant depth, vertical stress distribution on a horizontal plane (influence diagram for $\sigma z$ at $a$), $\sigma z$ distribution on vertical lane, vertical pressure under a uniformly, uniformly distributed load over circular area, vertical pressure due to a line load, vertical pressure under strip load, vertical. Pressure under centre of strip load, vertical pressure under a uniformly loaded rectangular area, rectangular loaded area, influence factor for rectangular area (after Steinbrenner), equivalent point load method, Newmark's influence chart, radii of concentric circles for influence chart, contact pressure,

**4 SURFACE TENSION CAPILLARITY & EFFECTIVE STRESS**
Modes of occurrence of water in soil, adsorbed water, adsorbed water and pore water (Lambe, 1953), capillary water, surface tension and formation of meniscus, capillary rise, values of unit weight, dynamic viscosity and surface tension for water, capillary heights of soil, stress conditions in soil: effective and neutral pressures, capillary siphoning.

**5 PERMEABILITY**
Introduction, Darcy's law, discharge velocity and seepage velocity, validity of Darcy's law, factors affecting permeability, constant head permeability test, falling head, permeability test, permeability of stratified soil deposits.

**6 SEEPAGE ANALYSIS**
Head gradient and potential, seepage pressure, upward flow: quick condition
Sand condition, two dimensional flow: Laplace equation, seepage through anisotropic soil, phreatic line of an earth dam, one dimensional consolidation, consolidation of laterally confined soil, semi-log plot of pressure voids ratio relationship, consolidation of undisturbed specimen, Terzaghi's theory of one dimensional consolidation, calculation of voids ratio and coefficient of volume change, calculation of voids ration by height of solids method, calculation of voids ratio by change in voids ratio method, determination of coefficient of consolidation, shear strength, theoretical considerations: Mohr's stress circle, Mohr-Coulomb failure theory, the effective stress principle, measurement of shear strength, direct shear test, triaxial compression test, vane shear test, shear strength of cohesive soils.

**7 EARTH PRESSURE**
Introduction, plastic equilibrium in soils: active and passive states, active and passive states of plastic equilibrium, active earth pressure: Rankine's theory, backfill with uniform surcharge, active earth pressure of cohesive soils, passive earth pressure: Rankine's theory, Coulomb's wedge theory.

**8 DESIGN OF GRAVITY RELATING WALL**
Design of gravity relating wall

**9 STABILITY OF SLOPES**
Introduction, stability analysis of infinite slopes, stability analysis of finite slopes, the Swedish slip circle method, stability of slopes of earth dam

**10 SUBSOIL EXPLORATION**
Introduction, site reconnaissance, site exploration, methods of site exploration, soil samples and samplers, disturbed sampling, undisturbed sampling, penetration and sounding tests, geophysical methods.

**11 SHALLOW FOUNDATION**
Types of foundations, spread footing, safe bearing pressure, settlement of footings, combined footing and strap footing, mat or raft footing, i.s. Code of practice for design of raft foundations, modulus of subgrade reaction $K_s$.

12 WELL FOUNDATION

Introduction: caissons, shapes of wells and component parts, depth of well foundation and bearing capacity, forces acting on a well foundation, analysis of well foundation, Heavy wells

MFC7 FINITE ELEMENT METHOD IN ENGINEERING

1. INTRODUCTION

2. FINITE ELEMENTS OF ELASTIC CONTINUUM DISPLACEMENT APPROACH

3. GENERALIZATION OF THE FINITE ELEMENT CONCEPTS WEIGHTED RESIDUAL AND VARIATIONAL APPROACHES

4. STRAIN PLANE STRESS AND PLANE

5. AXI-SYMMETRIC STRESS ANALYSIS
   Introduction, Element Characteristics, Some Illustrative Examples.

6. THREE – DIMENSIONAL STRESS ANALYSIS
   Introduction, Tetrahedral Element Characteristics.

7. ELEMENT SHAPE FUNCTIONS SOME GENERAL FAMILIES OF C0 CONTINUITY

8. CURVED, ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION

9. SOME APPLICATIONS OF ISOPARAMETRIC ELEMENTS IN TWO- AND THREE-DIMENSIONAL STRESS ANALYSIS
   Introduction, A Computational Advantage Of Numerically Integrated Finite Elements.

MFC8 HIGHWAY ENGINEERING
Section 1: Highway Planning And Administration;
1. TRANSPORTATION IN MODERN SOCIETY:
   Transport and Economic Growth, Transport overcomes the separation between the producer and the consumer, Preservation of Quality of Goods, Economics of Scale and Specialization, Exploitation of Natural Resources, Administration, Defense and Strategic Needs, Modes of Transport And Their Characteristics- Need for Coordinate Development, Multi-modal Transport Systems, Use of Information Technology in Transportation.

2. HIGHWAY ADMINISTRATION AND FINANCE:
   Roads as Infrastructure for Public Good, Administration of National Highways, Administration of Roads under other Central Ministries, Roads of Inter-state or Economic Importance, National Highways Authority of India (NHAI), Highway Staff Training Institute, National Rural Road Development Agency, Highway Financing and Taxation in India.

Section 2: Geometric Design Of Highways:
3. GEOMETRIC DESIGN:
   Design Controls and Criteria: General; Topography; Traffic; Design Vehicle Dimensions; Design speed; Capacity, Horizontal Alignment: Basic formula for movement of vehicles on curves; Maximum super-elevation value; Minimum radii of curves; Transition curves; Widening on curves; General controls for horizontal alignment

Section 3: Highway Project Preparation:
4. DESIGN, DRAWING, ESTIMATES AND PROJECT REPORT:
   Design: Need for assessment of various alternatives; Computer –aided highway design and its advantages; Step involved in design; Stage construction, Drawings: Types of drawings; Locality map-cum-site plan; Land acquisition plans; Plan and longitudinal section; Typical cross-section sheet; Detailed cross-sections; Drawing for cross–drainage structures; Road junction drawings; Drawings for retaining walls and other structures, Estimates, Earthwork Quantities; Mass diagram, Project Report, Stages In Project Preparation.

Section: 11 Highway Economics:
5. ECONOMICS OF PAVEMENT TYPES:
   Basis for Comparison, Period of Analysis, Costs of Initial Construction, Cost of Maintenance, Cost of Vehicle Operation, Equivalence in Thickness.

6. ECONOMIC EVALUATION OF HIGHWAY PROJECTS:
   Role of Economic Evaluation, Some Basic Principles, Time Value of Money, Costs and Benefits, Evaluation Techniques: Net present Value (NPV) Method, Benefit- Cost (B/C)Ratio Method; Internal Rate of Return (IRR) Method; Comparison of the Various Methods of Economic Evaluation; Selection of Discount Rate.

Section: 13 Construction Management
7. QUALITY ASSURANCE IN HIGHWAY ENGINEERING:
   Quality Assurance Vis A Vis Quality Control, Element of Quality Assurance System: General; Assessing Requirement of a Highway Project; Choice of Quality Materials and Design; Development of Specifications and Acceptance Criteria; Choice of Construction Method/ Equipment/ Plant; Inspection and Quality Control; Assessing Quality of Finished Pavement; Periodic Inspection and Maintenance Measures, Inspection and Quality Control During Construction; Preliminary Tests; Preliminary Inspection of Performance of Equipment; Trial Construction; Controlling Workmanship during Construction; Controlling Quality during Control, Statistical Methods in Quality Control: Normal distribution ;Mean; Point Estimate and Interval

8. CURRENT TRENDS IN HIGHWAY ENGINEERING IN INDIA (2002) AND PROSPECTS FOR THE FUTURE:
Introduction, Road Development Plan-VISION: 2001: Highlights of the VISION: 2021 Document, Expressway Master Plan. Pradhan Mantri Gram Sadak Yojana (PMGSY): Noteworthy Features of the PMGSY; Resources for Implementing PMGSY, Trends in Highway Engineering Practice: Survey and Investigations; Highway Design Software; Pavement Design; New Materials and Specification; Construction; Maintenance; Procurement; Quality Assurance; Research; Urban Roads, Institutional Issues: Background; Ministry of Road Transport and Highways (MoRT&H); National Highways Authority of India (NHAI); PWDs; Rural Engineering Organizations (REOs); Training Policy; Funding Issued, Concluding Remarks.
COURSE STRUCTURE & SYLLABUS OF 
MASTER OF TECHNOLOGY (M.TECH)

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Second Year

Third Semester

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<td>MSC2</td>
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<td>MSC3</td>
<td>Planning &amp; Design of Airports</td>
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<td>Transportation System Planning</td>
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SECOND YEAR

IIIrd Semester

MSC1 PRESTRESSED CONCRETE

1. INTRODUCTION TO PRESTRESSED CONCRETE

Introduction, Reinforced Concrete Versus Prestressed Concrete, Prestressing System, Loss Of Prestress, Steel For Prestressing, Basic Concepts Of Prestressed Concrete, Homogeneous Beam Concept, Pressure Line, Load Balancing Concept, Shear And Pricipal Streses

2. SYSTEMS OF PRESTRESSING


3. PRESTRESSED CONCRETE BEAMS

Introduction, Limit State Of Collapse, Limit State Of Collapse In Shear, Limit State Of Serviceability, Prestressed Concrete Poles, Other Design Considerations, Selection Of Sectional Dimensions, Detailing Of Reinforcement, Limits State Of Serviceability For Deflection
4. END BLOCK
Introduction, Magnel’s Method, Guyon’s Method, Beam With Two Anchor Plates Symmetrically Placed On The Face Of The Beam, Cable At An Eccentricity

5. PRESTRESSED CIRCULAR TANKS AND PIPES
Introduction, Principles of Circumferencential Prestressing, Methods Of Design

6. SMALL PRESTRESSED CONCRETE DAMS
Introduction, Design Requirements, Design

7. PRESTRESSED CONCRETE PILES
Introduction, Convenient Ways of Lifting A Pile, Maximum Length Of Pile

MSC2 HIGH RISE STRUCTURES

1. MULTISTOREY BUILDINGS

2. TYPES OF STAIRS
Introduction, Common Types Of Stairs, Central-Wall Type Stairs, Central-Column Type Stairs, Slabless Stairs, Helicoidal Stairs, Free Standing Stairs

3. MASONRY BUILDINGS
Introduction, Brick Wall Design Under Vertical Loads, Brick Wall Under Horizontal Loads, Resistance To Earthquake Forces By Wall Boxes, Loads, Multistorey Buildings, Response Reduction Factor, 2d Analysis, 3d Analysis, Analysis For Vertical Loads

4. FRAMED BUILDINGS UNDER VERTICAL LOADS

5. FRAMED BUILDING UNDER HORIZONTAL LOADS
Introduction, Allocation Analysis, Frame Analysis, Torsion In Buildings, Multistorey Buildings

6. SHEAR-WALLED BUILDINGS UNDER HORIZONTAL LOADS
Introduction, Allocation Analysis, Response Of Structure, Effect Of Joint Width, Monolithic Beam Or Column Joints

7. SHEAR WALL-FRAME INTERACTION

8. FOUNDATIONS
MSC3 PLANNING AND DESIGN OF AIRPORTS

1. INTRODUCTION & AIRCRAFT CHARACTERISTICS

Requirements Of Aircraft Types, Field Length Regulations, Restrictions On Payload- Range Performance, Weight Components, Aeroplane Components Parts, Military And Civil Aircrafts, Civil Military Co-Ordination, Classification Of Flying Activity, Relation Of Aircraft To Landing Facility, Aircraft Characteristics, Future Trends In Aircraft Design

2. AIRPORT OBSTRUCTIONS

Zoning Laws, Classification of Obstructions, Turning Zone

3. RUNWAY DESIGN

Runway Orientation, Basic Runway Length, Correction For Elevation, Temperature And Gradient, Airport Classification
Runway Geometric Design

4. AIRPORT CAPACITY AND CONFIGURATION

Airport Capacity, Runway Capacity, Gate Capacity, Taxiway Capacity, Runway Configurations, Runway Intersection Design

5. TAXIWAY DESIGN

Factors Controlling Taxiway Layout, Geometric Design Standards, Exit Taxiways, Fillets, Separation Clearance, Holding Apron, Turnaround or Bypass Taxiway

6. TERMINAL AREA

Building and Building Area, Vehicular Circulation and Parking Area, Apron, Hangar, Blast Considerations, Typical Airport Layouts

7. AIRPORT PLANNING

General, Airport Master Plan, Regional Planning, Data Required Before Site Selection, Airport Site Selection, Surveys For Site Selection, Drawings To Be Prepared, Estimation Of Future Air Traffic Needs

8. STRUCTURAL DESIGN OF AIRPORT PAVEMENTS

Introduction, Various Design Factors, Design Methods For Flexible Pavements, Design Method For Air Field Rigid Pavements, Influence Chart For The Moment Mn In A Concrete Pavement Due To A Load In The Interior Of The Slab, LCN System Of Pavement Design, Joints In Cement Concrete Pavements, Special Consideration For Design Of Pavement Facilities For V/Stol Operations

9. VISUAL AIDS
General, Airport Marking, Airport Lighting

**MSC4 TRANSPORTATION SYSTEMS PLANNING**

1. **HIGHWAY DEVELOPMENT IN INDIA**
   Roads In Ancient India, Jayakar Committee And The Recommendations, Central Road Fund, Second Twenty Year Road Development Plan 1961-81, Third Twenty Year Road Development Plan 1981-2001, Necessity Of Highway Planning, Classification Of Roads, Methods Of Classification Of Roads, Classification Of Urban Roads, Road Patterns, Planning Surveys, Preparation Of Plans, Reparation Of Master Plan And Its Phasing, Nagpur Road Plan Or First 20-Year Road Plan, Second Twenty Year Road Plan (1961-81), Second Twenty Year Road Plan (1961-81).

2. **HIGHWAY ALIGNMENT AND SURVEYS**

3. **HIGHWAY ECONOMICS & FINANCE**
   Highway User Benefits, Highway Costs, Economic Analysis, Methods Of Analysis, Highway Finance, Distribution Of Highway Cost, Sources Of Revenue Highway Financing In India

4. **TRAFFIC ENGINEERING**

5. **HIGHWAY PROJECT AND ESTIMATES**:
   Rough Cost Estimate, Detailed Estimate, Project Report
COURSE STRUCTURE & SYLLABUS OF
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Course Structure

Second Year

Fourth Semester

SPECIALIZATION – 1

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<td>MSHW 03</td>
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SPECIALIZATION 1: HIGH WAY & TRANSPORTATION ENGINEERING

MSHW 01: HIGHWAY ENGINEERING ECONOMICS

1. Economic Parameters In The Preparation Of The Development /Construction Of Different Types Of Intersection and Interchanges.
2. Estimation and Costing Of Earthwork, Excavation, Foundation, Embankments, Compaction
11. Economics Of Different Types Of Structures – Bridges Or Tunnels, Open Cut For Tunnel, Truss Or Girder, Bridge, Earth Fill Or Bridge.

MSHW 02: HIGHWAY ENGINEERING & DESIGN

1. Highway Planning
2. Highway Development
3. Highway Alignment (Horizontal)
4. Highway Alignment (Vertical)
5. Preparation Of Highway Alignment; Working Drawing In Terms Of Coordinates, Chainages, Offsets.
6. Different Types Of Pavements & Their Suitability.
8. Engineering Surveys and Other Surveys Required For Highway Widening.

MSHW 03: HIGHWAY MAINTENANCE AND MANAGEMENT SYSTEM

1. Maintenance Of Road Surface, Shoulders, Roadway Drainage, Bridge and Other Structure, Roadside, Amenity, Equipment.
2. High Profile Maintenance
3. Carriageway Maintenance.
4. Footways/Shoulders
5. Street Lightening and Illuminated Traffic Signs
6. Aid To Movement.
7. Road Assessment & Management System
8. Accident Precaution
12. Maintenance Of Approaches.
14. Maintenance and Traffic Control & Safety Devices
15. Pavement Rehabilitation
17. Pavement Recycling

MS 04: PROJECT

Project Guidelines:

Thinking up a Project

You are expected to come up with your own idea for a project. A wide range of topics is acceptable so long as there is substantial computing content and project is predominantly of a practical, problem-solving nature. You might take up an interest which you already have in your stream of engineering. You may do your project in any reputed organization or a department. Every student is to take up a project individually. The project is a vehicle for you to demonstrate the required level of competence in your chosen field of Masters.

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**A Guide**

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Sometimes a project containing good work is marred by a report, which is turgid, obscure and simply ungrammatical. In such cases, it is very difficult to find out the work done during the project. An examiner cannot be kind enough to look properly on a project that is almost unreadable.

**Important points for carrying out a project**

- The organizations or companies offer you a placement for project work out of good will or to get some useful work done. Usually the companies do not provide you everything required by you. You must settle this right in the beginning of the project with the business that what will you get from them and what you have to arrange yourself.

- Some times a complication arises due to the fact that some aspect of your project work is considered confidential by the company. If this is so, it is your responsibility to get whatever clearance is necessary from the organization right in the beginning as essential parts like system analysis and design, flow charts etc. can not be missing from a project report.
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SPECIALIZATION – 2

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SPECIALIZATION – 2 : HYDROLOGY AND WATER RESOURCES ENGINEERING

MSHWR 01 : Irrigation and Water resources Engineering

1. Introduction :- Methods of irrigation – Water requirements for crops – Hydrology

MSHWR 02 : Waste Water Engineering

1. Introduction
2. Collection and conveyance of sewage
3. Waste water flow rates
4. Hydraulic design of sewers
5. Construction of sewers
6. Sewer appurtenances
7. Sewage pumping
8. Waste water characteristics
9. Natural methods of waste water disposal
10. Unit operation of waste water treatment
11. Preliminary treatment
12. Sedimentation and chemical clarification
13. Biological treatment
14. Treatment and Disposal of sludge
15. Septic and imhoff tanks
16. Advanced waste water treatment
17. House drainage
18. Rural sanitation

MSHWR 03: Hydrology

1. Introduction
2. Hydrometeorology
3. Probability and statistics
4. Catchments
5. Precipitation
6. Stream Flow measurement
7. Evaporation & Evapotranspiration
8. Infiltration
9. Ground water
10. Runoff
11. Hydrograph analysis
12. Instantaneous unit hydrograph
13. Flood routing
14. Design flood
15. Sedimentation

MS 04 : PROJECT

Project Guidelines:

Thinking up a Project

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COURSE STRUCTURE & SYLLABUS OF
MASTER OF TECHNOLOGY (M.TECH)

In

Civil

Course Structure

Second Year

Fourth Semester

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SPECIALIZATION – 3 : STTRUCTURAL ENGINEERING

**MSS 01 :** Design of Industrial Structures & Bridges

(a) Design and analysis of Multi-storied framed structures.
(b) Design of liquid retaining structures.
(c) Investigation and selection of site. Economic spans. Water way calculation for bridges IRC classification for bridges.
Analysis and design of bridges selected from the following.
i) Girder Bridges
ii) Balanced Cantilever Bridges
iii) Rigid framed bridges
iv) Arch Bridges
v) Suspension Bridges

**MSS 02 :** Design of Hydraulic Structures

Project Planning, Site investigation, choice of type of dams, cost benefits studies, Non-overflow dams; gravity, arch and buttress type, rock fill and earthen dams, their design, stress analysis, stress concentration around opening.
Different types of spill ways and energy dissipaters, their design, preparations and protection of foundations for dams, model analysis of hydraulic structure, instrumentation in dams, temperature control in concrete dams.

**MSS 03 :** Plastic Analysis of Metallic Structures
Moment of resistance, shape factors, criteria of plastic analysis, comparison of Elastic and Plastic analysis, moment curvature relationships for beams, Plastic hinges, Redistribution of moments, Analysis of indeterminate beams and frames for ultimate load by the statically and mechanical method, Load interaction method, Approximate method of finding ultimate load, Uniqueness theorems, limit theorems-upper and lower bound theorems, factors affecting the fully plastic moments. 
Influence of axial force and shear estimation of deflections at ultimate load, load and lateral buckling, Design of connections, Minimum weight design , Shake down analysis.

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