

Section B

**Master of Technology
CURRICULA & SYLLABI**

CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

Credit Structure for M. Tech. (Hill Area Development Engineering)
(For newly admitted students from Session 2018-2019)

Category	Semesters	I	II	III	IV	Total
Maths (M)		4	-	-	-	4
Programme Core (PC)		13	13	-	-	26
Programme Electives (PE)		-	4	8	-	12
Minor Project (MP)		-	-	4	-	4
Dissertation (D)				4	14	18
Seminar (S)		-	-	-	2	2
Total		17	17	16	16	66

Curriculum for M. Tech. (Hill Area Development Engineering)
(For newly admitted students from Session 2018-2019)

Junior Year, Semester I

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	M	MAS-112	Advanced Engineering Mathematics	3	1	0	4
2.	PC	MCE-***	Advances in Civil Engineering	3	1	0	4
3.	PC	MCE-102	Water Resources Development	3	1	0	4
4.	PC	MCE-103	Hill Transportation	3	1	2	5
5.	AC		Audit Subject				-
Total				12	4	2	17

Junior Year, Semester II

S.N.	Category	PaperCode	SubjectName	L	T	P	Credits
1.	PC	MCE-104	LandResourcesManagement	3	1	0	4
2.	PC	MCE-105	Hill Habitat, Water SupplyandSanitation	3	1	2	5
3.	PC	MCE-101	Ecology and Eco-development	3	1	0	4
4.	PE1	MCE-***	ProgrammeElective	3	1	0	4
5.	AC		AuditSubject				-
Total				12	4	2	17

Senior Year, Semester III

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PE2	MCE-***	Programme Elective-2	3	1	0	4
2.	PE3	MCE-***	Programme Elective-3	3	1	0	4
3.	MP	MCE-120	Minor Project	0	0	8	4
4.	D	MCE-130	Dissertation Part-I	0	0	8	4
Total				6	2	16	16

Senior Year, Semester IV

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	S	MCE-140	Seminar	0	0	4	2
2.	D	MCE-150	Dissertation Part-II	0	0	28	14
Total				0	0	32	16

Programme Core for M. Tech. (Hill Area Development Engineering)

S.No.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-101	Ecology and Eco-development	-	3	1	0	4
2.	MCE-102	Water Resources Development	-	3	1	0	4
3.	MCE-103	Hill Transportation	-	3	1	2	5
4.	MCE-104	Land Resources Development	-	3	1	0	4
5.	MCE-105	Hill Habitat, Water Supply and Sanitation	-	3	1	2	5
6.	MCE-120	Minor Project	-	0	0	8	4
7.	MCE-130	Dissertation Part-I	-	0	0	8	4
8.	MCE-140	Seminar	-	0	0	4	2
9.	MCE-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PE1)

S.N.	PaperCode	SubjectName	PrerequisiteSubjects	L	T	P	Credits
1.	MCE-151	EnvironmentalQualityManagement	-	3	1	0	4
2.	MCE-152	EarthandEnvironment	-	3	1	0	4
3.	MCE-153	Principles ofRemoteSensing	-	3	1	0	4
4.	MCE-154	AppliedGeology	-	3	1	0	4
5.	MCE-157	Systems Analysis and Management	-	3	1	0	4

ProgrammeElectives(PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
3.	MCE-158	Solid Waste Management	-	3	1	0	4
4.	MCE-159	Groundwater Management	-	3	1	0	4
5.	MCE-167	Geographic Information System Techniques	-	3	1	0	4

ProgrammeElectives(PE3)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-169	Disaster Management	-	3	1	0	4
2.	MCE-166	Water Pollution	-	3	1	0	4
3.	MCE-163	Earthquake Resistant Design of Buildings	-	3	1	0	4
4.	MCE-164	Geo-technique of Hill Area	-	3	1	0	4
5.	MCE-168	Water Retaining Structures	-	3	1	0	4

Courses for other Departments

S. No.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MCE-191	Earth and Environment	-	3	1	2	5
2.	MCE-192	Environmental Impact Assessment and Management	-	3	1	0	4

Audit Courses for M. Tech. (Hill Area Development Engineering)

S. No.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-105	Applied Probability and Statistics	-	3	1	0	4
2.	MBA-109	Research Methodology	-	3	1	0	4
3.	MAS-109	Foreign Language-French	-	2	1	0	3
4.	MAS-110	Foreign Language-German	-	2	1	0	3
5.	BCS-68	Neural Network and Fuzzy System	-	3	1	0	4

Besides above electives, the students may be offered others electives subject to prior approval from competent authority.

CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

Credit Structure for M. Tech. (Environmental Engineering)

(For newly admitted students from Session 2018-2019)

Category	Semesters	I	II	III	IV	Total
Maths (M)		4	-	-	-	4
Programme Core (PC)		13	13	-	-	26
Programme Electives (PE)		-	4	8	-	12
Minor Project (MP)		-	-	4	-	4
Dissertation (D)				4	14	18
Seminar (S)		-	-	-	2	2
Total		17	17	16	16	66

Curriculum for M. Tech. (Environmental Engineering)

(For newly admitted students from Session 2018-2019)

Junior Year, Semester I

S.N.	Category	PaperCode	SubjectName	L	T	P	Credits
1.	M	MAS-112	AdvancedEngineeringMathematics	3	1	0	4
2.	PC	MCE-201	Environmental ChemistryandMicrobiology	3	1	0	4
3.	PC	MCE-203	WastewaterTreatment	3	1	2	5
4.	PC	MCE-000	Advances in Civil Engineering	3	1	0	4
5.	AC		AuditSubject				-
Total				12	4	2	17

Junior Year, Semester II

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PC	MCE-204	Air and Noise Pollution and Controls	3	1	2	5
2.	PC	MCE-205	Solid Waste Management	3	1	0	4
3.	PC	MCE-202	Water Treatment and Distribution	3	1	0	4
4.	PE1	MCE-***	Programme Elective-1	3	1	0	4
5.	AC		Audit Subject				-
Total				12	4	2	17

Senior Year, Semester III

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PE2	MCE-***	Programme Elective-2	3	1	0	4
2.	PE3	MCE-***	Programme Elective-3	3	1	0	4
3.	MP	MCE-220	Minor Project	0	0	8	4
4.	D	MCE-230	Dissertation Part-I	0	0	8	4
Total				6	2	16	16

Senior Year, Semester IV

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	S	MCE-240	Seminar	0	0	4	2
2.	D	MCE-250	Dissertation Part-II	0	0	28	14
Total				0	0	32	16

Programme Core for M. Tech. (Environmental Engineering)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-201	Environmental Chemistry and Microbiology	-	3	1	2	5
2.	MCE-202	Water Treatment and Distribution	-	3	1	0	4
3.	MCE-203	Wastewater Treatment	-	3	1	2	5
4.	MCE-204	Air and Noise Pollution and Controls	-	3	1	2	5
5.	MCE-205	Solid Waste Management	-	3	1	0	4
6.	MCE-220	Minor Project	-	0	0	8	4
7.	MCE-230	Dissertation Part-I	-	0	0	8	4
8.	MCE-240	Seminar	-	0	0	4	2
9.	MCE-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PE1)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-151	Environmental Quality Management	-	3	1	2	5
2.	MCE-152	Earth and Environment	-	3	1	0	4
3.	MCE-153	Principles of Remote Sensing	-	3	1	2	4
4.	MCE-256	Environmental Sanitation and Ecology	-	3	1	0	4
5.	MCE-266	Plumbing Services	-	3	1	0	4

Programme Electives (PE2)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-167	Geographic Information System Techniques	-	3	1	0	4
3.	MCE-261	Ground Water Management	-	3	1	0	4
4.	MCE-259	Rural Environmental Technology	-	3	1	0	4
5.	MCE-262	Building Environmental and Services	-	3	1	0	4

Programme Electives (PE3)

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
2.	MCE-268	Industrial Wastewater Treatment	-	3	1	0	4
3.	MCE-267	Hazardous Waste Management	-	3	1	0	4
4.	MCE-263	Geo-environmental Engineering	-	3	1	0	4
5.	MCE-169	Disaster Management	-	3	1	0	4

Audit Courses for M. Tech. (Environmental Engineering)

S. No.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-105	Applied Probability and Statistics	-	3	1	0	4
2.	MBA-109	Research Methodology	-	3	1	0	4
3.	MAS-109	Foreign Language-French	-	2	1	0	3
4.	MAS-110	Foreign Language-German	-	2	1	0	3
5.	BCS-68	Neural Network and Fuzzy System	-	3	1	0	4

Besides above electives, the students may be offered others electives subject to prior approval form competent authority.

CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

Credit Structure for M. Tech. (Structural Engineering)

(For newly admitted students from Session 2018-2019)

Category	Semesters	I	II	III	IV	Total
Maths (M)		4	-	-	-	4
Programme Core (PC)		13	13	-	-	26
Programme Electives (PE)		-	4	8	-	12
Minor Project (MP)		-	-	4	-	4
Dissertation (D)				4	14	18
Seminar (S)		-	-	-	2	2
Total		17	17	16	16	66

Curriculum for M. Tech. (Structural Engineering)

(For newly admitted students from Session 2018-2019)

Junior Year, Semester I

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	M	MAS-112	Advanced Engineering Mathematics	3	1	0	4
2.	PC	MCE-301	Advance Structural Analysis	3	1	0	4
3.	PC	MCE-302	Concrete Structures	3	1	2	5
4.	PC	MCE-000	Advances in Civil Engineering	3	1	0	4
5.	AC		Audit Subject				
Total				12	4	2	17

Junior Year, Semester II

S.N.	Category	PaperCode	SubjectName	L	T	P	Credits
1.	PC	MCE-304	Analysis and Design of Dynamic Effects	3	1	2	5
2.	PC	MCE-305	Metal Structures	3	1	0	4
3.	PE1	MCE-***	Programme Elective-1	3	1	0	4
4.	PC	MCE-303	Prestressed Concrete	3	1	0	4
5.	AC		Audit Subject				-
Total				12	4	2	17

Senior Year, Semester III

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PE2	MCE-***	Programme Elective-2	3	1	0	4
2.	PE3	MCE-***	Programme Elective-3	3	1	0	4
3.	MP	MCE-320	Minor Project	0	0	8	4
4.	D	MCE-330	Dissertation Part-I	0	0	8	4
Total				6	2	16	16

Senior Year, Semester IV

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	S	MCE-340	Seminar	0	0	4	2
2.	D	MCE-350	Dissertation Part-II	0	0	28	14
Total				0	0	32	16

Programme Core for M. Tech. (Structural Engineering)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-301	Advance Structural Analysis	-	3	1	0	4
2.	MCE-302	Concrete Structures	-	3	1	2	5
3.	MCE-303	Prestressed Concrete	-	3	1	0	4
4.	MCE-304	Analysis and Design of Dynamic Effects	-	3	1	2	5
5.	MCE-305	Metal Structures	-	3	1	0	4
6.	MCE-320	Minor Project	-	0	0	8	4
7.	MCE-330	Dissertation Part-I	-	0	0	8	4
8.	MCE-340	Seminar	-	0	0	4	2
9.	MCE-350	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives(PE1)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-351	Maintenance and Rehabilitation of Structures	-	3	1	0	4
2.	MCE-352	Pre-cast and Composite Structures	-	3	1	0	4
3.	MCE-368	Bridge Engineering	-	3	1	0	4
3.	MCE-353	Rock Engineering	-	3	1	0	4
4.	MCE-354	Continuum Mechanics	-	3	1	0	4

Programme Electives(PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-356	Retrofitting of Buildings	-	3	1	0	4
2.	MCE-357	Hydraulic Structures	-	3	1	0	4
3.	MCE-358	Machine Foundations	-	3	1	0	4
4.	MCE-369	Ground Improvement Technique	-	3	1	0	4
5.	MCE-359	Finite Element Method	-	3	1	0	4

Programme Electives(PE3)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-361	Nonlinear Analysis of Structures	-	3	1	0	4
2.	MCE-362	Earth & Rock fill Dam.	-	3	1	0	4
3.	MCE-366	Design of Plates and Shells	-	3	1	0	4
3.	MCE-363	Project Planning and Control	-	3	1	0	4
4.	MCE-367	Industrial Structures	-	3	1	0	4
4.	MCE-364	Soil Structure interaction	-	3	1	0	4

Audit Courses for M. Tech. (Structural Engineering)

S. No.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-105	Applied Probability and Statistics	-	3	1	0	4
2.	MBA-109	Research Methodology	-	3	1	0	4
3.	MAS-109	Foreign Language-French	-	2	1	0	3
4.	MAS-110	Foreign Language-German	-	2	1	0	3
5.	BCS-68	Neural Network and Fuzzy System	-	3	1	0	4

Besides above electives, the students may be offered others electives subject to prior approval form competent authority.

CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

Credit Structure for M. Tech. (Earthquake Engineering and Seismic Design)

(For newly admitted students from Session 2018-2019)

Category	Semesters	I	II	III	IV	Total
Maths (M)		4	-	-	-	4
Programme Core (PC)		13	13	-	-	26
Programme Electives (PE)		-	4	8	-	12
Minor Project (MP)		-	-	4	-	4
Dissertation (D)				4	14	18
Seminar (S)		-	-	-	2	2
Total		17	17	16	16	66

Curriculum for M. Tech. (Earthquake Engineering and Seismic Design)

Junior Year, Semester I

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	M	MAS-112	Advanced Engineering Mathematics	3	1	0	4
2.	PC	MCE-301	Advance Structural Analysis	3	1	0	4
3.	PC	MCE-000	Advances in Civil Engineering	3	1	0	4
4.	PC	MCE-402	Geotechnical Earthquake Engineering	3	1	2	5
5.	AC		Audit Subject				-
Total				12	4	2	17

Junior Year, Semester II

S.N.	Category	PaperCode	SubjectName	L	T	P	Credits
1.	PC	MCE-403	StructuralDynamics	3	1	2	5
2.	PC	MCE-404	Earthquake Resistant Designofstructures	3	1	0	4
3.	PE1	MCE-***	ProgrammeElective-1	3	1	0	4
4.	PC	MCE-401	Seismology and Tectonics	3	1	0	4
5.	AC		AuditSubject				-
Total				12	4	2	17

Senior Year, Semester III

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PE2	MCE-***	Programme Elective-2	3	1	0	4
2.	PE3	MCE-***	Programme Elective-3	3	1	0	4
3.	MP	MCE-420	Minor Project	0	0	8	4
4.	D	MCE-430	Dissertation Part-I	0	0	8	4
Total				6	2	16	16

Senior Year, Semester IV

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	S	MCE-440	Seminar	0	0	4	2
2.	D	MCE-450	Dissertation Part-II	0	0	28	14
Total				0	0	32	16

Programme Core for M. Tech. (Earthquake Engineering and Seismic Design)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-301	Advanced Structural Analysis	-	3	1	2	5
2.	MCE-401	Seismology & Tectonics	-	3	1	0	4
3.	MCE-402	Geotechnical Earthquake Engineering	-	3	1	2	5
4.	MCE-403	Structural Dynamics	-	3	1	2	5
5.	MCE-404	Earthquake Resistant Design of structures	-	3	1	0	4
6.	MCE-420	Minor Project	-	0	0	8	4
7.	MCE-430	Dissertation Part-I	-	0	0	8	4
8.	MCE-440	Seminar	-	0	0	4	2
9.	MCE-450	Dissertation Part-II	Dissertation Part-I	0	0	28	16

Programme Electives (PE1)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-351	Maintenance and Rehabilitation of Structures	-	3	1	0	4
2.	MCE-352	Pre-cast and Composite Structures	-	3	1	0	4
3.	MCE-368	Bridge Engineering	-	3	1	0	4
4.	MCE-353	Rock Engineering	-	3	1	0	4
5.	MCE-354	Continuum Mechanics	-	3	1	0	4

Programme Electives (PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-356	Retrofitting of Buildings	-	3	1	0	4
2.	MCE-357	Hydraulic Structures	-	3	1	0	4
3.	MCE-358	Machine Foundations	-	3	1	0	4
4.	MCE-369	Ground Improvement Techniques	-	3	1	0	4
5.	MCE-359	Finite Element Method	-	3	1	0	4

Programme Electives (PE3)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-364	Soil Structure Interaction	-	3	1	0	4
2.	MCE-367	Industrial Structures	-	3	1	0	4
3.	MCE-366	Design of Plates and Shells	-	3	1	0	4
4.	MCE-461	Random Vibrations	-	3	1	0	4

Audit Courses for M. Tech. (Earthquake Engineering and Seismic Design)

S. No.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-105	Applied Probability and Statistics	-	3	1	0	4
2.	MBA-109	Research Methodology	-	3	1	0	4
3.	MAS-109	Foreign Language-French	-	2	1	0	3
4.	MAS-110	Foreign Language-German	-	2	1	0	3
5.	BCS-68	Neural Network and Fuzzy System	-	3	1	0	4

Besides above electives, the students may be offered others electives subject to prior approval from competent authority.

Section C

SYLLABI

**CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR**

COURSES OFFERED

Programme Core for M. Tech. (Hill Area Development Engineering)

S.No.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-101	Ecology and Eco-development	-	3	1	0	4
2.	MCE-102	Water Resources Development	-	3	1	0	4
3.	MCE-103	Hill Transportation	-	3	1	2	5
4.	MCE-104	Land Resources Development	-	3	1	0	4
5.	MCE-105	Hill Habitat, Water Supply and Sanitation	-	3	1	2	5
6.	MCE-120	Minor Project	-	0	0	8	4
7.	MCE-130	Dissertation Part-I	-	0	0	8	4
8.	MCE-140	Seminar	-	0	0	4	2
9.	MCE-150	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PE1)

S.N.	PaperCode	SubjectName	PrerequisiteSubjects	L	T	P	Credits
1.	MCE-151	EnvironmentalQualityManagement	-	3	1	0	4
2.	MCE-152	EarthandEnvironment	-	3	1	0	4
3.	MCE-153	Principles ofRemoteSensing	-	3	1	0	4
4.	MCE-154	AppliedGeology	-	3	1	0	4

ProgrammeElectives(PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-157	Systems Analysis and Management	-	3	1	0	4
3.	MCE-158	Solid Waste Management	-	3	1	0	4
4.	MCE-159	Groundwater Management	-	3	1	0	4

ProgrammeElectives(PE3)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-161	Geo-environmental Engineering	-	3	1	0	4
2.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
3.	MCE-163	Earthquake Resistant Design of Buildings	-	3	1	0	4
4.	MCE-164	Geo-technique of Hill Area	-	3	1	0	4

Programme Electives (PE4)

S. N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MCE-166	Water Pollution	-	3	1	0	4
2.	MCE-167	Geographic Information System Techniques	-	3	1	0	4
3.	MCE-168	Water Retaining Structures	-	3	1	0	4
4.	MCE-169	Disaster Management	-	3	1	0	4

SYLLABI

MCE- * ADVANCES IN CIVIL ENGINEERING**

Course category	:	Engineering Fundamental (EF)
Pre-requisites	:	B. Tech (Civil Engineering)
Contact hours/week	:	Lecture: 3 , Tutorial: 1 , Practical: 0
Number of Credits	:	
Course Assessment methods	:	
Course Outcomes	:	

Topics Covered

UNIT-I

Shear Strength of Soils: Mohr-Coulomb Failure Criterion, Methods of Shear Strength Determination: Direct Shear Test, Triaxial test. Total and effective Stress Parameters, Pore Water Pressure Parameters, Stress-Strain Behaviour of Sands.

Compression and Consolidation of Soils: Compressibility Characteristics, Normally Consolidated and Over-Consolidated Clays, Estimation of Preconsolidation Stress, Terzaghi's Theory.

UNIT-II

Hydraulic Jump, Hydraulic Jump characteristics and its application in Civil Engineering, Stilling Basin types and Design (One complete problem on stilling Basin Design and Drawing).

UNIT-III

Equipment Management; Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, Hauling equipment, Hoisting equipment Conveying equipment, Concrete Production equipment. Importance of estimation, different types of estimates, specifications: general and detailed. Methods of estimation, Estimates of RC works, Estimates of Buildings

UNIT-IV

Beneficial uses of water and quality requirements, standards, sources of water, unit operations, process and flow sheets in water treatment.

Waste water characteristics, Preliminary, primary, secondary and tertiary treatment processes of waste water, aerobic and anaerobic treatment process, recycling, reuse and recrimination of waste water, waste water disposal.

Textbooks/ Reference books

1. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
2. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics, New Age Intl(P) Ltd.
3. K. R. Arora – Soil Mechanics & Foundation Engg. Standard Publishers & Distributors, Delhi
4. Chow, V.T., Open channel Hydraulics, McGraw Hill International, New York, 1959
5. Subramanya, K., Flow in Open Channels, Tata McGraw Hill., 4thEdn., 2015
6. IS 4997: Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron. by Bureau of Indian Standards
7. Construction Planning and Management by U. K. Srivastava.
8. Construction, Planning, Equipment and Methods by R. L. Peurify
9. Estimating and Costing by B. N. Dutta.
10. Estimating, Costing and Valuation in Civil Engineering by M. Chakraborty.
11. Peavy, Rowe and Tchobanoglous: Environmental Engineering
12. Metcalf and Eddy Inc.: Wastewater Engineering
13. Garg: Water Supply Engineering (Environmental Engineering Vol. – I)
14. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).

MCE-101	ECOLOGY AND ECO-DEVELOPMENT	4 Credits(3-1-0)
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UNIT I		9
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Ecology Levels of organization, Subdivision of Ecology principles and concepts pertaining to Ecosystems, examples of a lake, a watershed unit, a forest, as ecosystems. Homeostasis of an ecosystem

UNIT II		9
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Principles and concepts of pertaining to flow of energy in ecosystems, principles and concepts pertaining to biogeochemical cycles, Principles pertaining to limiting factors, Development and evolution of ecosystems, Ecosystem development with regard to shifting cultivation. Fresh water ecology and terrestrial ecology of hilly regions, systems approach and mathematical modeling in ecology

UNIT III		9
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Remote sensing as a tool for the study and management of ecosystems, Eco-development, The existing trends of economic development in hill, The adverse impact of water resources, industrial agricultural, horticultural tourist development in hills. The concept of Eco-development, Sukhomajrimodels

UNIT IV		9
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Socio economic development coordinated, action oriented research. Post harvest operation, Agro and plant based industries, Institutional framework, forest policy

Books & References:

1. Fundamentals of Ecology - Eugene Odum, Gary W. Bewet, Brooks Cole
2. Essentials of Ecology - Jr. G. Tylor miller, Brooks Cole
3. Elements of Ecology - Robert L. Smith, Thomas H. Smith, Graham C. Hickman, Susan M. Hickman, Benjamin Cummings
4. Ecology: Principles & Applications - J.L. Chopra & M.J. Reiss (Cambridge University Press)

MCE-102	WATER RESOURCES DEVELOPMENT	4 Credits(3-1-0)
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UNIT I		9
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Benefit cost ratio, systems approach to planning projects on river systems. Fixing optimum capacities by dynamic programming, Fixing priority of projects

UNIT II		9
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Design of high dams in seismic region and their foundation problems. Design of arch and shell dams, concrete membrane dams, and rolled fill concrete dams. Hydel power and its advantages and disadvantages

UNIT III		9
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Economics of peaking power and frequency control. Different types of power plants and their planning. Layout of a hydel power station and its fixtures

UNIT IV		9
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Design of power house structures, fore bay, penstocks, spiral casing, draft tube and superstructure, foundations of a powerhouse

Books & References:

1. Irrigation Engineering & Hydraulic Structures-S.R. Sahasrabudhe (Katson Book, Delhi)
2. Irrigation Engineering & Hydraulic Structures-S.K. Garg (Khanna Publishers, Delhi)
3. Water Resources Engineering-S.R. Sahasrabudhe (Katson Books)

UNIT I

9

Introduction: Special aspects of hill roads, preliminary investigations, Classification of hill roads, Environmental considerations and their impacts

UNIT II

9

Alignment of Hill Roads: Basic considerations, Survey and requirements of alignments, Gradient and selection of alignments, Future traffic considerations, Cross drainage.

Geometric Design of Hills Roads: Types of hill zones and terrain, Geometric Elements, Width of formation and land, Right of way, Speed limit requirement, Camber, Gradients, Sight distances, Horizontal curves Super-elevation curves, Super-elevations, Transition curves, Pavement widening curves, Hair-pin-bends, Over-taking crossing places, Vertical curves, Minimum vertical clearance.

UNIT III

9

Rock Blasting and Cutting Techniques: Rock cutting and blasting, Mechanism of blasting, Explosives for rock blasting and techniques for blasting, Drilling pattern.

Retaining Walls: Types of retaining walls, Stability of slopes, Backpressure on retaining walls, Design of retaining walls

UNIT IV

9

Drainage in Hill Roads: Drainage of water form hill slope, Roadside drains, Cross drainage, sub surface drainage

Maintenance Problems of Hill Roads: Common problems and their causes, Landslide Problems, Types of Landslides, Measures to prevent landslides, Breast walls

Safety Requirements and Labour Laws: Importance of safety and Labour laws on hill roads, type of accidents, accidents during hill cutting and blasting. Accidents with machines, various safety measures, Remedial measures, Labour regulation laws

LABORATORY WORK

1. Crushing Value Test of Aggregate
2. Impact Value Test of Aggregate
3. Los Angeles Abrasion Value of Aggregate
4. Shape Test (Flakiness Index, Elongation Index) of Aggregate
5. Penetration Test of Bituminous Sample
6. Softening Point Test of Bituminous Sample
7. Stripping Test of Bituminous Sample
8. Ductility Test of Bituminous Sample
9. Flash & Fire Point Test of Bituminous Sample
10. Classified both directional Traffic Volume Study
11. Traffic Speed Study (Using Radar Speedometer or Enoscope)
12. Marshall test

Books & References:

1. Highway Engineering-S.P. Bindra (Danpat Rai Publication, New Delhi)
2. Transportation Engineering (Vol.1)-V.N. Vazirani 7 S.P. Chandola (Khanna Publications, New Delhi)
3. Highway Engineering-L.R. Kadiyali & Dr. N.B. Lal (Khanna Publications, New Delhi)

MCE-104	LAND RESOURCES DEVELOPMENT	4 Credits(3-1-0)
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UNIT I	9
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Land capability classification, climate index for agricultural potential at high altitudes.

A study of crops in the hills, crop rotation, crop water and soil water relationship

UNIT II	9
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Crop yield/water use production, functions, Agriculture systems, jhum cultivation, Problems of agricultural plant resources, Terrace cultivation Economic, social and industrial aspects of the area and systems approach to optimum development of the potential.

UNIT III	9
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Hill irrigation, contour channels and diversion works, side channel spillways, lift channels. Techniques of accurate water placement trickle and sprinkler irrigation. Drainage to prevent washing away of fields crop cover effect

UNIT IV	9
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Drainage to prevent erosion by rain splash, Mathematical treatment of overland flow on surface and in drains

Books & References:

1. Irrigation & Water Power Engineering-Dr.B.C. Punamia & Dr.Pande B.B.Lal (Lakshmi Publishers, Delhi)
2. Irrigation & Water Power Engineering-B.C. Punamia, Ashok Kr Jain, Arun Kr Jain (Lakshmi Publisher, Delhi)

MCE-105	HILL HABITAT, WATER SUPPLY AND SANITATION	5 Credits(3-1-2)
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UNIT I	9
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Hill Habitats: Planning aspects, Site-selection, Orientation and General building requirements in relation to hilly settlements. Utilization of locally available materials like stones, timber, bamboo and mud etc. Precast and energy efficient construction technologies suitable for hilly settlements

UNIT II	9
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Water Supply: Sources of water supply, Water quality and impurities, Estimation of Water demand, collection and distribution techniques

UNIT III	9
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Water Conservation: Dual Water Supply systems, Concept of Domestic and Potable Water, Contour Bunds, Rain water harvesting and ground water recharge techniques

UNIT IV	9
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Sanitation: Principles of sanitation and vector control, Community sanitation. Refuse collection and disposal techniques, Low cost toilets

EXPERIMENTS

1. To estimate the hardness of the given water sample.
2. To estimate the P^H and turbidity of the given water sample.
3. To estimate the acidity of the given water sample.
4. To estimate the alkalinity of the given water sample.
5. To estimate the chloride concentration of the given water sample.
6. To estimate the total solids and total dissolved solids of the given water sample.
7. To estimate the MPN count of total coliforms in the given water sample.
8. To determine the BOD of given water sample.
9. To determine the COD of given water sample.

MCE-151	ENVIRONMENTAL QUALITY MANAGEMENT	4 Credits(3-1-0)
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UNIT I	9
Introduction, Development Needs, Environmental Impact Assessment (EIA), Environmental Statement (ES)	
UNIT II	9
Environmental Management Plan (EMP), Environmental Audit (EA), ISO-14000, Rules and Regulation for getting Consent to establish and Operate Industry	
UNIT III	9
General Provisions and salient features of Water Act, Cess Act, Air Act, EP Act, Hazardous Waste Act/Rules, Biomedical Waste Act/Rules, Noise Rules	
UNIT IV	9
Municipal Solid Waste Rules, Ozone Depleting Substances Rules, Various International Treaties Related to Environmental issues	

MCE-152	EARTH AND ENVIRONMENT	4 Credits(3-1-0)
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UNIT I	9
Introduction, Biosphere and Environment, Importance of Clean Environment, Assimilation Capacity of Environment, Conservation of Environment	
UNIT II	9
Impact of Development on Environment, Thermal Pollution, Radio activate and non- radioactive pollution, Soil and Land Pollution.	
UNIT III	9
Impact of Mining and Deforestation, Green House Effect and Global Warming, Depletion of Ozone	
UNIT IV	9
Biodiversity, Sustainable Development, e-Waste, Plastic Waste	

Books & References:

1. Chemistry of Environmental Engineering - C.N.Sawer, P.L.Mc Carty and G.F.Perkai (Tata McGraw Hill)
2. Environmental Chemistry - A.K. De (New Age International Pvt. Ltd., New Delhi)
3. Prospective in Environmental Studies - A. Kaushik & C.P. Kaushik (New Age International Pvt. Ltd.)

MCE-153	PRINCIPLES OF REMOTE SENSING	4 Credits(3-1-0)
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UNIT I	9
Remote sensing- Introduction, Sources of energy for remote sensing- active and passive sources, electromagnetic radiation and their characteristics, thermal emission	
UNIT II	9
Interaction of EMR with atmosphere-atmospheric windows, interaction of EMR with earth surface-spectral reflection curves. Multi concept of remote sensing, idealisms and real sequence of remote sensing, sensors and orbital characteristics	
UNIT III	9
Various sensing platforms for remote sensing, principle of Remote sensing devices (RBV, MSS, LISS), IRS and other sensing systems such as Landsat, and Spot, Remote sensing data products and their uses.	
UNIT IV	9
Digital Image Processing- Introduction, digital image representation and characterization, histograms and scatter plot, image enhancement-contrast stretching, pattern recognition and feature extraction. Image classification- unsupervised and supervised techniques, classification accuracy assessment, NDVI, Principle component analysis	

Books & References:

1. Remote Sensing & Image Interpretation - T.M. Lillesand & R.W. Kipler (John Wiley & Sons Inc. NY)
2. Introduction to Remote Sensing - James. B. Compbell (Taylor & Francis)
3. Introduction to Digital Image Processing: A Remote Sensing Perspective - John R. Jensen (Prentice Hall)
4. Remote Sensing & Geographic Information System - M. Anji Reddy (BS Publication)
5. Remote Sensing & GIS - B. Bhatta (Oxford University Press)
6. Remote Sensing & Geographic Int. System - Kalicharan Sahu (Atlantic Publishers)

MCE-154 APPLIED GEOLOGY 4 Credits (3-1-0)

UNIT I 9

Type of mountains, The Himalayas, classification of Himalayan range, Origin of Himalayas, structure of Himalayas, other mountain ranges of India, Tunneling in geologically weak and structurally disturbed media, Methods of tunnel excavation in rock, over break tunnel hazards,

UNIT II 9

Geological considerations in stability and safety of spillways, dams and powerhouses and remedial measures, Problems posed by adverse geological features in alignment of hill channels and their remedial measures, Geological aspects of highway planning, Foundations of bridge piers on rocks, Stability of hill slopes and cuttings, landslides and subsidence, types, causes, signification of geological factors and control of landslides.

UNIT III 9

Earthquakes, geological considerations for seismic design of structures, seismic zones of India, elements of earthquake forecasting, Blasting, drilling and quarrying

UNIT IV 9

Classification of rocks, engineering properties and behavior of rocks, laboratory tests, in situ measurement techniques and instrumentation for stress and strain, creep deformation, fracture of rocks. Shear strength of rocks, rock bolts and dowels, application of principles of rock mechanics to tunnel, apexing draft tube penstock cavities.

MCE-156 ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT 4 Credits (3-1-0)

UNIT I	9
Environmental Impact Assessment, Historical Background Global Environmental Policy Need for EIA	
UNIT II	9
Definition, Aims and Methodology of EIA, Role of EIA as a Planning Tool	
UNIT III	9
Environmental Impacts of developmental projects- Recent Case Studies	
Management and Audit Traditional Approach vs. the ISO 14000 Environmental Management Systems Approach,	
UNIT IV	9
Management through Environmental Legislations Management through Awareness, Environmental Education and Incentives Environmental Audit- Definition and role of EA, Methodology of EA Current Status of EA.	

Books & References:

1. Environmental Impact Assessment- Training Resource Manual, UNEP
2. EIA Notification - MOEP, Govt. of India
3. Environmental Science and Ecological Studies - S.K. Garg, Rajeshwari Garg and Rangini Garg

MCE-157	SYSTEM ANALYSIS AND MANAGEMENT	4 Credits(3-1-0)
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UNIT I	9
Introduction to Computer languages, Linear, Quadratic, Geometric, Direct and Non-Linear Programming	
UNIT II	9
Concept of Optimization, Application of Optimization techniques	
UNIT III	9
Theory of random variables, Modeling and Simulation	
UNIT IV	9
Design and Management of information systems applicable in Environmental management	

MCE-158	SOLID WASTE MANAGEMENT	4 Credits(3-1-0)
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UNIT I	9
Introduction, Overview of Solid Waste Management, Types of Solid wastes, sources of Solid wastes, Properties of Solid wastes	
UNIT II	9
Solid waste Generation, On-site handling, Storage, Collection, Transfer and Transport, processing techniques	
UNIT III	9
Ultimate Disposal, Resources and Energy recovery Systems, Biomedical Waste Management	
UNIT IV	9
Introduction to hazardous Waste and Fly Ash Management, Site selection Criteria for Landfill	

MCE-159 GROUNDWATERMANAGEMENT 4 Credits(3-1-0)

UNIT I	9
Introduction, Occurrence of ground water, Hydrological Cycle, Ground water movement.	
UNIT II	9
Well Hydraulics and Water Wells, Ground Water Modeling Techniques.	
UNIT III	9
Surface and Subsurface Investigations of Ground Water.	
UNIT IV	9
Artificial discharge and Recharge of Ground Water, Ground Water management Techniques.	

Books & References:

1. Ground Water Assessment Development & Management - K.R. Karanth (Tata McGrawHill)
2. Water Resources Systems Planning & Management - M.C. Chaturvedi (Tata McGrawHill)

MCE-162 NON-CONVENTIONAL SOURCES OF ENERGY 4 Credits(3-1-0)

UNIT I	9
Definition of micro, mini and small hydrous, Role of micro-mini and small hydrous in power development, Their advantages and disadvantages, Problems in operation and maintenance, Planning new micro-mini and small hydrous especially in hilly tracts, Diversion works, conveyance channels appurtenant structures	
UNIT II	9
Layout of conveyance channels, Layout of power plant, design of various structures of the power plant panchakkis, Standard tubular turbines, bulb turbines, and other types of turbines, their selection and layout. Power form existing irrigation works, methods of combining several falls. Power form wind, geysers, biogas and other renewable sources	
UNIT III	9
Design of Biogas plants and windmills and their comparison with hydel power, Concept of partial benefit from diversion tunnels, Development of power from partial heads by mobile runners, Interim benefits as making available power during construction period	
UNIT IV	9
Lifting water by pumps coupled to turbines and by windmills and hydram schemes	

Books & References:

1. Alternative Energy Sources - T. Negat Veziroglu (TMH)
2. Non-Conventional Sources of Energy - G.D. Roy (Khanna Publisher, New Delhi)

MCE-163 EARTHQUAKE RESISTANT DESIGN OF BUILDINGS 4 Credits(3-1-0)

UNIT I	9
Introduction-Origin of Earthquakes, magnitude, intensity, ground motions, sensors, Strong motion characteristics	
UNIT II	9
Concepts of Earthquake Resistant Design of Reinforced Concrete Buildings- Earthquake and vibration effects on structure, identification of seismic damages in R.C. buildings, Effect of structural irregularities on the performance of R.C. buildings during earthquakes and seismo resistant building architecture	
UNIT III	9
S.D.O.F. Systems-Equation of motion, free and forced vibrations, damping, Response spectrum. M.D.O.F. Systems-	
UNIT IV	9
Two degree and multi-degree freedom systems, Seismic Analysis and Modeling of R.C. Buildings-	

Codal procedure for determination of design lateral loads, in-fill walls, seismic analysis of R.C. building as per IS: 1893(Part 1). Earthquake Resistant Design of Buildings-Ductility considerations, E.R.D. of R.C. building, Design of load bearing buildings, Design of shear wall.

MCE-164	GEO-TECHNIQUE OF HILL AREA	4 Credits(3-1-0)
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UNIT I		9
	Retaining Walls: Type, Proportioning, Application of Lateral Earth Pressure Theories to Design, Stability Checks, Other Types of Possible Failures, Drainage, Breast Wall, Reinforced Earth Structures	
UNIT II		9
	Slope Movement: Types and Processes, Recognition and Identification. Field Investigation, Methods of Stability Analysis Design and Construction of Soil Slopes, Engineering of Rock Slopes	
	Foundation: Capacity of Foundation on Slopes, Bearing Capacity of Foundations on Difficult Grounds e.g. Sanitary Landfills, Collapsing Soil etc.	
	Grouting and Underpinning: Types of Grouting Suspension Grouts, Solution Grouts, Grouting Equipment and Methods, Grouting Design and Layouts for Seepage Control, Underpinning.	
UNIT III		9
	Geosynthetics: Types, Testing, Design and Application in Hilly region.	
	Frozen Ground: Introduction, Physical and Thermal Properties, Thaw Behaviour, Mechanical Properties of Frozen Soil, Foundations in Frozen Soils, Field investigations	
	Blasting Techniques: Purpose, Drilling Patterns, Type of Explosives, Safety measures	
UNIT IV		9
	Rock mechanics: Introduction, Classification & Index Properties of Rocks, Rock Strength and Failure Criteria, Initial Stresses in Rocks and Their Measurement Plane of weakness and Deformability, Application in Underground Openings and Foundation Engineering.	

MCE-166	WATER POLLUTION	4 Credits(3-1-0)
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UNIT I		9
	Definition of pollution, Effluent Standards, Development of Water Quality Standards, Water Quality Index, River Water Classification	
UNIT II		9
	Classification and impacts of Pollution Variables, Stream Surveys, Pollution zones and classification	
UNIT III		9
	Physical, Chemical and Biological Water Purification Processes in Natural Systems, BOD Kinetics assimilation and DO sag, Impoundments and their effects, Pollution control strategies including legislative approach	
UNIT IV		9
	Surface Water Modeling	

MCE-167	GEOGRAPHIC INFORMATION SYSTEMS	4 Credits(3-1-0)
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UNIT I		9
	Geographic Information System (GIS)-Introduction, Geographical concepts and terminology, Components of GIS.	
UNIT II		9
	Data acquisition, Raster and vector formats, Inter-conversion between raster and vector formats, Scanners and digitizers, Methods of digitization, Data pre-processing, form conversion, Data reduction and generalization.	
UNIT III		9
	Attribute database: scale and sources of inaccuracy Database structures. Conventional database management systems, Spatial database management	

UNITIV **9**
 Datamerging, Edgematching, registration and resampling, Data manipulation and analysis, Representation of real world problems, Problem solving and spatial modeling. Classification, Aggregation, overlay, buffers, and intervisibility, Network Analysis, Application of GIS in planning of utility lines, Water resources, Erosion modeling, Environmental Impact Assessment

Books & References:

1. Principles of Geographic Information System for Land Resources Assessment - P.A. Burrough (Oxford University Press)
2. Geographical Information System: A Management Perceptive - Stan Arnoff (WDL Publication)
3. Concept & Technique of Geographical Information System - Abbert K.W. Yeung & C.P. Lo. (PHI Learning)
4. Remote Sensing & Geographical Information System - M. Anji Redy (BS Publications)
5. Remote Sensing & GIS - B. Bhatta (Oxford University Press)
6. Remote Sensing & Geographic Int. Sstem - Kalicharan Sahu (Atlantic Publishers & Dist)

MCE-168 WATER RETAINING STRUCTURES **4 Credits(3-1-0)**

UNIT I **9**

Project planning, Site Investigations, Choice of type of dams, Cost benefit studies

UNIT II **9**

Non-overflow dams: Gravity, Arch and Buttress, Rock-fill and Earthen Dams, their Design. Different types of Spillways and Energy Dissipations, their design

UNIT III **9**

Preparation and Protection for dams, Model analysis of hydraulic structures, Instrumentation in Dams, Temperature control in Concrete Dams

UNIT IV **9**

Water Harvesting: Types of storage Structures, Water Yield from Catchments, Runoff diversion; Ponds and Reservoirs; Earth Embankments

MCE-169 DISASTER MANAGEMENT **4 Credits(3-1-0)**

UNIT I **9**

Type of disasters, Accent on land slides, earthquakes flashflood, avalanches, snow blizzards. Causes, consequences and mitigation techniques, Flashfloods their management and relief, Contingency planning for dam failures

UNIT II **9**

Characteristics of glaciers and protection of important monuments from glacial flow

UNIT III **9**

Land slides, their classification, causes, & preventive measures. Concept, growth presents trends status in India and concept of contingency planning and systems approach of disaster management. Sociology of disasters, Human and media response and role

UNIT IV **9**

Disaster prevention techniques, Disaster legislation, Disaster prone area building codes, Vulnerability analysis, Health and sanitation aspects, Relief administration in India and role of engineers in disaster mitigation

**CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR**

COURSES OFFERED

Programme Core for M. Tech. (Environmental Engineering)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-201	Environmental Chemistry and Microbiology	-	3	1	0	4
2.	MCE-202	Water Treatment and Distribution	-	3	1	0	4
3.	MCE-203	Wastewater Treatment	-	3	1	2	5
4.	MCE-204	Air and Noise Pollution and Control	-	3	1	2	5
5.	MCE-158	Solid Waste Management	-	3	1	0	4
6.	MCE-220	Minor Project	-	0	0	8	4
7.	MCE-230	Dissertation Part-I	-	0	0	8	4
8.	MCE-240	Seminar	-	0	0	4	2
9.	MCE-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives(PE1)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-151	Environmental Quality Management	-	3	1	2	5
2.	MCE-152	Earth and Environment	-	3	1	0	4
3.	MCE-153	Principles of Remote Sensing	-	3	1	2	4
4.	MCE-252	Systems Analysis and Management	-	3	1	2	4

Programme Electives(PE2)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-256	Environmental Sanitation and Ecology	-	3	1	0	4
3.	MCE-258	Environmental Geology	-	3	1	0	4
4.	MCE-259	Rural Environmental Technology	-	3	1	0	4

Programme Electives(PE3)

S.N.	PaperCode	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-161	Geo-environmental Engineering	-	3	1	0	4
2.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
3.	MCE-261	Ground Water Management	-	3	1	0	4
4.	MCE-262	Building Environmental and Services	-	3	1	0	4

Programme Electives(PE4)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-167	Geographic Information System	-	3	1	0	4
2.	MCE-169	Disaster Management	-	3	1	0	4
3.	MCE-267	Hazardous Waste Management	-	3	1	0	4
4.	MCE-268	Industrial Wastewater Treatment	-	3	1	0	4

SYLLABI

MCE-201	ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY	5 Credits(3-1-0)
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UNIT I		9
	Introduction, basic Concept from General Chemistry, Colloidal Chemistry	
UNIT II		9
	Environmental Biochemistry, Physico-Chemical and Biological examination of Water and Wastewater	
UNIT III		9
	Thermodynamic of Microbiological systems	
UNIT IV		9
	Mass and energy Balance of Microbial Process, Aerobic and Anaerobic Microbial growth	

MCE-202	WATER TREATMENT AND DISTRIBUTION	4 Credits(3-1-0)
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UNIT I		9
	Introduction and Sources of Water, Population Forecasting and Water Requirement.	
UNIT II		9
	Physical, Chemical and biological Water Quality Parameters	
UNIT III		9
	Solid Separation, Settling Operation, Coagulation, Softening, Filtration, Disinfection, Desalination, Dissolved Solids Removal, Adsorption and Ion Exchange, Electrolysis, Osmosis.	
UNIT IV		9
	Special Treatment, Pumping and Distribution Systems	

Book & References:

1. Water Work Engineering - S.R. Qasim, E.M. Motley and GuangZhu (Prentice Hall of India, NewDelhi)
2. Water Supply Engineering - S.K. Garg (Khanna Publication, NewDelhi)

MCE-203	WASTEWATER TREATMENT	5 Credits(3-1-2)
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UNIT I		5
	Overview of Wastewater Engineering, Terminology in Wastewater Treatment	
UNIT II		7
	Wastewater Flow rates, Wastewater Characteristics, Water Born Disease	
UNIT III		15
	Physical and Chemical Unit Operations, Biological Unit Processes including Kinetics of Biological growth, Sludge Thickening, Digestion, Disposal and Nutrient removal, Self Purification of Streams.	
UNIT IV		9
	Advanced Treatment Processes, Wastewater Collection, Disposal and Reuse, Introduction to generation of Industrial Wastewater	

EXPERIMENTS

1. To estimate the hardness of the given watersample.
2. To estimate the pH and turbidity of the given watersample.
3. To estimate the acidity of the given watersample.
4. To estimate the alkalinity of the given watersample.
5. To estimate the chloride concentration of the given watersample.

6. To estimate the total solids and total dissolved solids of the given watersample.
7. To determine the MPN count of total coliforms in the given watersample.
8. To determine BOD of given wastewatersample
9. To determine the COD of the given wastewatersample.

Book & References:

1. Environmental Engineering - Peavey, Rowe and Technologies (McGraw Hill Co.Ltd.)
2. Wastewater Engineering - Metcalf and Eddy (McGraw Hill Co.Ltd.)
3. Sewage Disposal and Air Pollution Engineering (Environmental Engineering), Vol.-II - S.K. Garg (Khanna Publication, NewDelhi)

MCE-204 AIR AND NOISE POLLUTION AND CONTROL 5 Credits(3-1-2)

UNIT I	9
Introduction, Classification, Sources, Effects, Air Quality Standards, Role of Meteorology and Natural Purification Processes	
UNIT II	10
Sampling, Measurement and Analysis, Control Devices for Particulate and Gaseous Contaminants	
UNIT III	7
Industrial and Vehicular Pollution, Indoor Air Pollution	
UNIT IV	10
Physics of Sound, Noise-Sources and Standards, Measurement and Control of Noise Pollution	

EXPERIMENTS

1. Monitoring of ambient air quality for total suspended particulate matter and respirable SPM (OM₁₀).
2. Measurements of CO and HC in tail pipe exhaust emission of petrol vehicles (two wheelers).
3. Measurements of CO and HC in tail pipe exhaust emission of petrol vehicles (four wheelers).
4. Measurements of smoke density in tail pipe exhaust emission of diesel vehicles.
5. Measurements of SO₂ in ambient air.
6. Measurements of NO₂ in ambient air.
7. Measurements of levels of noise pollution in residential, commercial, industrial and silence zones.
8. Comparison of energy equivalent noise levels in indoor and outdoor environments.

Book & References:

1. Environmental Engineering - Peavey, Rowe and Technologies (McGraw Hill Co.Ltd.)
2. Environmental Noise Pollution - Patrick D. Cunniff (McGraw Hill Co.Ltd.)

MCE-256 ENVIRONMENTAL SANITATION AND ECOLOGY 4 Credits (3-1-0)

UNIT I	9
Introduction and terminology, Pollution types and Sources, Health hazards	
UNIT II	9
Water Supply and Sanitary Installations in Buildings, Ecology and Environment	
UNIT III	9
Principles of Ecology, Ecosystems, Energy Flow, Trophic Level	
UNIT IV	9
Food chain and Food Web, Eco-cycles of Pollutants and Species	

Book & References:

1. Water Supply Engineering - S.K. Garg (Khanna Pub. Pvt Ltd, New Delhi)
2. Ecology- E.P.Oduni

MCE-259 RURAL ENVIRONMENTAL TECHNOLOGY 4 Credits(3-1-0)

UNIT I	9
General: Concept of environment and scope of sanitation in rural areas. Magnitude of problems of rural water supply and sanitation, Population to be covered, difficulties, National policy, Water Supply Design population and demand loads. Various approaches of planning of water supply schemes in rural areas. Development of preferred sources of water springs	
UNIT II	9
Wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source. Specific problems in rural water supply and treatment, Improved methods and compact systems of treatment of surface and ground waters for rural water supply such as multi bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges	
UNIT III	9
Pumps, pipe materials, appurtenances and improved devices for use in rural water. Planning of distribution system in rural areas, Treatment and Disposal of waste water, Various methods of collection and disposal of night soil. Community and sanitary latrines	
UNIT IV	9
Compact and simple waste-water treatment units and systems in rural areas such as stabilization ponds, septic tanks, imhoff tank, soak pit etc. Disposal of waste water-soakage pits and trenches, Disposal of solid wastes composting, land filling, incineration. Biogas plants	

Book & References:

1. Water Supply Engineering - S.K. Garg (Khanna Pub. Pvt.Ltd.)
2. Water Supply Engineering - B.C. Punamia and A.K. Jain (Laxmi Publications)

MCE-261 GROUND WATER MANAGEMENT 4 Credits(3-1-0)

UNIT I	9
Introduction, Occurrence of ground water, Hydrological Cycle	
UNIT II	9
Ground water movement, Well Hydraulics and Water Wells	
UNIT III	9
Ground Water Modeling Techniques, Surface and Subsurface Investigations of Ground Water	
UNIT IV	9
Artificial discharge and Recharge of Ground Water, Ground Water management Techniques	

Book & References:

1. Ground Water Assessment, Development and Management - K.R. Karanth (Tata McGraw Hill, New Delhi)
2. Water Resource System Planning and Management - M.C. Chaturvedi (Tata McGraw Hill, New Delhi)

MCE-262 BUILDING ENVIRONMENTAL LAND SERVICES 4 Credits(3-1-0)

UNIT I	9
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Acoustics material properties, reverberation, acoustical design of assembly hall building, noise and its control. Ventilation, health and comfort ventilation, ventilation systems, natural and artificial ventilation for tropic regions

UNITII **9**

Electrical wiring systems in domestic and commercial buildings, conductors, cables and conduits. Communications, intercommunications systems, sound amplification equipments. Fire protection and equipments, code provisions from NBC. Illumination, artificial lighting, day lighting, laws and principles of illumination. Design of lighting systems, flood lighting, relevant IS Codes.

UNITIII **9**

Elevators, escalators and conveyors. Thermal environment inside a building and its control, factors affecting inside conditions, heat transfer through building fabric, steady state and periodic heat transfer, thermal properties of building materials and insulation materials for building. Thermal responding of building cooling and heating loads. Air – conditioning systems, types, design, installation and maintenance costs. Energy conservation in buildings.

UNITIV **9**

Water supply to building, systems of water supply, appurtenances, and difficulties encountered in water supply to high rise building systems suggested hot water and fire water systems. Drainage of buildings, systems of drainage from buildings, appurtenances, choice of systems, solid waste disposal from buildings

MCE-267 HAZARDOUS WASTE MANAGEMENT 4 Credits(3-1-0)

UNITI **9**

Hazardous Waste, Regulatory Process, Process Fundamentals, fate and Transport of Contaminants, Toxicology.

UNITII **9**

Environmental Audits, Pollution Prevention, facility Development and Operations

UNITIII **9**

Physico – Chemical Treatment Process, Biological Treatment Methods, Stabilization and Solidification, Thermal Treatment Methods

UNITIV **9**

Land Disposal, Quantitative Risk Assessment

Book & References:

1. Hazardous Waste Management- Lagrega, Buckingham & Evans (McGraw Hill, N.Y.)
2. Hazardous Material and Waste Management- Cheremisinoff & Cheremisinoff (Elsevier)
3. Toxic & Hazardous Waste - La Grega & Hendrian (Butterworth Publications)

MCE-268 INDUSTRIAL WASTE WATER TREATMENT 4 Credits(3-1-0)

UNITI **9**

Scenario of Industrial Pollution, Capabilities and Constraints of Industries for Pollution Control, Impact of Pollution Control on Project Coast.

UNITII **9**

Typical Industrial Wastes Characteristics and Treatment Planning of Sugar Industry, Distillery, Tannery, Electroplating Industry, Petroleum Industry, Pesticide and Fertilizer Industry, Pharmaceutical Industry, Textile Industry, Pulp and Paper Industry.

UNITIII **9**

Chlor-Alkali Industry, Soap and Detergent Industry, Atomic Power Plants, dairy, Steel, Thermal Power Plants.

UNITIV **9**

General Standards for Disposal of Effluents, Concept of Common Effluent Treatment Plant

Book & References:

1. Industrial Pollution and Control - G.N. Pandey(Vikas Pub. Pvt. Ltd., NewDelhi)
2. Industrial Pollution and Control - K.N. Rao (CRC Press,Hyderabad)

**CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR**

COURSES OFFERED

Programme Core for M. Tech. (Structural Engineering)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-301	Advanced Structural Analysis	-	3	1	2	5
2.	MCE-302	Concrete Structures	-	3	1	2	5
3.	MCE-303	Prestressed Concrete	-	3	1	0	4
4.	MCE-304	Analysis and Design of Dynamic Effects	-	3	1	2	5
5.	MCE-305	Metal Structures	-	3	1	0	4
6.	MCE-320	Minor Project	-	0	0	8	4
7.	MCE-330	Dissertation Part-I	-	0	0	8	4
8.	MCE-340	Seminar	-	0	0	4	2
9.	MCE-350	Dissertation Part-II	Dissertation Part-I	0	0	28	14

ProgrammeElectives(PEI)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-351	Maintenance and Rehabilitation of Structures	-	3	1	0	4
2.	MCE-352	Pre-cast and Composite Structures	-	3	1	0	4
3.	MCE-353	Rock Engineering	-	3	1	0	4
4.	MCE-354	Continuum Mechanics	-	3	1	0	4

ProgrammeElectives(PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-356	Retrofitting of Buildings	-	3	1	0	4
2.	MCE-357	Hydraulic Structures	-	3	1	0	4
3.	MCE-358	Machine Foundations	-	3	1	0	4
4.	MCE-359	Finite Element Method	-	3	1	0	4

ProgrammeElectives(PE3)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-361	Nonlinear Analysis of Structures	-	3	1	0	4
2.	MCE-362	Earth & Rock fill Dam	-	3	1	0	4
3.	MCE-363	Project Planning and Control	-	3	1	0	4
4.	MCE-364	Soil Structure interaction	-	3	1	0	4

ProgrammeElectives(PE4)

S. N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-366	Design of Plates and Shells	-	3	1	0	4
2.	MCE-367	Industrial Structures	-	3	1	0	4
3.	MCE-368	Bridge Engineering	-	3	1	0	4
4.	MCE-369	Ground Improvement Techniques	-	3	1	0	4

SYLLABI

MCE-301	ADVANCED STRUCTURAL ANALYSIS	5 Credits(3-1-2)
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UNIT I	9
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Static and kinematic indeterminacies stiffness and flexibility matrices, force & displacement methods

UNIT II	9
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Stiffness matrices for prismatic and non-prismatic members, solution techniques, substructure analysis techniques, application to plane and space frame analysis.

UNIT III	9
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Organization of computation, programming considerations, applications to practical problems

UNIT IV	9
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Techniques of non-linear structural analysis, material and geometrically non-linear problems, incremental and iterative procedures, convergence criteria

EXPERIMENTS

1. Modeling of a Pin jointed Plane Frame Via STAADPro
2. Modeling of a Rigid Jointed Plane Frame through STAADPro
3. Modeling of a Bridge by STAADPro
4. Modeling of a Multi Story Building for Earthquake Load

Books & References:

1. Matrix Method of Structural Analysis - Madhu B. Kanl (Wiley Eastern Limited, New Delhi)
2. Matrix Structural Analysis - William Mc Guire Richard, H. Gallghare, Ronald D. Ziemian (Wiley International)

MCE-302	CONCRETE STRUCTURES	5 Credits(3-1-2)
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UNIT I	9
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Limit state design philosophy

UNIT II	9
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Redistribution of moments in continuous span beams, plastic hinge concept, and rotation capacity of sections and detailing for ductility, Beam column joints

UNIT III	9
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Yield line theory for slabs, equilibrium and virtual work methods.

UNIT IV	9
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Shrinkage and creep, Building frames, box frames

EXPERIMENTS

1. High performance Concrete Mix design.
2. Design and testing of R.C.C. beam for Two Points loading.
3. Design & Testing of a one way slab.
4. Design & Testing of a two way slab.

Books & References:

1. Limit State Method of Design - Dr. B.C. Purnia, Ashok Kumar Jain and Arun Jain (Lakshmi Publication)
2. IS 456:2000

MCE-303	PRESTRESSED CONCRETE	4 Credits(3-1-0)
UNIT I		9
General principles of prestressing- Materials for prestressing, Prestressing systems		
UNIT II		9
Losses of prestress, Load balancing concept		
UNIT III		9
Partial prestressing, Circular prestressing, Prestressed Concrete Beams, End Blocks		
UNIT IV		9
Prestressed concrete pipes and poles		
Books & References:		
1. Prestressed Concrete-N.Rajgopalan(Narosa) 2. NBC:2005.		
MCE-304	ANALYSIS AND DESIGN OF DYNAMIC EFFECTS	5 Credits(3-1-2)
UNIT I		9
Single degree freedom systems, damping, impact, earthquake and blast loads		
UNIT II		9
Duhamel integral, Rayleigh method, Green's function, elastic response spectra, Fourier series, Fast Fourier Transform, complex frequency response function, response of SDF system in frequency domain, time history analysis of SDF system		
UNIT III		9
New mark method and Wilson theta method for linear problems, convergence criteria. Multi degree of freedom systems, application to multistory buildings, SRSS and CQC mode superposition techniques		
UNIT IV		9
Introduction to computer program(s) on dynamics, vibration of continuous systems including axial effects, lumped and consistent mass matrix, introduction to inelastic response spectra, design specifications in IS:875(Pt.3)		
EXPERIMENTS		
1. Earthquake resistant detailing of Non-Engineered Buildings		
2. Earthquake resistant detailing of Brick Masonry Buildings		
3. Earthquake resistant detailing of R.C.C. Buildings		
4. Modelling, Design & Detailing of a moment resisting frame		
Books & References:		
1. Structural Dynamics - Mario Paz (CBS Publishers)		
2. Earthquake Resistant Design of Structure - Pankaj Agrawal, Manish Snikhande (PHI Pvt Ltd.)		
MCE-305	METAL STRUCTURES	4 Credits(3-1-0)
UNIT I		9
Limit State Design Philosophy- Overview of IS 800- 2007 Codal provisions for Welded and Bolted Connections, Slip resistant connections. Defects in welds		
UNIT II		9
Beam Column joints- Eccentric Connections, Seat connections, Flexible connections, Splices in Beams and columns.		
UNIT III		9
Light gauge structures		
UNIT IV		9
Tubular structures		

Books & References:

1. IS:800 2007
2. Limit State Design of Steel Structure - Dr. S.K. Duggal (TMH)

MCE-351	MAINTENANCE AND REHABILITATION OF STRUCTURES	4 Credits (3-1-0)
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UNIT I		9
	Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration	
UNIT II		9
	Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking	
UNIT III		9
	Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Gunit and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection	
UNIT IV		9
	Repair of structures distressed due to earthquake – Strengthening using FRP -Strengthening and stabilization techniques for repair, Engineered demolition techniques for structures -case studies	

Books & References:

1. Concrete Structures, Materials, Maintenance and Repair- Denison Campbell, Allen and Harold Roper, (Longman Scientific and Technical, UK), 1991
2. Repair of Concrete Structures - Allen R.T and Edwards S.C. (Blakie and Sons, UK), 1987
3. Learning from Failures, Deficiencies in Design, Construction and Service- Raikar, R.N., RandD Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Concrete Technology- Santhakumar A.R. (Oxford University Press), 2007, Printed in India by Radha Press, New Delhi
5. Concrete Repair and Maintenance Illustrated - Peter H. Emmons (Galgotia Publications Pvt. Ltd.), 2001
6. Maintenance and Durability of Concrete Structures- Dayaratnam. P and Rao. R (University Press), 1997.

MCE-352	PRECAST AND COMPOSITE STRUCTURES	4 Credits (3-1-0)
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UNIT I		9
	Precast and cast in situ concrete structures	
UNIT II		9
	Prestressed and cast in situ concrete structures, Steel and concrete Composite structures	
UNIT III		9
	Encased beams and columns	
UNIT IV		9
	Applications to bridge decks, girders and precast building systems Pre-Engineered Buildings	

Books & References:

1. Advances in Building Materials & Construction, CBRI Roorkee
2. Precast Concrete Structures - Habber Benckmann & Altreid Stainle (Wille VCH)

MCE-353	ROCKENGINEERING	4 Credits(3-1-0)
UNIT I		9
Introduction, Geological considerations, Index properties and rock mass classifications		
UNIT II		9
Strength and failure criteria for rocks and rock masses, Insitu stresses in rocks and their measurement. Strength and deformation behaviour of discontinuities in rocks		
UNIT III		9
Deformation behaviour of rocks and rock masses, Time dependent behaviour of rocks		
UNIT IV		9
Application of Rock mechanics to Underground Structures, Slopes and Foundations, Improving the properties of insitu rock masses		
MCE-354	CONTINUUMMECHANICS	4 Credits(3-1-0)
UNIT I		9
Vectors and tensors, analysis for stresses, principal stresses and principal planes, stress invariants, equations of equilibrium, octahedral stresses, Analysis of strains, principal strains, octahedral strains, large deformations and finite strains		
UNIT II		9
Elgerian, Lagrangian and Almansi, Green's and Cauchy's strain tensors Compatibility equations, elastic stress strain equations, generalized Hookean Law, principle of virtual work, nonlinear constitutive laws, hypo and hyper elastic solids, linearised theory of elasticity, two dimensional plane stress, plane strain and axi-symmetric formulations		
UNIT III		9
Cartesian and polar coordinate systems, three dimensional elasticity formulation for isotropic and anisotropic solids, boundary Value problems Torsion and bending theory Material yield criteria- Von Mises, Tresca, Mohr-Coulomb, Drucker-Prager etc.		
UNIT IV		9
Isotropic and kinematic hardening, normality principle, plastic flow rule, Plastic Potential, Elasto-plastic Stress strain relations- Prandtl- Rauss equations, Levy-Mises Relations, Hardening Modulus, Generalised elasto-plastic stress-strain relations		
Books & References:		
1. Continuum Mechanics for Engineers - G. Thoma Mase (CRC Press)		
2. Tensor & Tensor Algebra for Engineers - Mikhail Ibkov (Springer Publication)		
MCE-356	RETROFITTING OF BUILDINGS	4 Credits(3-1-0)
UNIT I		9
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.		
UNIT II		9
Terminology in Repair, Restoration, Strengthening and Rehabilitations, Criteria for Repair		
UNIT III		9
Restoration and Retrofitting; Repair Materials; In-situ testing methods for RC and masonry structure; Techniques of repair and retrofitting of masonry buildings		
UNIT IV		9

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

Books & References:

1. Retrofitting Design for Building Structures-Xin Lin Lu (CRCPress)
2. Earthquake Resistant Design of Structures- Pankaj Agrawal, MainshShikhande (PHI PvtLtd.)

MCE-357 HYDRAULICSTRUCTURES 4 Credits(3-1-0)

UNITI	9
Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's Theory, Khosla's theory for determination of pressure and exit gradient.	
Regulation Works: Falls, Classification, Introduction to design principle of falls, Design of Sarda type and straight glacis fall.	
Principle and design of Distributory head regulator and cross regulator.	
UNITII	9
Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.	
Cross drainage works: Necessity and types. Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works	
UNITIII	9
Dams: classification and selection criteria.	
Earth Dams: Classification, causes of failure Phreatic line, and its determination	
Introduction to stability analysis	
Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.	
UNITIV	9
Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.	
Hydro-Electric Power: assessment of potential specially in reference to India, classification of power plants, important terms, types of turbines and their suitability. Power House layout and important structures of a powerhouse	

Books & References:

1. Irrigation, Water Resources and Hydraulic Structures -S.K. Garg (Khanna Publication, NewDelhi)
2. Water Resources and Irrigation Engineering - G.H. Asawal(New Age International Pvt. Ltd., NewDelhi)

MCE-358 MACHINEFOUNDATIONS 4 Credits(3-1-0)

UNITI	9
Dynamic Properties of soils, various types of machine foundations, factors affecting the resonant frequency and amplitudes of vibrations	
UNITII	9
Foundations under reciprocating machine; behaviour and design of block foundations, framed foundations, advantage for high speed machines, design principles	
UNITIII	9
Vibration Isolation, IS Code of Practice, critical review	
UNITIV	9

Structural design; general principles of design, construction aspects, case histories of failures o machine foundations

Books & References:

1. Handbook of Machine Foundation - Srinivaslu&Vandyathan (McGrawHill)
2. Theory of Vibrations - Shabana A.(Springer)
3. Vibration of Soil & Foundation - Hall &Wood (PrenticeHall)
4. Foundation of Machines: Analysis & Design - Shamsher Prakash (JohnWiley,N.Y.)

MCE-359 FINITEELEMENTMETHOD 4 Credits(3-1-0)

UNITI	9
Introduction to Finite: Element Model-concept of nodes and elements, Formulation of stiffness and transformation matrices, Implementation details	
UNITII	9
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	
UNITIII	9
Accuracy and mesh-locking aspects in plane strain and plane stress analysis	
UNITIV	9
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;	

Books & References:

1. Finite Element Procedure - K.O. Bathe (PrenticeHall)
2. FiniteElementMethod: ItsBasics&Fundamentals-O.C.Zienkiewicz&R.I.(TaylorPus:ElsevierBH)

MCE-361 NONLINEAR ANALYSISOFSTRUCTURES 4 Credits(3-1-0)

UNITI	9
Introduction to nonlinear mechanics; statically determinate and statically indeterminate flexible bars of uniform and variable thickness	
Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of flexible bars of uniform and variable stiffness members with and without axial restraints	
UNITII	9
Vibration theory and analysis of flexible members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading	
UNITIII	9
Elastic and inelastic analysis of uniform and variable thickness plates	
UNITIV	9
Nonlinear vibration and Instabilities of elastically supported beams	

Books & References:

1. Non LinearMechanics- Delmetor E. Firtis (CRC,Press)
2. Non LinearModelling & Analysis of Solids & Structures - Stein Krak (CRCPress)

MCE-362 EARTH & ROCKFILLDAM 4 Credits(3-1-0)

UNITI	9
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Performance of earth and rockfill dams during past earthquakes, Homogenous and non-homogenous dams, zoned dams, Dams with upstream impervious linings, composite dams, seepage in earth and rockfill dams, flow net, piping and liquefaction

UNITII **9**

Stability analysis, effective and total stress methods, analysis by Fellinius, Morgenstern-Price, Carter, Spencer and Bishop methods

UNITIII **9**

Pseudo-static analysis, Shear beam analysis using Bellel's function. Design criteria for Earth Dams.

UNITIV **9**

Selecting a suitable Preliminary Section for an Earth Dam, Stability of the foundation against shear, Seepage control in earth dams, Seepage control through foundations

Books & References:

1. Irrigation and Water Resources Engineering - B.C. Punamia & Pande B.B. Lal (Luxmi Publications)
2. Water Resources and Hydraulic Structures - S.K. Garg (Khanna Publications)

MCE-363 PROJECT PLANNING AND CONTROL **4 Credits(3-1-0)**

UNITI **9**

Work-study, work breakdown structure, Time estimates, Applications of CPM/PERT, statistical concepts, Man-Material-Machinery money optimization, scheduling, monitoring, updating.

UNITII **9**

Cost functions, time-cost trade off, resource planning-leveling and allocation.

UNITIII **9**

Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques, application of digital computers.

UNITIV **9**

Material management- purchases management and inventory control, ABC analysis. Human Resource management

Books & References:

1. PERT & CPM - B.C. Punamia (Luxmi Publications)
2. Construction Planning & Management - P.K. Bhatnagar

MCE-364 SOIL STRUCTURE INTERACTION **4 Credits(3-1-0)**

UNITI **9**

Definition of soil- foundation interaction, soil- foundation-structure interaction, soil-fluid-structure interaction, idealization of soil by linear and non-linear Winkler model, elastic continuum model (isotropic and anisotropic), two parameter elastic models-heteny model, pasternak model, reissner model, soil-parameters; Interpretation of parameters elastic and elastic-continuum models, experimental investigations, finite beams on elastic foundation: finite beams on Winkler model

UNITII **9**

Finite beams on two parameter elastic medium, finite beams on two parameter elastic medium, finite beams on homogeneous, isotropic elastic continuum, finite difference solution to problems of beams on linear and non-linear Winkler models

UNITIII **9**

plates on elastic foundation: rectangular and continuous plates on elastic foundation, plates carrying rows of equidistant columns, rectangular and circular plates on Winkler medium, two parameter elastic medium and non elastic continuum, finite difference solution of problems of rectangular plates on linear and non-linear elastic foundation, soil-structure interaction in framed structures: structures with isolated foundations- spring analog

approach, determination of spring parameters, structures with continuous beams and rafts as foundation-finite element modeling, sub-structure technique of analysis.

UNITIV **9**

Concept of relative stiffness, interactive behaviour of some framed structures, soil-pile interaction: laterally loaded single piles-concept of coefficient of horizontal subgrade reaction, finite difference and finite element solutions, soil-structure interaction of framed structures with pile foundations, interaction of other structures with soil-foundation system: tanks with annular ring foundation, chimneys, silos, cooling towers, underground subways and tunnels, introduction to dynamic soil-structure interaction, as well as non-linear soil/concrete behavior.

MCE-366	DESIGN OF PLATES AND SHELLS	4 Credits(3-1-0)
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UNITI **9**

Classification of plates, governing equations, boundary conditions, analysis of rectangular and circular plates, buckling of plates, design criteria and code specifications.

UNITII **9**

Classification of shells, membrane theory for shells of revolution with axi-symmetric and non-symmetric loading, bending analysis of shells of revolution for axi-symmetric loadings

UNITIII **9**

Membrane and bending theories of cylindrical shells, theory of edge beams, doubly curved shells, membrane theory and design of hyperbolic shells, buckling of shells, design applications

UNITIV **9**

Analysis and design of folded plates, code specifications, practical considerations, computer applications

Books & References:

1. Design & Construction of Concrete shell Roof - G.S. Ramaswamy (CBS.Publisher)
2. Reinforced Concrete Structures - B.C. Purnmia, Volume-II(LakshmiPublications)

MCE-367	INDUSTRIAL STRUCTURES	4 Credits(3-1-0)
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UNITI **9**

Planning of industrial structures

UNITII **9**

Design of single and multibay industrial structures in steel and concrete, Bunkers and silos

UNITIII **9**

Pressure vessels and chimneys, Cooling towers

UNITIV **9**

Large span roof structures, Suspension roof structures. Structural aspects of machine foundations

Books & References:

1. IS: 8002007
2. Limit State Design of Steel Structures - S.K. Duggal(TM)
3. Reinforced Concrete Structure, Volume II - B.C. Purnima (LakshmiPublications)

MCE-368	BRIDGEENGINEERING	4 Credits(3-1-0)
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UNIT I 9

General Considerations- Types of Bridges, Economic Spans

UNIT II 9

Suitability of different types of Bridges, Design loads for highway and Railway Bridges.

UNIT III 9

Solid slab bridge, Slab and beam bridge

UNIT IV 9

Lattice girder Bridge Plate girder bridge

Bridge substructure and bearings

Note: Detailed design shall be worked out for at least one concrete bridge and one steel bridge

Books & References:

1. Introduction to Bridge Engineering-Victor JophnStreeter
2. Bridge Engineering -Ponnwami.

MCE-369	GROUNDIMPROVEMENTTECHNIQUES	4 Credits(3-1-0)
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UNIT I 9

Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes.

UNIT II 9

In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement

In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method

UNIT III 9

Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout

UNIT IV 9

Geotextiles: types, functions, specifications, precautions in transportation and storage.

Fiber- Reinforcement, Advantage, Applications

Books & References:

1. Ground Improvement Techniques – Raj. P (FarewallMedia)
2. Ground Improvement Technique – Patre (VikasPublisher)
3. Geosynthetic World - Mandel J. N. (WileyEastern)

**CIVIL ENGINEERING DEPARTMENT
M. M. M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR**

COURSES OFFERED

Programme Core for M. Tech. (Earthquake Engineering and Seismic Design)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-301	Advanced Structural Analysis	-	3	1	2	5
2.	MCE-401	Seismology & Tectonics	-	3	1	0	4
3.	MCE-402	Geotechnical Earthquake Engineering	-	3	1	2	5
4.	MCE-403	Structural Dynamics	-	3	1	0	4
5.	MCE-404	Earthquake Resistant Design of structures	-	3	1	0	4
6.	MCE-420	Minor Project	-	0	0	8	4
7.	MCE-430	Dissertation Part-I	-	0	0	8	4
8.	MCE-440	Seminar	-	0	0	4	2
9.	MCE-450	Dissertation Part-II	Dissertation Part-I	0	0	28	16

ProgrammeElectives(PE1)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-351	Maintenance and Rehabilitation of Structures	-	3	1	0	4
2.	MCE-352	Pre-cast and Composite Structures	-	3	1	0	4
3.	MCE-353	Rock Engineering	-	3	1	0	4
4.	MCE-354	Continuum Mechanics	-	3	1	0	4

ProgrammeElectives(PE2)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-356	Retrofitting of Buildings	-	3	1	0	4
2.	MCE-357	Hydraulic Structures	-	3	1	0	4
3.	MCE-358	Machine Foundations	-	3	1	0	4
4.	MCE-359	Finite Element Method	-	3	1	0	4

ProgrammeElectives(PE3)

S. N.	Paper Code	Subject Name	Prerequisite Subjects	L	T	P	Credits
1.	MCE-361	Nonlinear Analysis of Structures	-	3	1	0	4
2.	MCE-363	Project Planning and Control	-	3	1	0	4
3.	MCE-364	Soil Structure Interaction	-	3	1	0	4
4.	MCE-461	Random Vibrations	-	3	1	0	4

ProgrammeElectives(PE4)

S. N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MCE-366	Design of Plates and Shells	-	3	1	0	4
2.	MCE-367	Industrial Structures	-	3	1	0	4
3.	MCE-368	Bridge Engineering	-	3	1	0	4
4.	MCE-369	Ground Improvement Techniques	-	3	1	0	4

SYLLABI

MCE-401	SEISMOLOGY & TECTONICS	4 Credits(3-1-0)
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UNIT I		9
	Propagation of elastic waves, body and surface waves, Seismic Method for subsurface exploration, internal structure of the earth, Seismicity of the earth, important Indian earthquakes, plate tectonics, causes of earthquakes.	
UNIT II		9
	Magnitude, energy, intensity, acceleration, return period and frequency of earthquakes. Earthquake recording instruments, Seismographs	
UNIT III		9
	Interpretation of earthquake data, determination of magnitude, epicenter, epicentral distance, focal depth, Seismic hazard and risk, seismic zoning map of India; Introduction to earthquake prediction	
UNIT IV		9
	Plate tectonics, plate boundaries, ridges, trenches and rifts, Gravity and magnetic field of Earth and its tectonic implications. Faults, major, minor, active, dormant. Fault movement, slip, creep. Fault models rupture, source zones, Seismotectonic units, Current seismic activity.	

MCE-402	GEOTECHNICAL EARTHQUAKE ENGINEERING	5 Credits (3-1-2)
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UNIT I		9
	Introduction, Seismology and earthquakes, ground motion	
UNIT II		9
	Seismic Hazard Analysis Wave Propagation, Dynamic soil properties.	
UNIT III		9
	Liquefaction Dynamic Earth pressure Seismic design, Seismic slope stability	
UNIT IV		9
	Remediation of Seismic Hazards	

EXPERIMENTS

1. Wave propagation Test
2. Refraction survey method
3. Spectral Analysis of surface waves
4. Block Vibration Test
5. Cyclic Plate Load Test
6. Liquefaction potential evaluation using SPT
7. Liquefaction potential evaluation using CPT
8. Electric Resistivity Test
9. Cyclic Triaxial Test
10. Cross Hole Seismic survey techniques.

Books & References:

1. Geotechnical Earthquake Engineering - Towhate, I. (Springer)
2. Geotechnical Earthquake Engineering - Kramer, S.L. (Prentice Hall)
3. Basic Geographic Earthquake Engineering - Kamleshwar, K. (New Age International)
4. Earthquake Geotechnical Engineering - Mangen & Socdate (CRC Press)

MCE-403	STRUCTURAL DYNAMICS	5 Credits (3-1-2)
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UNIT I	9
Sources of vibration, Digress of freedom, Single degree of freedom systems: Free vibrations of undamped and viscously damped systems.	
UNIT II	9
Response to harmonic excitations; Vibration Isolation, Force transmissibility and base motion, Response of an undamped SDOF to short duration impulse; Duhamel Integral method, Response spectra, Frequency domain analysis	
UNIT III	9
Multiple degree of Freedom Systems, Response to harmonic excitation, mode superposition method Lagranges' equations, Eigen value problems; iteration methods	
UNIT IV	9
Vibrations of Continuous Systems, Earthquake response of systems	

List of Experiments

1. Free Vibration of Spring Mass System.
2. To determine the radius of gyration and mass moment of inertia of the given rectangular rod experimentally.
3. vibration characteristics of aluminium cantilever beam using Piezoelectric Sensor
4. Identification of high frequency modes of beam in "free-free" conditions using electro-mechanical impedance (emi) technique.
5. Forced excitation of steel beam using Shaker Machine.
6. To Determine the modes of Vibration of Simply Supported Machine.

Text/Reference Books:

1. Hibler and Gupta (2010), *Engineering Mechanics (Statics, Dynamics)* by Pearson Education
2. Dynamics of Structures, Anil K. Chopra, Prentice Hall, India.
3. Dynamics of Structures, Cloguh & Penzein, Tata McGraw Hill. New Delhi
4. Structural Dynamics, John M. Biggs, Tata McGraw Hill. New Delhi

MCE-404	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	4 Credits(3-1-0)
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UNIT I	9
Idealization of structures, Response spectrum analysis, Equivalent lateral force concepts, Torsionally coupled systems, Orthogonal effects, Nonlinear Pushover and Time history analyses, Effects of soil- structure interaction.	
UNIT II	9
Philosophy of earthquake Characteristics of earthquakes, Design response spectrum, Site effects, Earthquake response of structures resistant design, Ductility	
UNIT III	9
Redundancy & Overstrength, Damping, Supplemental Damping, Base Isolation, Codal Provisions, Seismic behaviour of concrete, steel and masonry structures	
UNIT IV	9
Material properties and analysis of members under cyclic loads, Detailing provisions	

Books & references:

1. Structural Dynamics - Mario Paz (CBS Publisher)
 2. Earthquake Resistance Design of Structures - Pankaj Agrawal, Manish Shrikhande (PHI, Pvt.Ltd.)
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UNIT I	9
Basic Theory of probability, events, random variables, discrete and continuous distribution, expectations, characteristic functions, orthogonality principles, sequence of random variables	
UNIT II	9
Stochastic process, Markov chain, Gaussian process, filtered point process, Markov process and non-stationary Gaussian process.	
UNIT III	9
Correlation and power spectrum, Threshold crossing, Random vibration of systems	
UNIT IV	9
Single degree and multi-degree of freedom system, continuous system and nonlinear system-equivalent linearization and Gaussian closure technique	

Books & references:

1. Loren D.Lutes and Shahram Sarkani (2004)Random Vibrations: Analysis of Structuraland Mechanical Systems, Elsevier Butterworth-Heineman.Structural Dynamics - Mario Paz (CBS Publisher)
2. Random Vibrations, Theory and Practice,by P. H. Wirsching, T. L. Paez, and K. Ortiz.
3. Probability, Statistics, and Random Processes for Electrical Engineering,by Alberto Leon-Garcia