DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH, LUCKNOW

Syllabus

For

M.Tech. (Civil Engineering)

(Effective from the Session: 2016-17)

Course Structure and Evaluation Scheme for M Tech Civil Engineering
(Effective from session 2016-17)

Semester - I

S. No.	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTCE-101	Advance Structural Analysis	3	0	0	3	20	10	70	--	--	100
2	MTCE-102	Air Pollution, Control, & Environmental Management	3	0	0	3	20	10	70	--	--	100
3		Departmental Elective – I	3	0	0	3	20	10	70	--	--	100
4		Departmental Elective – II	3	0	0	3	20	10	70	--	--	100
5		Research Process & Methodology	3	0	0	3	20	10	70	--	--	100
6	MTCE-151	Lab-I	-	-	3	2	--	--	--	20	30	50
7	MTCE-152	Lab-II	-	-	2	1	--	--	--	20	30	50
		Total				**18**						**600**

Semester - II

S. No.	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTCE-201	Advance Structural Design	3	0	0	3	20	10	70	--	--	100
2	MTCE-202	Advance Foundation Engineering	3	0	0	3	20	10	70	--	--	100
3		Departmental Elective - III	3	0	0	3	20	10	70	--	--	100
4		Departmental Elective - IV	3	0	0	3	20	10	70	--	--	100
5		Departmental Elective - V	3	0	0	3	20	10	70	--	--	100
6	MTCE-251	Lab-III	-	-	3	2	--	--	--	20	30	50
7	MTCE-252	Seminar-I	-	-	2	1	--	--	--	50	--	50
		Total				**18**						**600**

Semester - III

S. No.	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTCE-351	Seminar-II	0	0	6	3	--	--	--	100	--	100
2	MTCE-352	Dissertation	0	0	30	15	--	--	--	200	300	500
		Total				**18**						**600**

Semester - IV

S. No.	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTCE-451	Dissertation (Final)	0	0	36	18	--	--	--	200	400	600
		Total				**18**						**600**

Departmental Elective I

1. MTCE-011 Building Architecture & Planning
2. MTCE-012 Advance Concrete Structure
3. MTCE-013 Hydrology and Hygronomy
4. MTCE-014 Advance Fluid Mechanics
5. MTCE-015 Advance Soil Mechanics

Departmental Elective II

1. MTCE-021 Transportation System and Planning
2. MTCE-022 Water Pollution and Control
3. MTCE-023 Remote Sensing and GIS
4. MTCE-024 Concrete Technology & Prestressed Concrete
5. MTCE-025 Water Resource Engineering

Departmental Elective III

1. MTCE-031 Industrial Effluent and Sewage Treatment
2. MTCE-032 Advance Transportation Engineering
3. MTCE-033 Precast and Composite Structures
4. MTCE-034 Ground Water Flow and Pollution Modelling
5. MTCE-035 Repair Rehabilitation and Retrofitting of Buildings

Departmental Elective IV

1. MTCE-041 Earth and Environment
2. MTST-202 Finite Element Method
3. MTCE-043 Advance Steel Structure
4. MTCE-044 Bridge Engineering
5. MTCE-045 Unsteady Flow in Hydrological Engineering

Departmental Elective V

1. MTCE-051 Solid Waste Management
2. MTCE-052 Earthquake Geotechnical Engineering
3. MTCE-053 Structural Design of Foundation & Retaining Structures
4. MTCE-054 Water Resources Development & Management
5. MTCE-055 Sediment Transportation

1. For dissertation, the students are required to compile a report including title of the dissertation, literature review, methodology of work to be pursued and activity schedule in the III semester. The compiled report shall be presented at the end of the IIIrd semester. Same dissertation shall be continued in the fourth semester.

M.Tech. Civil Engineering

SEMESTER I

MTCE-101 Advanced Structural analysis

Static and kinematic indeterminacies stiffness and flexibility matrices, force & displacement methods, stiffness matrices for prismatic and non- prismatic members, solution techniques, substructure analysis techniques, application to plane and space frame analysis. Organization of computation, programming considerations, applications to practical problems. Techniques of non-linear structural analysis, material and geometrically non- linear problems, incremental and iterative procedures, convergence criteria.

MTCE-102 Air Pollution, Control & Environmental management

Introduction to air pollution; types, sources, effects, and standards of air pollution. Monitoring (sampling & analyses) of common air pollutants. Meteorology and mathematical models related to dispersion & transport of air pollutants, strategies for air pollution control through rational urban planning. Air pollution due to automobiles and its control measures. Engineering control of industrial air pollution: theory & design of particulate control devices theory & design of gaseous pollutants' control devices. Some case studies of industrial emission control. Legal aspects of air pollution. Environmental Acts and Regulations. Environmental impact assessment, Public participation in environment decision making: Prediction and assessment of impact, Legislations in Indian context, Norms & Standards, Principles of sustainable development and implications, Environmental Management Systems.

Elective-I

MTCE 011- Building architecture & Planning

Principles of architecture, ecofriendly, utility of spaces, future growth, spanning, environmental filter. Environmental art and design for urban landscape-Objectives, principles, elements, material, soft landscaping, hard landscaping, and garden styles, water body conservation and creation. Built environment in urban areas-need, concept and importance – byelaws, Urban design and renewal for quality of life, Sustainable development Advantages and usage of sustainable materials and sustainable technologies. Green building concept, rating systems. Case study of rated buildings Objective of town planning, principles, stages in town development, growth of towns and theories of developments. Study of new towns and planned towns like new

Mumbai, Gandhinagar ,Neighborhood planning and role in urban development, town planning schemes, garden city & three magnet theory, green belts. Levels In planning, City development plan -Scope & purpose, Surveys- demographic, housing, land use, ws & sanitation, etc. Traffic; transport- urban road objectives, classification, traffic management. Legislative mechanisms, planning agencies for various levels of planning. their organisation and purpose. Acts-: land acquisition, udpfi, sez, spl townships Application of gis, gps remote sensing in planning.

MTCE 012- Advanced Concrete Structures

Constituent materials and their properties, types of cement, fresh concrete, workability; strength, elasticity and fracture of hardened concrete : Time dependent properties of concrete, durability of concrete ; Concrete admixtures, mix design methods ; Manufacture and processes ; Codal provisions ; Special concretes.

MTCE 013- Hydrology and Hygronomy

Introduction: Historical background, Hydrological cycle, forms of precipitation, its Arial and time variation, missing records, hydrological abstraction, runoff, hydrograph analysis, unit hydrograph, IUH, Nash and Clarke models. Rainfall runoff models, black-box type and physics based models. Statistical Methods: Correlation coefficient, curve fitting, regression analysis, multiple regression. Various distribution and their use in hydrology, plotting positions, frequency factors, extreme value theory. Generation of random numbers and synthetic data when persistence is absent. Flow Generation: Stochastic processes, their classification, time series and its components, cor-relogram, autoregressive processes. Synthetic generation of yearly and monthly flows in hydrology. Floods and Droughts: Flood estimation by various methods, design for various hydraulic structures, flood forecasting, droughts

MTCE 014 -Advanced fluid mechanics

Fundamental concepts and scope. Kinematics of fluid motion. Continuity equation, rotational and irrotational motion, circulation, vorticity, velocity potential and stream function, Methods of solving Laplace's equation. Dynamics of ideal fluids, Euler's equation of motion and their integration. iscous Laminar flow, derivation of Navier-stokes equations and their solutions for simple problems.Instability of Laminar flow. Theory of boundary layer, boundary layer approximations, Separation, Turbulent flow. Prandtl's mixing length theory, Von Karman

similarity hypothesis. Turbulent flow in smooth and rough pipes, velocity equation, Resistance of smooth and artificially roughened pipes. Flow around submerged objects. Types of drag; drag at high velocities, circulation and circulation theory of lift. Compressible flow. Hydraulic models and model techniques. Electrical analogies applied to hydraulic problems. Wind tunnels. Water tunnels.

MTCE 015- Advanced Soil Mechanics

Water flow in soils, Steady state flow, Transient flow; One, two and three dimensional consolidation theories and applications; Stresses in soil mass under applied loads: Two dimensional and three dimensional problems; Shear strength characteristics of soils; Critical states of soils; Stability of Slopes.

Elective II

MTCE-021 Transportation System and Planning

Introduction to Transportation systems, Transportation innovations, Social and Economic impacts of Transportation, Decision makers and their options, Demand modeling and prediction, Supply and equilibrium flows, Modelling and transportation technology, Analysis of network flows, Transportation network,Network theory, Concepts in transportation models and location models, Analysis of utility maximizing systems such as entropy Concepts, Major transportation technologies, Cost functions and estimation, Urban transport economic policy, Models for selecting network investments and operation planning, Case Studies.

MTCE-022 Water Pollution and Control

Definition of Pollution, Effluent Standards, Development of Water Quality Standards, Water Quality Index, River Water Classification, Classification and impacts of Pollution Variables, Stream Surveys, Pollution zones and classification, Physical, Chemical and Biological Water Purification Processes in Natural Systems, BOD Kinetics assimilation and DO sags, Impoundments and their effects, Pollution control strategies including legislative approach, Surface Water Modeling

MTCE-023 Remote Sensing and GIS

Energy sources, energy interaction in the atmosphere, data acquisition and interpretation, types of scanning and sensing system. Concept of GPS and its application. History of Indian Remote Sensing. Image interpretation. Digital Image Analysis - rectification and restoration. Image enhancement, manipulation techniques, Image classification. Post classification Smoothing; classification accuracy assessment; Principles of GIS. Application of Remote Sensing and GIS in Engineering Problems.

MTCE-024 Concrete Technology & Prestressed Concrete

Portland cement – its manufacture, physical and chemical properties; Standard test methods; Different types of Portland and other cements – a brief introduction; Properties of fine and coarse aggregates; Properties and standard test method concrete in fresh and hardened state; Mixing, transportation, placing and compaction of concrete; Effect of chemical admixtures on fresh and hardened concrete; Durability of concrete; Mix proportioning; Introduction to special concrete – Lightweight and foam concrete; High performance concrete; Ultra high strength concrete; Ready mix concrete, Roller compacted concrete, fibre reinforced concrete, high density concrete, pumped concrete etc.

General principles of Prestressing- Materials for prestressing, Prestressing systems, Losses of prestress, Load balancing concept. Partial prestressing, Circular prestressing. Prestressed Concrete Beams. End Blocks Prestressed concrete pipes and poles

MTCE-025 Water Resource Engineering

Water Resource development, Objectives, Constraints and criteria based on technical, economic, environmental, social and political factors. Multiple objectives in Water Resource Management, Benefit cost ratio for Water Resources development projects, General formulation of Water Resource Engineering problems in a system engineering frame work, Conjunctive water resource use. Environmental aspects of Water Resources Projects. Deterministic models-linear programming and dynamic programming. Classical optimization techniques and elementary non-linear programming, fundamentals of decision theory and its applications in Water Resource Management. Theory of games. Sustainable water resource development, Watershed development and management, Rain water harvesting.

MTCE-151

1. Stress analysis of a plate with a circular hole.

2. Stress analysis of rectangular L bracket

3. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)

4. Mode frequency analysis of a 2 D component

5. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)

6. Program using arrays and functions for matrix manipulation.

7. Programs to draw bending moment and shear force diagrams. Using graphic in C.

8. Analysis of truss using STAAD Pro.

9. Analysis of multistoreyed space frame, using STAAD Pro.

10. Analysis of Bridge deck slab.

From the above list of experiments minimum 8 experiments are required to be done.

MTCE-152

1. Monitoring of ambient air quality for total suspended particulate matter and respirable SPM.

2. Measurement of CO, HC, H_2S and NH_4 in exhausts.

3. Measurements of SO_x and NO_x in ambient air.

4. Study of Arc GIS, Air MOD, SPSS and other statistical software.

5. To determine the chlorine demand and residual chlorine in water.

6. To determine cations (Na, K, Li) and anions (sulfate, nitrate, fluoride).

7. To determine MPN count - total and fecal.

8. To determine the BOD, COD of the given sample.

9. To determine Heavy Metals (Pb, Cr, As, CN, Cd) in waste water.

10. Field visit of Industrial treatment plan and stack monitoring by BIS/EPA methods

From the above list of experiments minimum 8 experiments are required to be done.

SEMESTER II

MTCE-201 Advance Structural Design

Building Frames: Dead, Live, Wind and Earthquake loads, Analysis of framed building by approximate methods for vertical and horizontal loads, Concept of Exact Analysis, Joint detailing.

Liquid Retaining Structures: Basic design philosophy, Analysis and design of single cell rectangular water tanks subjected to hydrostatic loading based on plate theory

Earth Retaining Structures: Basic design philosophy, Calculation of lateral earth pressure based on Rankine's theory. Analysis and design of RC gravity walls, cantilever walls and Counterfort walls. Introduction to soil-structure interaction**.**

Pre-Stress concrete: Advantages of prestressing, methods of prestressing, losses in prestress, Analysis of simple prestressed rectangular and T- Section

Design of Bridges: Loads, Forces and Permissible Stresses, Code Recommendations regarding design and detailing, Design of slabs under concentrated loads using Effective width and Pigeaud's method, Courbon's method of load distribution, Detailed design of Highway Bridges: RC slab and R.C. T-beam types.

MTCE-202 Advance Foundation Engineering

Bearing capacity: Shallow and deep foundations; Settlement analysis: Shallow and deep foundations; Different types of foundations and their designs: Raft, Piles, and Well foundation; Sheet pile walls: Cantilevered and anchored; Excavation and bracings; Design of retaining walls. Foundations subjected to dynamic loads; Design of machine foundations.

Departmental Elective III

1. MTCE-031 Industrial Effluent and Sewage Treatment

Industrial wastewater: sources, types, characteristics. Industrial water demand and quality criteria, General treatment options for industrial effluents, common equipments used for industrial wastewater treatment. Removal of specific pollutants in industrial effluents, eg oil & grease, phenol, cyanide, toxic organics, heavy metals. Treatment of industrial effluents originating from dairy, paper & pulp, textile, tannery, distillery, electro-plating, petroleum & petro-chemical complex, iron & steel industry, pharmaceutical, food processing units.

2. MTCE-032 Advance Transportation Engineering

Transport policy, processes and surveys. Travel demand forecasting, route assignment analysis, Transport Networks and flow analysis. Classification of systems, Introduction to Intelligent Transportation System (ITS), Public Transport policy, Introduction to BRT, metro projects, concept of Integrated Inter Model transit system. Vehicle costs- operation, running, pollution, travel time, road damage, congestion and accident costs. Various economic studies. Transportation plans –various methods & their comparison. Pavement management systems.- methods and financing, its advantages & limitations. Traffic studies, traffic analysis process, basic traffic theory, intersection studies, parking studies, Traffic generation and parking- surveys, requirements and facilities. Instrumentation of traffic monitoring, Highway pavements and airport pavements, Flexible pavements studies and design as per IRC, Strengthening of pavement – Benkelmen beam method. Concept of rigid pavement and its design as per IRC. Overlay types and their design as per IRC.

3. MTCE-033 Precast and Composite Structures

Precast and cast in situ concrete structures,Prestressed and cast in situ concrete structures,Steel and concrete Composite structures,Encased beams and columns Applications to bridge decks, girders and precast building systems

4. MTCE-034 Ground Water Flow and Pollution Modelling

Darcy’s law, General hydro-dynamic equations, flow-nets in isotropic medium.Steady and unsteady flow through confined and unconfined aquifers, Schwartz-Christoffel Transformation and its application for groundwater flow and Seepage problems.Multiple well system, partially wells, Image wells, Mutual interference of wells. Contamination of groundwater, control of Ground water, Control of ground water pollution.Storage and exploration of groundwater, drainage, construction and maintenance of wells, groundwater recharge and runoff, water quality, budgeting, stimulation of groundwater basin application of GIS and remote sensing for groundwater. Roof-top Rainwater Harvesting and Recharge.

Groundwater Occurrence & Movement: General Introduction, Numerical modeling of groundwater flow - Review of differential equations, finite difference solution, direct problem, inverse problem., Planning of groundwater development-water balance, assessment of recharge, utilizable recharge, Groundwater estimation norms in India, Constraints on groundwater development. Groundwater modeling using finite element method

5. MTCE-035 Repair Rehabilitation and Retrofitting of Buildings

Appraisal of damage and deterioration of structures by non-destructive and other techniques; Cause of deterioration; Environmental aspects and earthquake effects; Repair and strengthening of superstructure – structural components, load bearing wall, panel walls; Strengthening of foundation; Grouting; Grout material, guniting, shotcreting, under pinning; Repair of steel structures – bridge, building, towers etc., monuments and historical structures. Prevention of water leakage in structures; Underwater repair; Durability of repairing material; Case histories.

Seismic Hazard Evaluation, Methodologies for seismic evaluation, Components of seismic evaluation Methodology, seismic evaluation of RC Columns, Beams, Joints and Slabs, Non destructive evaluation techniques, Principles of Repair and Retrofitting, Terminology in Repair, Restoration. Strengthening and Rehabilitations, Criteria for Repair, Restoration and Retrofitting; Repair Materials; In-situ testing methods for RC and masonry structure; Techniques of repair and retrofitting of masonry buildings; Techniques of Repair and Retrofitting in RC buildings; Retrofitting of buildings by seismic base isolation and supplemental damping; Retrofitting of heritage structures; Retrofitting of bridges; Case studies in retrofitting.

Departmental Elective IV

1. MTCE-041 Earth and Environment

Introduction, Biosphere and Environment, Importance of Clean Environment, Assimilation Capacity of Environment, Conservation of Environment, Impact of Development on Environment, Thermal Pollution, Radioactive and Non- Radioactive Pollution, Soil and Land Pollution, Impact of Mining and Deforestation, Green House Effect and Global Warming, Depletion of Ozone, Biodiversity, Sustainable Development, e-Waste, Plastic Waste.

2. MTST-202 Finite Element Method

Introduction to Finite: Element Model-concept of nodes and elements, Formulation of stiffness and transformation matrices, Implementation details. Basic equations of elasticity Finite element formulations. Isoparametric elements. Formulation of mass and damping matrices. Dynamic equilibrium equation and methods of solution for seismic loading. Accuracy and mesh-locking aspects in plane strain and plane stress analysis. Brief introduction to Fourier analysis of folded

plates, geometric and material non-linearity; Node numbering; Plate and shell elements, soil structure interaction; Modelling of unbounded media and singularities.

3. MTCE-043 Advance Steel Structure

Limit State Design Philosophy- Overview of IS 800- 2007 codal provisions for Welded and Bolted Connections, Slip resistant connections. Defects in welds. Beam Column joints- Eccentric Connections, Seat connections, Flexible connections, Splices in Beams and columns. Light gauge structures Tubular structures

4. MTCE-044 Bridge Engineering

Site Investigation, Bridge Hydrology, Geometry of Bridges, Steel, R.C.C., Prestressed Road and Rail Bridges; Suspension and Cable Stayed Bridges: Bearings, Joints, etc. Foundation, construction and erection; Maintenance of bridges; Codes of Practice; Multi-beam multi-cell R.C.C. bridges, curved and Skew Bridges, Dynamic Analysis of Bridges.

5. MTCE-045 Unsteady Flow in Hydrological Engineering

Gradually varied unsteady flow in open channels: continuity and dynamic equations, wave profile, propagation and subsidence of flood waves. Flood routing in open channel-kinematic and dynamic including diffusion analogy. Rapidly varied unsteady flow in open channels : Uniformly progressive flow, positive and negative surges. Water waves : Translatory, oscillatory and solitary waves, their development and propagation. Wave trains, group velocity, reflection and refraction of surface waves. Unsteady flow through closed conduits : Fundamental differential equations. Applications in water hammer analysis, simple and differential surge tanks.

Departmental Elective V

1. MTCE-051 Solid Waste Management

Introduction, Overview of Solid Waste Management, Types of Solid Wastes, Sources of Solid Wastes, Properties of Solid Wastes, Solid Waste Generation, On-site Handling, Storage, Collection, Transfer and Transport, Processing Techniques, Ultimate Disposal, Resource and Energy recovery Systems, Biomedical Waste Management, Introduction to Hazardous Waste and Fly Ash Management, Site selection Criteria for Landfill.

2. MTCE-052 Earthquake Geotechnical Engineering

Introduction, Seismology and earthquakes, ground motion, Seismic Hazard Analysis Wave Propagation, Dynamic soil properties, liquefaction Dynamic Earth pressure Seismic design, Seismic slope stability, Remediation of Seismic Hazards

3. MTCE-053 Structural Design of Foundation & Retaining Structures

Shallow foundations: All types of footings and raft subjected to axial, eccentric and lateral loads; Pile foundations: Types, design and placement; Well foundations: Types, design and methods of construction; Retaining Structures: Types and design; Break Waters: Design and methods of construction.

4. MTCE-054 Water Resources Development & Management

Objectives: of water resource planning and management, its Necessity, Aspects of water resources planning, of water resource development; needs and opportunities; societal goals, Spatial and temporal characteristics of water resources, constraints for its development like non-reversibility; planning region and horizon. Cost benefit studies of single and multipurpose projects– multi objective planning models, financial analysis of water resources projects, allocation of cost of multipurpose projects; repayment of cost.

Demand for drinking water; irrigation, hydropower; navigational; planning for flood control. Characteristics and functions of reservoir; reservoir sedimentation; conservation storage; conflict among uses, Reservoir operation studies - effect on river regime; long term simulation; reliability; resiliency and vulnerability assessment Ground water evaluation; conjunctive use of surface and ground water. Discounting techniques; benefit cost parameters; estimation of benefits and costs; appraisal criteria; social benefit cost analysis. Basin planning; inter-basin transfer of water

5. MTCE-055 Sediment Transportation

Properties of sediments, Sediment yield, Models of sediment transport, regimes of flow, forms of bed roughness, Resistance to flow. Bed load transport and related equations. Theory of sediment suspension, sediment distribution along vertical, Total load equations. Sediment distribution in a stream section, Sediment distribution with time, fine sediments and bed materials discharge. Bed load and suspended load samples. Design of alluvial channels. Principles of stream power and minimum energy. Meandering and braiding of streams, Reservoir sedimentation, density currents. Coastal sediment problems. Sediment transport through pipelines. Sediment sampling and measuring devices

MTCE-251 Lab-III

1. Mix design of concrete of different grades & using admixtures.
2. Tensile and Flexural strength of concrete of different grades.
3. Tensile strength of different types of steel rebars, rolled steel sections.
4. Testing of simply supported RCC beams for flexural failure.
5. Testing of simply supported RCC beams for shear failure.
6. Testing of RCC column.
7. Non-destructive testing of concrete including rebound hammer and ultrasonic pulse method.
8. Permeability of concrete.
9. Vibration analysis of beams and plates.
10. Buckling load of struts.