# M.Tech. CIVIL ENGINEERING Batch 2016

## 1st Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
<th>Title of the Subject</th>
<th>Teaching Load/Week</th>
<th>Credits</th>
<th>Total Hrs/week</th>
<th>Evaluation Marks</th>
<th>Total</th>
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<td>Theory</td>
<td>Sessional</td>
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<tr>
<td>1.</td>
<td>MTCE201</td>
<td>Composite Materials</td>
<td>3 1 - 4 4</td>
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<tr>
<td>2.</td>
<td>MTCE202</td>
<td>Hydrological Processes</td>
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<td>3.</td>
<td>MTCE203</td>
<td>Pavement Design</td>
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<td>4.</td>
<td>MTCE204</td>
<td>Geoenvironmental Engineering</td>
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## 2nd Semester

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<td>MTCE206</td>
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<td>Earthquake Engineering</td>
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<td>MTCE208</td>
<td>Advanced Traffic Engineering</td>
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<td>15 5 - 20 20</td>
<td>500</td>
<td>250</td>
<td>750</td>
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### List of electives

#### Elective - I
- MTCE209  Introduction to the Theory of Plasticity
- MTCE210  Advance Bridge Design
- MTCE211  Industrial Structures

#### Elective - II
- MTCE212  Computational Geotechnology
- MTCE213  Engineering Rock Mechanics
- MTCE214  Soil Dynamics
### IIIrd Semester

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<td>L     T    P/D</td>
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<td>Theory</td>
<td>Sessional</td>
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<tr>
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<td>MTCE</td>
<td>Elective - III</td>
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<tr>
<td>2.</td>
<td>MTCE</td>
<td>Elective - IV</td>
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<td>MTCE221</td>
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<td>MTCE222</td>
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<td>-     100</td>
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**List of electives**

#### Elective - III

- MTCE215 Urban Hydrology
- MTCE216 Remote Sensing and GIS for Water Resources and Environmental Engineering
- MTCE217 Ground Water and Contamination Hydrology

#### Elective - IV

- MTCE218 Disaster Reduction & Management
- MTCE219 Construction and Maintenance Management
- MTCE220 Expert Systems in Civil Engineering

### IVth Semester

<table>
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<tr>
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<td>1.</td>
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i. Each theory paper examination will be of three hours duration

ii. Seminar will be an independent study on the related topic and will be evaluated internally

iii. Thesis in the specified Area (Geotechnical Engineering/Structural Engineering/ Water Resources and Environmental Engineering)

iv. Thesis will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his thesis work and Viva-voce will be held
Core Course

<table>
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**Supplementary Cementing Materials:** Types of supplementary cementing materials such as fly ash, silica fume, rice husk ash, and metakaolin; their physical, chemical, mineralogical properties; Effects of these materials on the fresh properties; Strength properties; Durability properties.

**Fibre Reinforced Concrete:** Definition; types of fibres; Properties of fibres; Factors affecting FRC. Mixing and casting procedure; Composite materials approach; Effect of fibres on the workability, strength and durability of concretes; Applications of different types of fibres.

**High Volume Fly Ash Concrete:** Definition, Effect of types of fly ash in large quantities on the strength properties of concrete; Durability and abrasion resistance of HVFA; Applications of HVFA.

**Self-Compacting Concrete (SCC):** Definition, Advantages and disadvantages of SCC; Various mix design procedures; Tests for SCC; Applications for SCC.

**High Performance Concrete:** Definition of HPC; Material selection and its properties; Parameters for concrete being considered as HPC; Applications of HPC.

**Polymer Concrete Composites:** Definition; Types of monomers and polymers; Types of polymer concretes and their applications.

**Fibre Reinforced Plastics (FRP):** Types of FRP, their properties and effects on concrete elements under various loading conditions.

**Use of Waste Materials and By-products:** Types of waste materials and by-products such as waste glass, scrap tires, waste foundry sand, clean coal ash, etc. Effect of these materials on the various properties of mortar and concrete; Introduction of leachates from waste materials and their analysis.

**Behaviour of Concrete at High Temperature:** Definition of high temperature; Mechanism of concrete failure at high temperature; Spalling characteristics; Difference in the behaviour of normal concrete, High strength concrete and self-compacting concrete at high temperature.

**Recommended Books**

Core Course

| MTCE202 | Hydrological Processes | 3 | 1 |


**Recommended Books**


Core Course

L T/P

MTCE203 Pavement Design 3 1


Recommended Books

Rajib B Mallick and Tahar El-Korchi, Pavement Engineering, Principles and Practice, CRC Press, 2009
| MTCE204 | Geo-environmental Engineering | 3 | 1 |

Geoenvironmental Engineering; Waste generation; subsurface contamination, waste containment; Types of landfills, design and operation of landfills, subsurface contamination control and remediation. Sources and effects of subsurface contamination; Physical, chemical and biological characteristics of solid wastes; Soil-waste interaction; Contaminant transport; Laboratory and field evaluation of permeability; Factors affecting permeability; Waste disposal on land.

Types of landfills: Siting criteria; Waste containment principles; Types of barrier materials; Barrier systems—basic concepts, design and construction, stability, compatibility and performance. Transport in subsurface Engineering properties Planning and design aspects relating to waste disposal in landfills, in ash ponds and tailing ponds, and in rocks.

Environmental monitoring around landfills; Detection, control and remediation of subsurface contamination; and geotechnical reuse of waste materials such as coal ash, mining waste, demolition waste etc; Reclamation of old waste dumps; Regulations; Contaminated site remediation Case studies.

**Recommended Books**


Core Course

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<td>Advanced Structural Design</td>
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**Building Frames:** Introduction, Loads, Analysis for vertical loads, Analysis for lateral loads, Concept of redistribution of moments, Reinforcement detailing in various components.

**Retaining Walls:** Review of design of cantilever type retaining walls, Design of counterfort retaining walls.

**Special Structural Elements:** Domes, Deep Beams, Brackets or Corbels, Grid floor systems.

**Flats Slabs:** Advantages and disadvantages of flat Slabs, Action of Flat Slab, Preliminary design of flat slabs, Basic action of two-way slab, Determination of minimum thickness of slab, Direct Design Method, Equivalent frame analysis of flat slabs.

**Yield Line Theory:** Introduction, Assumptions, Location of yield lines, Methods of Analysis, Analysis of one-way and two-way slabs.

**Recommended Books**


Core Course

| MTCE206 | Water Quality Modeling | 3 | 1 |

Basic characteristics of water quality, stoichiometry and reaction kinetics. Mathematical models of physical systems, completely and incompletely mixed systems. Movement of contaminants in the environment. Water quality modeling in rivers and estuaries - dissolved oxygen and pathogens. Water quality modeling in lakes and ground water systems.

**Recommended Books**
Core Course

MTCE207  Earthquake Engineering  3  1


Recommended Books


Recommended Books


IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.
Elective Course

<table>
<thead>
<tr>
<th>MTCE209</th>
<th><strong>Introduction to the Theory of Plasticity</strong></th>
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1D plasticity and viscoplasticity; physical basis of plasticity; uniaxial tensile test & Bauschinger effect; phenomenological basis of assumptions in plasticity; Levy-Mises equations; yield criteria (Tresca, von Mises, Mohr-Coulomb, Drucker-Prager); geometry of yield surfaces; flow rules and hardening; plastic / viscoplastic potentials; Drucker's postulate; convexity; normality; Illyushin's principle; shakedown; problems in rigid-perfectly plastic solids; slip line fields; introduction to upper and lower bounds; selected rigid-perfectly plastic and elastic-plastic boundary value problems; advanced hardening models; introduction to computational plasticity; radial return and other integration algorithms

**Recommended Books**

Chakrabarty, J. Theory of Plasticity, Butterworth, 2006

Calladine, C.R., Plasticity for Engineers, Woodhead, 2000

Lubliner J., Plasticity Theory, Dover, 2008
Elective Course

MTCE210  Advance Bridge Design  3  1

General: Bridge System, Considerations in alignment, Planning, Economic consideration, Aesthetics and selection of type of bridge (Review).


Super Structure Analysis: Bridge deck analysis using different methods, Load distribution theories – Courbon specifications for loading, Geometrical proportioning etc. of road, rail-cum-road bridges. Indian Road Congress (IRC) and Indian Railway Loading standards and their comparison with loading, Hendry-Jaegar, Morris-Little (Orthotropic plate theories) methods, Stiffness method, Finite difference method, Folded Plate method, Finite strip method and Finite Element method (General treatment), Limit analysis, Design of bridge decks.

Connections: Design of different connections, Bearings and joints.

Substructure Analysis and Design: Piers, Abutments, Wing walls and other appurtenant structures.

Foundations: Well foundations and pile foundation, Design and construction and field problems.


Dynamics Behaviour: Behaviour of bridges under dynamic loads, Discussion of code provisions for design of bridges for wind and earthquake forces.

Long Span Bridges: General discussion of suspension and cable stayed bridges.

Recommended Books
Elective Course

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<td>Industrial Structures</td>
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<td>1</td>
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Review of Plastic Design: Concept of minimum weight design

Design of Industrial Buildings: General, Framing, Crane girders & columns, Analysis of trussed bents, Design of industrial frame.

Design of Storage Structures: Design of containers like bunkers, silos.

Design of Space Structures: Transmission towers, Steel domes, Pre-cast building components.

Design using Light Gauge Sections: Structural use of pressed sections and light gauge sections, Aluminium as a material of construction for industrial structures and design of such structures, Tubular structures and Sandwich plate construction.

Aluminium structures: Introduction, Permissible stresses, Tension members, Compression members, Design of beams, Local buckling of compression elements, Riveted and bolted construction, Design of chimneys, Load analysis, Design of steel supporting chimney, Chimney foundation

Construction Practices: Shop practice in steel construction, Fabrication erection and production.

Recommended Books
Elective Course

MTCE212    3    Computational Geotechnics    1    3


Recommended Books

Elective Course

L T/P

MTCE213 3 Engineering Rock Mechanics 3 1

Rock as an engineering material, Geological factors affecting rocks, Stress, Strain and Strength of rocks, Insitu stresses in rock, Intact Rock - Elastic Deformation, Discontinuities and deformability and strength of rock masses, permeability, anisotropy and in homogeneity in rocks, Stereonet Analysis, testing techniques, rock mass classification, Failure criteria for rock and rock masses, Rock mechanics interactions and rock engineering systems, Excavation and stabilization principles, rock slope stability, foundations on rock, rock blasting support and reinforcement, Underground excavation and stability, Urban tunnels, Problematic Rocks - Rock Engineering, Modern modelling techniques & analyses in rocks


Recommended Books


Engineering in Rocks for Slopes, Foundation and Tunnels, Editor T.Ramamurthy, Prentice Hall India Pvt. Ltd.

Related codes and manuals from International Society of Rock Mechanics, ASTM and Bureau of Indian Standards
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<td>Soil Dynamics</td>
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Fundamental of vibrations; analysis of free and forced vibrations using spring dashpot model; equations’ formulation and solution; block vibration test for determining stiffness and damping coefficient of soil mass; formulation of the problem for the multi-degree freedom system. Theories for foundations on elastic half space; effect of different pressure distribution; comparison with spring-dashpot model. Wave propagation in bar and elastic media; different types of waves; dynamic tests for determination of elastic and shear modulus. Geophysical survey using reflection, refraction steady state vibration and cross hole shear tests. Liquefaction analysis; cyclic shear test; assessment of zone of liquefaction. Seismic bearing capacity of foundations and seismic earth pressures. Vibration isolations

**Recommended Books**
Elective Course

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<tr>
<td>MTCE215</td>
<td>Urban Hydrology</td>
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Review of basic hydrology. Storm water runoff generation; return period; hydrologic risk; frequency analysis – IDF relationships; open channel flow in urban watersheds; interception storage, infiltration, depression storage; combined loss models; estimation of runoff rates from urban watersheds; flow routing; storm water drainage structures; storm water detention; structural and non-structural control measures; Source control techniques; urban storm water models. Introduction to urban ground water systems.

**Recommended Books**

Elective Course

MTCE216  Remote Sensing and GIS for Water Resources & Environmental Engg  3  1


**Recommended Books**
Elective Course

MTCE217   Ground Water and Contaminant Hydrology  3  1


Recommended Books
Elective Course

MTCE218 Disaster Reduction & Management

1. Disaster Reduction
Earthquake resistant design of structures, Response spectra and design earthquake parameters, Principles and philosophies, Codal provisions, Factors affecting damage to structures, Enforcement of codal provisions, Strong motion instrumentation and data processing, Effective rescue operation, General planning and design aspects, Conventional earthquake resistant design, Seismic base isolation method, retrofitting, Training and lecturing at various levels, Preparedness to meet earthquake disaster, Programmes for public awareness, demonstrations and exhibitions, Information management (Safety, emergencies, management and planning, design, response, user experience problems and case studies), Proper land use practices, long term disaster preparedness measures, Precautions after a major earthquake, Preparedness for medical supply Emergency care (First aid, Home remedies), Disposal of dead bodies (Human and Cattle), Care for old and orphans.

2. Indirect Damages
Damage due to ground failures, Landslides, rockslides, liquefaction, fire, floods, tsunamis, release of hazardous material like poisonous gas, nuclear radiation.

3. Disaster Management
Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilitation (Infrastructure rehabilitation, Housing rehabilitation, Social rehabilitation), Role of volunteers, Emergency operation centres, Information system, Danger zone restrictions, Cooperation with local authority, Coordination for international relief, Role of government, NGO's, Business and donors, Role of remote sensing in relief operations, Information management and related technologies in engineering and disaster management.
The design and management of Disaster Information Resource Network, Asian Disaster Preparedness Centre, Regional data base, Contacts and Sources, CD – ROM Library for Natural Disaster Management, Regional Disaster Documentation Centre, Non Governmental Organisations.
Elective Course

MTCE219  Construction and Maintenance Management  3  1

1. Services in Residential, Commercial and Medical buildings
(A) Sanitation, water supply, electric wiring, rain water disposal, lighting & illumination, calculation methods for these services
(B) Air Conditioning & Ventilation: Natural ventilation, control cooling systems, modern systems of air conditioning, ducting systems, different mechanical means of air conditioning.
(C) CCD-CS: General principles of transmission and passage of sound reverberation, absorption, reflection, acoustic materials and their coefficient, principles of good acoustic design.
(D) Thermal Insulation: Behavior of various building materials & thermal conductivity. Thermal insulation for air conditioned interior spaces, working out air conditioning loads for different spaces.
(E) Fire Safety Dye.

2. Architectural controls and building byelaws: Role of building byelaws in a city, local byelaws and architectural controls, façade control and zoning plans.

3. Regional planning: Understanding of physical, social and economical parameters for regional planning.

4. Landscaping: Forces of man and nature, their relationship and effect on shaping landscape, site analysis, site and.
Chapter –I Introduction
History of expert system research e.g. aquittance with researchers and their research fields. Current research activities. Conventional programs vs. Expert Systems Advantages and limitations of expert systems
Chapter –II Architecture of an expert system Components of expert system Knowledge base, Inference mechanism User Interface
Chapter –III Knowledge base Knowledge Engineering. Nature of expert knowledge., Knowledge acquisition and knowledge representative e.g. rule based systems, Semature nets, frames, Validity nature base , working memory
Chapter –IV Inference Engine and user interface, Techniques for inference mechanism, forward chaining and backward chaining , Interface language, terminal interface
Chapter-V Development of expert systems Problem formulation, Search spaces, Task for expert system, application to engineering analysis and design, Consideration , Operations Representative application in Civil engg.
There will be project for developing an expert system by small group of students using the profile of a given shell. The project will carry 50 sessional marks.

References:
A guide to expert system- Waterman D.A.
Introduction to expert systems- Jackson, P.