

Scheme & Syllabus

(Choice Based Credit System)

For

M.Tech Programme in Civil Engineering
Specializations: Environmental Engineering, Highways & Transportation
Engineering, Structural Engineering & Infrastructure Development &
Management

(Batch 2016-18)

Program Code: CIV 401



DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF ENGINEERING

RIMT UNIVERSITY, MANDIGOBINDGARH, PUNJAB

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SECTION 1

Vision & Mission of the University

VISION

- To become one of the most preferred learning places and a centre of excellence to promote and nurture future leaders who would facilitate the desired change in the society.

MISSION

- To impart teaching and learning through cutting-edge technologies supported by the world class infrastructure
- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

SECTION2

Vision and Mission of the Department

VISION

- Through excellence in technical education, research, and innovation become an internationally renowned technical department for human resource development.

MISSION

- Providing a scholarly atmosphere for Undergraduate, Post Graduate and Doctoral programmes while dissemination knowledge through leading edge research.
- Designing academic programmes and methods with dynamism, innovation, and flexibility.
- Engaging in joint initiatives with industry for the advancement and benefit of society.
- Creating morally competent, compassionate, and innovative world leaders.

SECTION3

About the Program

M.Tech (Civil Engineering) or Master of Technology in Civil Engineering is a Post-Graduate Civil Engineering course. The Civil Engineering program encompasses tasks such as planning, overseeing, and constructing public works such as roads, bridges, tunnels, buildings, airports, dams, water works, sewage systems, ports, and so on, and provides a variety of difficult professional options.. This course basically provides students a platform with which they will be able to discover the extent to shape up the buildings, dams, roads, railways and repair the existing constructions to develop societies and cities. With the help of this course, students will be able to acquire knowledge which is very important to build and manage all the Civil related work.

SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO1 To mould the students to become effective global science students in the competitive environment of modern society.

PEO2 To provide students with strong foundation in contemporary practices of Science, different functional areas and scientific environment.

PEO3 To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in range of professions.

PEO4 To develop communication, analytical, decision-making, motivational, leadership, problem solving and human relations skills of the students.

PEO5 To inculcate professional and ethical attitude in students.

PEO6 To pursue lifelong learning as a means of enhancing knowledge and skills necessary to contribute to the betterment of profession

Program Outcome (POs)

M.Tech -Structural Engineering

Program Outcomes

- PO1 An ability to independently carry out research /investigation and development work to solve practical problems.
- PO2 An ability to write and present a substantial technical report/document.
- PO3 Students should be able to demonstrate a degree of mastery for designing and solving structural engineering problems.
- PO4 An ability to use appropriate modern tools in structural engineering. In doing so he should demonstrate sufficient knowledge of competing tools and their relative merits and demerits.
- PO5 An ability to demonstrate the traits of learning and unlearning throughout his professional career, and be willing to learn new techniques, methods and processes.
- PO6 To impart practical knowledge to become a responsible engineer adhering to all established practices of his profession.

M.Tech – Highway and Transportation Engineering

Program Outcomes

- PO1 To impart the knowledge of planning, design, construction, maintenance, up gradation, and operation of the highways/Transportation Infrastructure
- PO2 To develop innovative capability among students using modern equipment's and latest software so as to inculcate in them the ability to participate in creative and integrative activities in their relevant branch.
- PO3 To create research aptitude among the students in the field of transportation engineering and its interdisciplinary areas.
- PO4 Students should be able to understand how to implement construction process using effective and efficient project planning tools

M.Tech – Environmental Engineering

Program Outcomes

PO1 To equip the students with capabilities required for identifying, formulating and management of environmental issues/problems.

PO2 To impart training to the students to prepare them for conducting high value research on environmental engineering and other related issues and also to pursue lifelong learning.

PO3 To introduce the students to the environmental problems at international, national and regional level so that they get exposure to the burning issues.

PO4 To impart training to the students to gain capabilities for conducting joint collaborating works.

M.Tech – Infrastructure development and management

Program Outcomes

PO1 To impart knowledge to students in the latest technological aspects of Infrastructure Projects and to provide them with opportunities in taking up advanced topics of the field of study.

PO2 To mould the graduate civil engineers to undertake safe, economical and sustainable infrastructure projects.

PO3 Critically assess the relevant technological issues.

PO4 Conduct experimental and/or analytical work and analyzing results using modern mathematical and scientific methods.

PO5 Formulate relevant research problems and critically assess research of their own and of others.

Program Specific Outcome (PSOs)

PSO 01: Development of professional skills in the area of Structural Engineering, Water Resources Engineering, Transportation Engineering, Environmental Engineering, Geotechnical Engineering, Geo-informatics & Remote sensing, and Construction techniques & management

PSO 02: Application of relevant aspects of mathematics in engineering analysis and design.

PSO 03: Refurbishing of technical communication skills

PSO 04: Application of these principles and practices to problems related to Civil Engineering and other allied technical & industrial fields.

PSO 05: Work as design consultants in construction industry for the design of civil engineering structures.

SECTION-5**Curriculum / Scheme with Examination Grading Scheme****SEMESTER WISE SUMMARY OF THE PROGRAMME M.TECH
(CIVIL ENGINEERING)**

S.No	Semester	No. of Contact Hours	Marks	Credits
1	I	16	500	16
2	II	20	500	18
3	III	12	500	26
4	IV	00	100	20
	Total	48	1600	80

EXAMINATION GRADING SYSTEM

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A ⁺	9	Excellent
60-69	A	8	Very Good
55-59	B ⁺	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Pass
0-39	F	0	Fail
ABSENT	AB	0	Fail

Percentage Calculation: CGPA*10

M.Tech Civil Engineering(Regular)

Structural Engg.

M.Tech CE	Semester	Subject	Code	L	T	P	A	Credits
M.Tech CE	1st	Operation Research and Methodology	ORML401	3	1	0	1	4
M.Tech CE	1st	Bridge Engineering	BREL401	3	1		1	4
M.Tech CE	1st	Seminar	SESL401					2
M.Tech CE	1st	Lab-I	LB1P401			4		2
M.Tech CE	1st	Elective-I- Solid Mechanics	SMEL401	3	1	0	1	4
M.Tech CE	1st	Disaster Management	DIML401					
M.Tech CE	2nd	Dynamics of Structures	DOSL402	3	1		1	4
M.Tech CE	2nd	Pre Stressed Concrete Structures	PSCL402	3	1		1	4
M.Tech CE	2nd	Advanced Structural Analysis	ASAL402	3	1		1	4
M.Tech CE	2nd	Plastic Analysis and Design of Steel Structures	PADL402	3	1		1	4
M.Tech CE	2nd	Lab -2	LB2P402			4		2
M.Tech CE	3rd	Advanced Foundation Engineering	AFEL403	3	1		1	4
M.Tech CE	3rd	Pre Thesis Seminar	SESL403	0	0	0	8	4
M.Tech CE	3rd	Project	SEPL403				20	10
M.Tech CE	3rd	Elective -II - Construction & Maintenance Management	CMML403	3	1		1	4
M.Tech CE	3rd	Computer Aided Design Methods	CADL403					
M.Tech CE	3rd	Elective-III- High Rise Buildings	HRBL403	3	1		1	4
M.Tech CE	3rd	Composite Materials	CMAL403					
M.Tech CE	4th	Thesis	STTL404				40	20

Transportation Engg.

M.Tech CE	Semester	Subject	Code	L	T	P	A	Credits
M.Tech CE	1st	Operation Research and Methodology	ORML401	3	1		1	4
M.Tech CE	1st	Bridge Engineering	BREL401	3	1		1	4
M.Tech CE	1st	Seminar	TESL401				4	2
M.Tech CE	1st	Lab-I	TELP401			4		2
M.Tech CE	1st	Elective-I - Land use and Regional Transportation Planning	LRTL401	3	1		1	4
M.Tech CE	1st	Disaster Management	DIML401					
M.Tech CE	2nd	Advanced Traffic Engineering	ATEL402	3	1		1	4
M.Tech CE	2nd	Geometric Design of Transportation Infrastructure	GDTL402	3	1		1	4
M.Tech CE	2nd	Pavement Material Characterizaation	PMCL402	3	1		1	4
M.Tech CE	2nd	Pavement Analysis and Design	PDOL402	3	1		1	4
M.Tech CE	2nd	Lab-2	TELP402			4		2
M.Tech CE	3rd	Advanced Foundation Engineering	AFEL403	3	1		1	4
M.Tech CE	3rd	Pre Thesis Seminar	TESL403				8	4
		Project	TEPL403				20	10

M.Tech Civil Engineering(Regular)

M.Tech CE	3rd	Elective -II - Construction & Maintenance Management	CMML403	3	1		1	4
M.Tech CE	3rd	Pavement Management System	PMSL403					
M.Tech CE	3rd	Elective-III- Transportation system planning and management	TSPL403	3	1		1	4
M.Tech CE	3rd	Composite Materials	CMAL403					
M.Tech CE	4th	Thesis	TETL404				40	20

Infrastructure Development & Management

M.Tech CE	Semester	Subject	Code	L	T	P	A	Credits
M.Tech CE	1st	Operation Research and Methodology	ORML401	3	1		1	4
M.Tech CE	1st	Principles and Practices of Management	PPML401	3	1		1	4
M.Tech CE	1st	Seminar	IDSL401				4	2
M.Tech CE	1st	Lab-I	IDLP401			4		2
M.Tech CE	1st	Elective-I- Management in Organization	MIOL401	3	1		1	4
M.Tech CE	1st	Disaster Management	DIML401					
M.Tech CE	2nd	Materials and Equipment Management	MEML402	3	1		1	4
M.Tech CE	2nd	Infrastructure Development and Management	IDML402	3	1		1	4
M.Tech CE	2nd	Project Management Systems and Techniques	PMSL402	3	1		1	4
M.Tech CE	2nd	Quality, Safety and Environment Management	QSEL402	3	1		1	4
M.Tech CE	2nd	Lab-2	IDLP402			4		2
M.Tech CE	3rd	Contracts Management	CMOL403	3	1		1	4
M.Tech CE	3rd	Pre Thesis Seminar	IDSL403				8	4
M.Tech CE	3rd	Project	IDPL403				20	10
M.Tech CE	3rd	Elective -II - Construction & Maintenance Management	CMML403	3	1		1	4
M.Tech CE	3rd	Construction Finance Management	CFML403					
M.Tech CE	3rd	Elective -III - Joint Ventures and Privatization in Infrastructure Projects	JVPL403	3	1		1	4
M.Tech CE	3rd	Composite Materials	CMAL403					
M.Tech CE	4th	Thesis	IDTL404				40	20

Environmental Sci. & Technology

M.Tech CE	Semester	Subject	Code	L	T	P	A	Credits
M.Tech CE	1st	Operation Research and Methodology	ORML401	3	1		1	4
M.Tech CE	1st	Environmental Chemistry	ECHL401	3	1		1	4
M.Tech CE	1st	Seminar	ESSL401				4	2
M.Tech CE	1st	Lab-I	EL1P401			4		2
M.Tech CE	1st	Elective-I- Hydrology & Water Harvesting	HWHL401	3	1		1	4
M.Tech CE	1st	Disaster Management	DIML401					

M.Tech Civil Engineering(Regular)

M.Tech CE	2nd	Physics of Environment	POEL402	3	1		1	4
M.Tech CE	2nd	Air Pollution and Control	APCL402	3	1		1	4
M.Tech CE	2nd	Industrial & Hazardous Waste Management	IHWL402	3	1		1	4
M.Tech CE	2nd	Unit Processes & Operations -I	UPOL402	3	1		1	4
M.Tech CE	2nd	Lab-2	EL2P402			4		2
M.Tech CE	3rd	Unit Processes & Operations-II	UPOL403	3	1		1	4
M.Tech CE	3rd	Pre Thesis Seminar	ESSL403				8	4
M.Tech CE	3rd	Project	ESPL403				20	10
M.Tech CE	3rd	Elective -II - Construction & Maintenance Management	CMML403	3	1		1	4
M.Tech CE	3rd	Energy through Water Utilization	EWUL403					
M.Tech CE	3rd	Elective-III- Environmental Standards & Laws	ESLL403	3	1		1	4
M.Tech CE	3rd	Composite Materials	CMAL403					
M.Tech CE	4th	Thesis	ESTL404				40	20

Environmental Sci. & Technology

M.Tech CE	Sem	Subject	Code	L	T	P	A	Credits
M.Tech CE	1	Operation Research and Methodology	ORML407	3	1		1	4
M.Tech CE	1	Environmental Chemistry	ECHL407	3	1		1	4
M.Tech CE	1	Lab-I	EL1P407			4		2
M.Tech CE	2	Physics of Environment	POEL407	3	1		1	4
M.Tech CE	2	Unit Processes & Operations -I	UPOL407	3	1		1	4
M.Tech CE	2	Lab-2	EL2P407			4		2
M.Tech CE	3	Seminar	ESSL407				4	2
M.Tech CE	3	Elective-I- Hydrology & Water Harvesting	HWHL407	3	1		1	4
M.Tech CE	3	Disaster Management	DIML407					
M.Tech CE	3	Air Pollution and Control	APCL407	3	1		1	4
M.Tech CE	4	Industrial & Hazardous Waste Management	IHWL407	3	1		1	4
M.Tech CE	4	Unit Processes & Operations-II	UPOL407	3	1		1	4
M.Tech CE	4	Project	ESPL407				20	10
M.Tech CE	5	Pre Thesis Seminar	ESSL407				8	4
M.Tech CE	5	Elective -II - Construction & Maintenance Management	CMML407	3	1		1	4
M.Tech CE	5	Energy through Water Utilization	EWUL407					
M.Tech CE	5	Elective-III- Environmental Standards & Laws	ESLL407	3	1		1	4
M.Tech CE	5	Composite Materials	CMAL407					
M.Tech CE	6	Thesis	ESTL407				40	20

M.Tech Structures

Course Name :	OPERATION RESEARCH AND METHODOLOGY
Course Code:	ORML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Introduction to Research: Meaning, Definition, Objective and Process Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, And Factorial Design. Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal	10
2	Sources of Data: Primary and Secondary, Validation of Data Data Collection Methods: Questionnaire Designing, Construction Sampling Design & Techniques – Probability Sampling and Non Probability Sampling Scaling Techniques: Meaning & Types Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability Validity: Content Validity, Criterion Related Validity and Construct Validity	8
3	Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA	12
4	Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling Report Writing: Essentials of Report Writing, Report Format	10

S. No.	References:
1	R.I Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi..
2	N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3	Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers
4	Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
5	C.R.Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age Pub.

M.Tech Structures

Course Name :	BRIDGE ENGINEERING
Course Code:	BREL401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	General Bridge systems: Considerations in alignment, Planning, Economic considerations, Aesthetics and selection of type of bridge, Bridge Hydrology, Scour Depth, Depth of foundation, Estimation of Design Discharge	6
2	Loading Standards: Specifications for loading, geometrical proportioning etc. Road, Rail-cum-Road bridges, Indian Road Congress and Indian Railway loading standards and their comparison with loading standards followed in U.K., U.S.A. and Europe.	6
3	Design of Bridges: Reinforced Concrete Bridges, Slab culverts, T-Beam Bridges, Box Girder Bridges.	8
4	Bridge Bearings	3
5	Design of sub structure - Piers and Abutments	4
6	Dynamic Response of Bridges, Design considerations for pre-stressed bridges, trussed steel, Cable stayed and suspension bridges	9
7	Limit State concept for Design of RCC bridges.	4

S. No.	References:
1	Design of Bridges, N.Krishna Raju, Oxford and IBH Publications
2	Victor D.J, Essential of Bridge Engineering Oxford & I.B.H. Publishing Co., New Delhi.
3	N. Rajagopalan, Bridge Superstructure, Narosa Publishing House
4	B. Bakht and L.G. Jaeger, Bridge Analysis Simplified, McGraw Hill
5	T. Y. Lin and N. H. Burns, Design of Prestressed Concrete Structures, John Wiley and Sons

M.Tech Structures

Course Name :	Seminar
Course Code :	SESL401
Credits:	2
L T P A:	0-0-0-4

Course Details:
Seminar will be an independent study on the related topic and will be evaluated internally

M.Tech Structures

Course Name :	LAB-I
Course Code:	LB1P401
Credits:	02
L T P A:	0-0-4-0

Contents
<p>Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis</p> <p>*Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consist of Applications of Tests and Techniques Mentioned in The Research Methodology UNITS.</p>

M.Tech Structures

Course Name :	SOLID MECHANICS
Course Code :	SMEL 401
Credits:	04
L T P A	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Theory of stress, state of stress in a body, Differential equations of equilibrium.	10
2	Analysis of state of stress at a given point in a body, geometrical theory of strains, displacement components and strain components and relation between them	10
3	Generalized hooks law, strains expressed in terms of stresses, stresses expressed in terms of strains, torsion of prismatic bars and bending	10
4	Saint- Venant method, three dimensional stress systems , Unsymmetrical bending.	8

S. No.	References:
1	Theory of elasticity- S.Timoshenko
2	Theory of elasticity-M.Filonenko
3	Solid mechanics-S.H. Crandall
4	L.S.Srinath, "Advanced Mechanics of Solids" Tata McGraw Hill, 2007.
5	A.R. Ragab, and S.E.Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press, 1999.
6	M.H.Sadd, "Elasticity: Theory, Applications and Numeric", Academic Press, 2006

M.Tech Structures

Course Name :	DISASTER MANAGEMENT
Course Code:	DIML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.</p> <p>Disaster Mitigation and Preparedness: Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought. Man-made hazards: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.</p>	14
2	<p>Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.</p> <p>Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.</p> <p>Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.</p>	12
3	<p>Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.</p> <p>Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.</p> <p>Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.</p>	13

S. No.	References:
1	Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
2	Disaster Management, R.B. Singh (Ed), Rawat Publications
3	Disaster Management –Future Challenges & Opportunities by Jagbir Singh

M.Tech Structures

Course Name	DYNAMICS OF STRUCTURES
Course Code	DOSL402
Credits	04
L T P A	3-1-0-1

Lecture Wise Break Up		No. of Lectures
1	Single Degree of Freedom Systems: Fundamental, Mass spring damper system, Analysis of free vibrations, Response to harmonic loading, periodic loading, Impulsive loading and general dynamic loading. Generalized SDOF, Vibration analysis by Rayleigh method.	8
2	Multi Degree of Freedom Systems: Two degree of freedom system – undamped, free & forced. Multidegree of freedom system-undamped, Hozler’s method, Stodola’s method, Orthogonality condition, Damped system. Dynamic analysis and Response- Modal Analysis, Response spectrum analysis, Rayleigh’s- Ritz method.	10
3	Structures with Distributed Mass And Load: Axial, shear and transverse vibration due to bending of beams, Uniform shear beam, Beam in bending, Numerical techniques for shear beam, Bending of beams, Forced vibration, Plates or slabs subjected to normal loads.	10
4	Earthquake Motion And Response: Introduction, Strong motion earthquake, Numerical method for spectra, Elastic spectra, Ground velocity and displacement, Inelastic spectra	7
5	Machine Foundations: Design of machine foundations, industrial floors subjected to dynamic loading.	5

S.No.	References
1	Dynamics of Structures by John’s Biggs
2	Elementary Earthquake Engineering by Jai Krishna & Chander Shekhran.
3	Dynamic of Structures by Walter c. Hurty & Moshe F.Rubinsten.
4	Dynamics of structures by Anil K.Chopra.

M.Tech Structures

Course Name :	PRESTRESSED CONCRETE STRUCTURES
Course Code:	PSCL402
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Limit state design of statically determinate pre-stressed beams- limit state of collapse by flexure, shear, torsion limit state of serviceability	7
2	Anchorage zone stresses for posttensioned members. Statically indeterminate structures- analysis and design- continuous beams and frames.	6
3	Choice of profile, linear transformation, concordancy, omically viable profile. Composite beam with precast prestressed beams and cast in situ RC slab- analysis and design.	8
4	Time dependant effects such as creep, shrinkage etc. on composite construction inclusive of creep relaxation and relaxation creep- partial prestressing principles, analysis and design of simple beams, crack and crack width calculations	9
5	Analysis and design of prestressed pipes, tanks and spatial structures slabs, grids, folded plates and shells.	8

S. No.	References:
1	Prestressed concrete structures – Lundy.
2	Prestressed concrete – T.Y. Lin.
3	Prestressed concrete – N. Krishna Raju.
4	Prestressed concrete – Ramamurtham

M.Tech Structures

Course Name	ADVANCED STRUCTURAL ANALYSIS
Course Code	ASAL402
Credits	04
L T P	3-1-0-1

Lecture Wise Break Up		No. of Lectures
1	Stiffness Matrix Method: Basis of stiffness method, Influence coefficients, Kinematic indeterminacy, Degree of freedom, Action displacement relationship, Matrix approach to stiffness method, Transformation of axes system, Formation of load vectors, Elastic supports, Support displacements, Application of stiffness matrix method to various type of structures e.g. Continuous beams, Trusses, Frames and grids, partially discontinuous structures, Temperature effects,	14
2	Flexibility Matrix Method: Compatibility equations, Flexibility coefficients, Application of complimentary energy principles, Basis of the method, Application of flexibility matrix method to various types of structures, Analysis of pin jointed trusses, Rigid frames.	12
3	Finite Element Method: Introduction to finite element method, Theory of elasticity, Coordinate systems, Rotation of axes, Shape functions, Elements stiffness matrix and load vector, Triangular element in plane stress and strain, Numerical integration, Isoparametric elements, Rectangular elements in flexure, Triangular element, Rectangular element in plane stress and bending combined, Computer programming concepts.	14

S.No.	References
1	Matrix Analysis of Framed Structures by Gere and Weaver.
2	Analysis of Indeterminate Structures by C.K. Wang
3	Advance Structural Analysis by A.K.Jain.
4	Introduction to Finite Element Method by C.S.Desai and John F. Abel

M.Tech Structures

Course Name :	PLASTIC ANALYSIS AND DESIGN OF STEEL STRUCTURES
Course Code :	PADL 402
Credits:	04
L T P A	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Ductility of metals: Concept of plastic design, over loaded factors, ultimate load as design criteria.	4
2	Hinge formation in indeterminate structures, Redistribution of moments, Assumption made for structures subjected to bending only.	5
3	Minimum weight design: concept, assumptions, Design of frame with prismatic members, Elements of linear programming and its application to minimum weight design problems.	6
4	Deflections: Assumption, calculation of deflection at ultimate loads, permissible rotations.	5
5	Secondary design considerations: Influence of direct load, shear, local buckling, lateral buckling, repeated loading and brittle fracture on moment capacity design of eccentrically loaded columns.	5
6	Problem of incremental: collapse, shake down analysis.	4
7	Special consideration for design of structures using light gauge metals.	5

S. No.	References:
1	Baker J. and Heyman J., Plastic Design of Frames, Cambridge the University Press, 1969.
2	Neal B.G., The Plastic Methods of Structural Analysis, John Wiley & Sons. New York, 1977.
3	SP: 6(6) – 1972, Handbook for Structural Engineers
4	Application of Plastic Theory in Design of Steel Structures, Bureau of Indian Standards, New Delhi 110002.

M.Tech Structures

Course Name	LAB II
Course Code	LB2P402
Credits	04
L T P	0-0-4-0

List of Laboratory Experiments	
1	Effect of water/cement ratio on workability and strength of concrete
2	Effect of fine aggregate/coarse aggregate ratio on strength and permeability of concrete.
3	Study of Mix Design Methods using admixtures.
4	Stress- Strain relationship for concrete, correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture

M.Tech Structures

Course Name	ADVANCED FOUNDATION ENGINEERING
Course Code	AFEL403
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up		No. of Lectures
1	Shallow Foundations : Design considerations - factors of safety (including limit state), allowable settlements, location and depth of foundations, Codal provisions. Presumptive bearing, capacity. Bearing capacity theories. Layered soils. Choice of shear strength parameters. Bearing capacity from N-values, static cone tests, plate load tests .Settlement: Total and differential settlement. Stress distribution. Consolidation settlement in clays (with correction factors). Immediate settlement. Settlement in sands from N-values, elastic solutions. Static cone tests, Plate load tests.	12
2	Deep foundations: Type of Piles. Construction methods. Axial capacity of single piles-static formulae, Skin friction and end bearing in sands and clays. Axial capacity of groups. Settlement of single piles and groups. Uplift capacity (including under- reamed piles). Negative skin friction. Pile load tests. Pile integrity tests. Codal provisions. Laterally Loaded Piles: Short and long piles; Free head and fixed head piles; Lateral load capacity of single piles; Lateral deflection; Elastic analysis; Group effect; Lateral load test; Codal provisions. Caissons and Wells.	12
3	Soil structure interaction: Introduction to soil-foundation interaction problems, soil behaviour , Foundation behavior, interface behavior, soil foundation interaction analysis, Soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour.	6
4	Soil Liquefaction and remedial measures, stone column, deep compaction.	4
5	Foundations in difficult soils: Expansive soils, chemically aggressive environment, soft soils, fills, regions of subsidence.	6

S.No.	References
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M.Tech Structures

1	Joseph E. Bowles Foundation Analysis and Design.
2	Kaniraj S.K., Design aids in soil mechanics and foundation engineering.
3	Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley

Course Name :	PRE-THESIS SEMINAR
Course Code :	SESL403
Credits:	4
L T P A:	0-0-0-8

Course Details:
Following things to be included in Pre-thesis Seminar: <ol style="list-style-type: none">1. Literature survey.2. Gap Reflection.3. Objectives and Methodology4. Expected Outcomes Synopsis presentation through PPT will be evaluated internally.

M.Tech Structures

Course Name :	PROJECT
Course Code :	SEPL403
Credits:	10
L T P A:	0-0-0-20

Course Details:
Students are required to work on project in any of the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering).
Project will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his Project work and Viva-voce will be held

M.Tech Structures

Course Name :	CONSTRUCTION AND MAINTENANCE MANAGEMENT
Code :	CMML 403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of lectures
1	Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control.	6
2	General & Material Management: Introduction and characteristics of management, Principle and function of management, Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management. Disposal of Surplus Materials	8
3	Safety In Construction: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario	6
4	Maintenance Management : Definition, Organization structure, work force for Maintenance, Communication needs, Building inspections, Maintenance budget and estimates, Property inspections and reports, Specification for maintenance jobs, Health and safety in maintenance, Quality in Maintenance, maintenance Manual and their importance.	6
5	Investigation and diagnosis for Repair of structures: Basic Approach to investigations, Physical inspection, Material Tests, Non destructive testing for diagnosis, Estimation of actual, loads and environmental effects, Study of design and construction practices used in original construction, Retrospective analysis, and Confirmation and repair steps.	8
6	Building Defects and Remedial Measures : 6.1 Nature, types of problems, their causes, remedial measures and special treatment for building elements. –Foundation, - Basements – D.P.C. - Walls - Wall finishes – Chimney, stacks and shafts –Columns and beams – Roof and roof terraces – Floor and floor finishes – Joinery work – Decorative/decorative finishes –Services – Materials – Dampness	6

Sr No	References
1	Construction Planning equipment and Methods by RL Peuripo Tata McGraw Hill.
2	Mangement Machines and Methods in Civil Engineering-John,Christan, John Wiley and Sons.
3	Maintenance of Buildings A.C. Panchadari New age international (P) limited Publishers

M.Tech Structures

4	Common Defects in Buildings -H.J.Eidridge, Her Majesty's Stationery Office, London
Course Name	COMPUTER AIDED DESIGN AND EXPERT SYSTEMS IN ENGINEERING
Course Code	CADL403
Credits:	04
L T P A	3-1-0-1

Lecture Wise Break Up		No. of Lectures
1	Computer Aided Design: Introduction, Computer graphics, Geometric modeling, Three dimensional graphics, Raster graphic fundamentals, Computer aided linkage displays and synthesis, Interactive acceleration analysis.	8
2	Programming Using Matrix Methods of Structural Analysis: Assembly of matrices, Solution of equilibrium equations, Flow charts.	10
3	Interactive Computer Programming: Computer programs for design of simple civil engineering structural elements.	8
4	Expert System in Engineering: Introduction, History, Advantages and limitations of expert systems. Components of Expert Systems: Knowledge base, Inference Engine, User's Interface .	8
5	Development of Expert Systems: Problem formulation, Application to engineering analysis & design consideration and Operations, Representative applications in civil engineering.	6

S.No.	References
1	“Matrix Analysis of Framed Structures” by William Weaver.
2	“Introduction to Expert Systems” by Jackson, P.
3	“A guide to Expert Systems” Waterman, D.A.

M.Tech Structures

Course Name :	HIGH RISE BUILDINGS
Course Code :	HRBL 403
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Tall Building systems and Concepts: environmental systems. Service systems, construction system, foundation design, architectural-structural interaction.	6
2	Tall building criteria and loading gravity load. Earthquake loadings, wind loading and effects, fire and blast, quality control crib Structural safety	6
3	Structural design of tall steel buildings: commentary on structural standards, elastic analysis and design. Plastic analysis and design, stability.	8
4	Design methods based on stiffness, fatigue and fracture, load factor (Limit State) design.	3
5	Structural design of tall concrete and masonry buildings: commentary structural standards, plastic analysis-strength of members and correction,	4
6	Non-linear analysis and limit design, stability, stiffness and crack control creep shrinkage and temperature effects. Limit state design, masonry structures.	9
7	Frame-shear wall systems: Twist of frame. Analysis of shear wall, frame wall interaction, analysis of coupled shear wall, computation of earthquake load dynamic analysis of tall building.	4

S. No.	References:
1	Structural Analysis and design of Tall Buildings by Tara Nath Bungale
2	Advances in tall buildings by Beedle L.S.
3	Experimental design, Theory & application, Federer, Oxford & IBH pub Co.

M.Tech Structures

Course Name	COMPOSITE MATERIAL
Code :	CMAL403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of lectures
1	Introduction, Historical background, Technological Applications, Composites – various reinforcement and matrix materials, Classification of composites	2
2	High performance concrete: Materials for high performance concrete, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.	6
3	Ferro cement: Constituent materials and their properties, Mechanical properties of Ferro cement, Construction techniques and application of Ferro cement	6
4	Fibre reinforced concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Application of fibre reinforced concrete	8
5	Polymer concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete	6
6	Fly ash concrete: Classification of Indian Fly ashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly ash concretes, Properties of Fly ash concrete in fresh and hardened state, Durability of fly ash concrete	6
7	Light weight concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete	6

Sr No	References
1	Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monterio
2	Ferrocement by B.K. Paul, and R.P. Pama
3	Fibre Reinforced Concrete by Bentur and Mindess
4	Flyash in Concrete by Malhotra and Ramezaniapour
5	Concrete Technology by M.L Gambhir

M.Tech Structures

Course Name :	THESIS
Code :	STTL404
Credits:	20
L T P A:	0-0-0-40

Course Details:	
1	Thesis in the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering)
2	Thesis will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his thesis work and Viva-voce will be held

M.Tech- Transportation & Highway Engineering

Course Name :	OPERATION RESEARCH AND METHODOLOGY
Structures Course:	ORML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction to Research: Meaning, Definition, Objective and Process</p> <p>Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental</p> <p>Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature</p> <p>Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.</p> <p>Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal</p>	10
2	<p>Sources of Data: Primary and Secondary, Validation of Data</p> <p>Data Collection Methods: Questionnaire Designing, Construction Sampling Design & Techniques – Probability Sampling and Non Probability Sampling</p> <p>Scaling Techniques: Meaning & Types</p> <p>Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability</p> <p>Validity: Content Validity, Criterion Related Validity and Construct Validity</p>	8
3	<p>Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation</p> <p>Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number</p> <p>Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA</p>	12
4	<p>Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling</p> <p>Report Writing: Essentials of Report Writing, Report Format</p>	10

S. No.	References:
1	R.I Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi..
2	N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3	Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers
4	Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
5	C.R.Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age Pub.

M.Tech- Transportation & Highway Engineering

Course Name :	BRIDGE ENGINEERING
Structures Course:	BREL401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	General Bridge systems: Considerations in alignment, Planning, Economic considerations, Aesthetics and selection of type of bridge, Bridge Hydrology, Scour Depth, Depth of foundation, Estimation of Design Discharge	6
2	Loading Standards: Specifications for loading, geometrical proportioning etc. Road, Rail-cum-Road bridges, Indian Road Congress and Indian Railway loading standards and their comparison with loading standards followed in U.K., U.S.A. and Europe.	6
3	Design of Bridges: Reinforced Concrete Bridges, Slab culverts, T-Beam Bridges, Box Girder Bridges.	8
4	Bridge Bearings	3
5	Design of sub structure - Piers and Abutments	4
6	Dynamic Response of Bridges, Design considerations for pre-stressed bridges, trussed steel, Cable stayed and suspension bridges	9
7	Limit State concept for Design of RCC bridges.	4

S. No.	References:
1	Design of Bridges, N.Krishna Raju, Oxford and IBH Publications
2	Victor D.J, Essential of Bridge Engineering Oxford & I.B.H. Publishing Co., New Delhi.
3	N. Rajagopalan, Bridge Superstructure, Narosa Publishing House
4	B. Bakht and L.G. Jaeger, Bridge Analysis Simplified, McGraw Hill
5	T. Y. Lin and N. H. Burns, Design of Prestressed Concrete Structures, John Wiley and Sons

M.Tech- Transportation & Highway Engineering

Course Name :	SEMINAR
Structures Course:	TESL401
Credits:	02
L T P A:	0-0-0-4

Course Details:
Seminar will be an independent study on the related topic and will be evaluated internally

M.Tech- Transportation & Highway Engineering

Course Name :	LAB-I
Structures Course:	TEPL401
Credits:	02
L T P:	0-0-4-0

Contents

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

*Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consist of Applications of Tests and Techniques Mentioned in The Research Methodology UNITS.

M.Tech- Transportation & Highway Engineering

Course Name :	LAND USE AND REGIONAL TRANSPORTATION PLANNING
Structures Course:	LRTL401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Land Use And Transportation Engineering: Transportation modeling in Planning; Models and their role, Characteristics of Transport demand and supply, Equilibrium of supply and demand, Modeling and decision making, Issues in Transportation modeling and structure of the classic transport model.	8
2	Land Use Transportation and Activity Models: Introduction to Land Use Planning; Relation between Transportation and Land Use Planning; The economic base mechanism and allocation mechanism; Spatial allocation and employment interrelationship; Garin Lowry models.; Activity modeling	8
3	General Travel Demand Models and Regional Transport Models: Aggregate, Disaggregate models ; Behavioral models; Recursive and direct demand Models; Linear, Non-Linear models; Logit, discriminant and probit models; Mode split models - Abstract mode and mode specific models. Regional Transport Models: Factors affecting goods and passenger traffic; Prediction of traffic; Growth factor models; Time function iteration models; internal volume forecasting models.	8
4	Regional Network Planning: Problems in Developing Countries, Network Characteristics - Circuitry, Connectivity, Mobility, Accessibility and Level of Service Concepts - Network Structures and Indices – Network Planning – Evaluation - Graph Theory – Cut sets – Flows & Traversing – Optimum Network - Inter-modal Co-ordination. – Rural Road Network Planning.; User equilibrium concepts	5
5	Advanced Spatial analysis Modelling: Applications of Artificial Neural networks, Cellular automata, Fuzzy logic systems, Genetic algorithms, artificial intelligence concepts to transportation Modelling	5

S. No.	References:
1	Modelling Transport by Jhan De Dios Ortuzar. Luis E. Willumsen. John Wiley & Sons. 1970/1975.
2	Economic Models and Economic Forecast - Robert S, Pindyek, Daniel L. Rubin Field; McGraw Hill.
3	Introduction to Transportation Engineering and Planning, Morlok EK, McGraw Hill

M.Tech- Transportation & Highway Engineering

Course Name :	DISASTER MANAGEMENT
Structures Course:	DIML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.</p> <p>Disaster Mitigation and Preparedness: Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought. Man-made hazards: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.</p>	14
2	<p>Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.</p> <p>Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.</p> <p>Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.</p>	12
3	<p>Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.</p> <p>Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.</p> <p>Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.</p>	13

S. No.	References:
1	Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
2	Disaster Management, R.B. Singh (Ed), Rawat Publications
3	Disaster Management –Future Challenges & Opportunities by Jagbir Singh

M.Tech- Transportation & Highway Engineering

Course Name :	ADVANCED TRAFFIC ENGINEERING
Structures Course:	ATEL402
Credits:	04
L T P A:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up:		No. of Lectures:
1	Introduction: Elements of Traffic Engineering, Components of traffic system – road users, vehicles, highways and control devices.	4
2	Vehicle Characteristics: IRC standards, Design speed, volume, Highway capacity and levels of service, capacity of urban and rural roads, PCU concept and its limitations.	4
3	Traffic Stream Characteristics: Traffic stream parameters, characteristics of interrupted and uninterrupted flows.	4
4	Traffic Studies: Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, parking studies, accident studies	5
5	Traffic Regulation and Control: Signs and markings, Traffic System Management, At-grade intersections, Channelisation, Roundabouts	5
6	Traffic Signals: Pre-timed and traffic actuated. Design of signal setting, phase diagrams, timing diagram, Signal co-ordination	5
7	Grade Separated Intersections: Geometric elements for divided and access controlled highways and expressways.	4
8	Traffic Safety: Principles and practices, Road safety audit.	4
9	Intelligent Transportation System: Applications in Traffic Engineering	5

S. No.	References:
1	Kadiyali, L.R., “Traffic Engineering & Transport Planning”, Khanna Publishers, New Delhi
2	William, R.M. and Roger, P.R., “Traffic Engineering”, Prentice Hall
3	Hobbs, F.D., “Traffic Planning and Engineering”, Pergamon Press.
4	Mannering, “Principles of Highway Engineering & Traffic Analysis”, Wiley Publishers, New Delhi

M.Tech- Transportation & Highway Engineering

Course Name :	GEOMETRIC DESIGN OF TRANSPORTATION INFRASTRUCTURE
Course Code :	GDTL402
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design, Cross Section Elements: Design specifications; Pavement Surface characteristics– Skid Resistance, Camber, Objectives. Specifications for hill roads	6
2	Horizontal Alignment of Roads: Sight Distances – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance ; Objectives of horizontal curves; Super elevation; Extra- widening on Curves; Vertical Curves –Summit Curves, Valley Curves and Design criteria for Vertical Curves; Sight Distances, Grade Compensation.	10
3	Geometric Design of Intersections : Types of Intersections; At-grade Intersections –Channelization; Traffic Islands and Design standards; Rotary Intersection – Concept, Advantages and Disadvantages; Grade separated Interchanges.	8
4	Miscellaneous Elements: Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays –Types and Guide lines; Design of On-street and Off street Parking facilities – Guidelines for lay out Design, Traffic Signs and Markings.	8
5	Airport and Railway Infrastructure Design – Runway orientation, Site selection, Wind rose analysis Geometric design standards for runways, taxiways, aprons , Airport capacity analysis, Terminal design; GEOMETRIC DESIGN OF RAILWAY TRACK: Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – Crossings and Turn outs .	8

S. No.	References:
1	Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna, 2007.
2	Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
3	IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.
4	Railway Engineering, Arora and Saxsena.

M.Tech- Transportation & Highway Engineering

Course Name :	PAVEMENT MATERIAL CHARACTERIZATION
Course Code :	PMCL402
Credits:	04
L T P A:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up:		No. of Lectures:
1	Subgrade Soil Characterization: Properties of subgrade, soils, A critical look at the Different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. GI, CBR & Plate Load test, Field compaction and control, Modulus of subgrade reaction.	8
2	Aggregate: Introduction, Desirable properties of road aggregates, Tests for Road aggregates	8
3	Bituminous materials: Introduction, Types of Bituminous materials, Requirements of bitumen, Tests on Bitumen, Cutback Bitumen, Bituminous Emulsion, Bituminous paving mixes, Design by Marshall Method and Modified Hubbard-Field method	8
4	Cement and Cement Concrete Mix Characterization: Types of cements and basic cement properties, Special cements; Quality tests on cement; Tests on cement concrete including compressive strength, flexural strength, modulus of elasticity and fatigue properties; Introduction to advanced concretes like self compacted concrete, Light weight concrete, Roller Compacted Concrete for pavement application; Role of different admixtures in cement concrete performance; Joint filers for Jointed Plain Cement Concrete Pavements and their characterization; Nano technology applications in cement concrete.	8
5	Soil Stabilization: Introduction, Mechanics of soil stabilization, stabilization with admixtures like cement, lime, fly ash, bitumen, stabilization using soft aggregates, stabilization of Black Cotton soils, stabilization of desert sand, Introduction to Geotextiles application.	8

S. No.	References:
1	Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
2	Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, 1971.
3	Relevant IRC and IS Codes of Practices (Separate List will be given).
4	Highway Engineering, S.K. Khanna – C.E.G. JUSTO

M.Tech- Transportation & Highway Engineering

Course Name :	PAVEMENT ANALYSIS & DESIGN
Course Code :	PD0L402
Credits:	04
L T P A:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up:		No. of Lectures:
1	Pavement Types: Definition, highway and airport pavement comparison, wheel loads, tyre pressure, Contact pressure, design factors. Type of distresses structural and functional, serviceability	6
2	Stresses in Flexible: Layered system concept, multilayered solutions. Burmister's method, Fundamental design concepts. Stresses in Rigid Pavements: Relative stiffness of slabs. Modulus of subgrade reaction. Stresses due to warping, stresses due to friction, effect of warping, contraction and expansion. Plain versus reinforced pavements, stresses in dowel bar, tie bar, combined stresses.	10
3	Design of Flexible Pavements: Design factors. Design wheel load. Equivalent single wheel load. Difference between airport and highway design concept. Different design methods. CBR, GI, Triaxial method, McLeod method. Design of Rigid Pavement: General design considerations. Design of joints in cement concrete pavements, spacing of expansion joint, spacing of contraction joints. Design of dowel bar. Design of tie bar. IRC recommendations for design of concrete pavements.	16
4	Pavement Evaluation and Rehabilitation: Pavement distresses in flexible and rigid pavements, condition and evaluation survey. Present serviceability index. Methods of measuring condition, skid resistance. Principles of maintenance. Methods of structural evaluation.	8

S. No.	References:
1	Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
2	Highway Engg by S. K. Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
3	Principles of Pavement Design, by Yoder E.J. and Witczak M.W. 2nd, John Wiley & Sons, INC.
4	Principles and Practice of Highway Engg. By L.R. Kadiyali, Khanna Publishers, Delhi.
5	Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw-Hill Publishing Co. Ltd. New Delhi

M.Tech- Transportation & Highway Engineering

Course Name :	LAB-2
Structures Course:	TEPL402
Credits:	02
L T P:	0-0-4-0

Contents

Tests on bitumen

1. Penetration test
2. Flash and fire point test
3. Ductility test
4. Softening point test

Tests on aggregates

1. Shape tests - Elongation, Flakiness Index & Combined Index
2. Aggregate impact value test
3. Los angeles abrasion value test
4. Specific gravity & Water absorption test

Field Tests

1. Field density by sand replacement & Core cutter method
2. Bitumen Extraction, bitumen content and aggregate gradation

M.Tech- Transportation & Highway Engineering

Course Name :	ADVANCED FOUNDATION ENGINEERING
Structures Course:	AFEL403
Credits:	04
L T P:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up		No. of Lectures:
1	Shallow Foundations : Design considerations - factors of safety (including limit state), allowable settlements, location and depth of foundations, Codal provisions. Presumptive bearing, capacity. Bearing capacity theories. Layered soils. Choice of shear strength parameters. Bearing capacity from N-values, static cone tests, plate load tests .Settlement: Total and differential settlement. Stress distribution. Consolidation settlement in clays (with correction factors). Immediate settlement. Settlement in sands from N-values, elastic solutions. Static cone tests, Plate load tests.	12
2	Deep foundations: Type of Piles. Construction methods. Axial capacity of single piles-static formulae, Skin friction and end bearing in sands and clays. Axial capacity of groups. Settlement of single piles and groups. Uplift capacity (including under-reamed piles). Negative skin friction. Pile load tests. Pile integrity tests. Codal provisions. Laterally Loaded Piles: Short and long piles; Free head and fixed head piles; Lateral load capacity of single piles; Lateral deflection; Elastic analysis; Group effect; Lateral load test; Codal provisions. Caissons and Wells.	12
3	Soil structure interaction: Introduction to soil-foundation interaction problems, soil behaviour , Foundation behavior, interface behavior, soil foundation interaction analysis, Soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour.	6
4	Soil Liquefaction and remedial measures, stone column, deep compaction.	4
5	Foundations in difficult soils: Expansive soils, chemically aggressive environment, soft soils, fills, regions of subsidence.	6

S.No.	References
1	Joseph E. Bowles Foundation Analysis and Design.
2	Kaniraj S.K., Design aids in soil mechanics and foundation engineering.
3	Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley

M.Tech- Transportation & Highway Engineering

Course Name :	PRE-THESIS SEMINAR
Course Code :	TESL403
Credits:	04
L T P A:	0-0-0-8

Course Details:
Following things to be included in Pre-thesis Seminar: <ol style="list-style-type: none">1. Literature survey.2. Gap Reflection.3. Objectives and Methodology4. Expected Outcomes Synopsis presentation through PPT will be evaluated internally.

M.Tech- Transportation & Highway Engineering

Course Name :	PROJECT
Course Code :	TESL403
Credits:	10
L T P A:	0-0-0-20

Course Details:
Students are required to work on project in any of the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering). Project will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his Project work and Viva-voce will be held

M.Tech- Transportation & Highway Engineering

Course Name :	CONSTRUCTION AND MAINTENANCE MANAGEMENT
Code :	CMML 403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures
1	Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control.	6
2	General & Material Management: Introduction and characteristics of management, Principle and function of management, Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management. Disposal of Surplus Materials	8
3	SAFETY IN CONSTRUCTION: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario	6
4	Maintenance Management : Definition, Organization structure, work force for Maintenance, Communication needs, Building inspections, Maintenance budget and estimates, Property inspections and reports, Specification for maintenance jobs, Health and safety in maintenance, Quality in Maintenance, maintenance Manual and their importance.	6
5	Investigation and diagnosis for Repair of structures: Basic Approach to investigations, Physical inspection, Material Tests, Non destructive testing for diagnosis, Estimation of actual, loads and environmental effects, Study of design and construction practices used in original construction, Retrospective analysis, and Confirmation and repair steps.	8
6	Building Defects and Remedial Measures : 6.1 Nature, types of problems, their causes, remedial measures and special treatment for building elements. –Foundation, - Basements – D.P.C. - Walls - Wall finishes – Chimney, stacks and shafts –Columns and beams – Roof and roof terraces – Floor and floor finishes – Joinery work – Decorative/decorative finishes –Services – Materials – Dampness	6

Sr No	References
1	Construction Planning equipment and Methods by RL Peuripo Tata McGraw Hill.
2	Mangement Machines and Methods in Civil Engineering-John,Christan, John Wiley and Sons.
3	Maintenance of Buildings A.C. Panchadari New age international (P) limited Publishers
4	Common Defects in Buildings -H.J.Eidridge, Her Majesty's Stationery Office, London
5	Appraising building defects : Properties on stability and hygro-thermal performances, Geoffrey K.Cook Dr. A John Hinks Longman Scientific & Technical.
6	IVOR H. Seeley, Building Technology Mac Millian

M.Tech- Transportation & Highway Engineering

Course Name :	PAVEMENT MANAGEMENT SYSTEM
Course Code :	PMSL403
Credits:	04
L T P A:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction: A Pavement Management System is a set of defined procedures for collecting, analyzing, maintaining, and reporting pavement data, to assist the decision makers in finding optimum strategies for maintaining pavements in serviceable condition over a given period of time for the least cost.</p> <p>To counteract the problems of bad condition of roads causing discomfort, safety risk, larger travel time and travel cost, more fuel consumption and affected the quality of social life, national security and national economy.</p>	2
2	<p>Pavement Failures: General causes of pavement failures; Pavement failures; Failure in flexible pavements- Sub grade, Base Course, Wearing Course</p> <p>Typical Flexible Pavement Failures- Alligator cracking, consolidation of pavement layers, shear failure, longitudinal cracking, frost heaving, lack of binding to the lower course, reflection cracking, formation of waves & corrugation.</p>	8
3	<p>Failure in Cement Concrete pavements: Deficiency of pavement material; structural inadequacy of the pavement system.</p> <p>Typical Rigid Pavement Failures- Scaling of cement concrete, shrinkage cracks, spalling of joints, warping cracks, mud pumping, structural cracks.</p>	8
4	<p>Maintenance of Highways: General routine maintenance; Maintenance of - Earth roads, WBM roads, Bituminous surfaces, Cement concrete roads.</p> <p>Advantages of Good Roads: General benefits; Motor vehicle operation cost; Highway cost.</p>	8
5	<p>Pavement Evaluation and Performance: Introduction; Structural Evaluation; Evaluation of Pavement Surface Condition</p> <p>Case Studies related to Pavement Failure.</p> <p>Study of software dealing with Pavement Management Process.</p>	14

S. No.	References:
1	Haas, R.C.G. and Hudson, W.R., "Pavement Management System", McGraw Hill Company, Inc. New York
2	Yoder E.J., "Principals of Pavement Design", Second Edition, John Wiley & Sons, Inc. New York 1975.
3	Khanna -Justo, "HIGHWAY ENGINEERING" , Nem Chand & Bros, Roorkee, U.K., India

M.Tech- Transportation & Highway Engineering

Course Name :	TRANSPORTATION SYSTEM PLANNING AND MANAGEMENT
Course Code :	TSPL403
Credits:	04
L T P A:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up:		No. of Lectures:
1	Introduction: Traffic planning includes Field studies, Accident analysis, Traffic control devices, Design & planning, Economic analysis.	2
2	Accident studies: Various objectives of the accident studies; Causes of Accidents- Drivers, Pedestrians, Passengers, Vehicle defects, Road condition, Road design, Weather, Animals, Other causes; Accident studies and Records- Collection of accident data, Accident report, Condition diagram, Collision diagram; Accident Investigations- Recording general observations, Driver tests, Skid resistance of pavement surface, Probable causes of the accident, Vehicle tests, Cost analysis. Traffic Regulations: Driver controls, Vehicle controls, General controls; One-way streets; Traffic control devices; Regulatory signs; Warning signs; Informatory signs; Traffic signals; Restricting of Turning movements.	8
3	Urban Transportation Planning: Inventories, Trip Generation, Trip distribution, Model split, Traffic assignment, Plan preparation & Evaluation.	8
4	Traffic Engineering & Management: Traffic Characteristics; Traffic Studies- Volume, Speed, O-D & Parking studies; Capacity and Level of Service analysis; Statistical analysis of traffic flow variables; Traffic control- principles, methodologies and devices, advance technologies; Fundamentals of traffic managements- principles & methodology, Traffic Systems Management, Technique of management, Exclusive Bus lanes traffic management techniques, speed control & zoning, Parking control, Segregation & channelization, Principles and design of traffic signs, their placement & visibility.	10
5	Airport Planning and Design: History and development of aviation in India, Aviation organizations and their functions, Deregulation. Aircraft characteristics, Master plan, Site selection, Obstructions, Air traffic, Demand and forecasting, Airport configuration. Geometric design of landing area. Runway orientation, Exit taxiways, Separation clearance. Structural design of landing area, ESWL concepts, FAA method and LCN-PCN method of pavement design, Modern evaluation techniques. Runway capacity and its improvement, Delay related capacity, Gate position and gate capacity. Terminal area, Space requirements, Aircraft parking system, Terminal related visual aids. Air traffic control, Flight rules, Navigational and landing aids, VASI, PAPI enroute air traffic control, ILS, MLS. Airport drainage, Design runoff, Surface and subsurface drainage.	12

S.No.	References:
1	Hutchinson, B.G., "Principles of Urban Transport Systems Planning " Mc Graw Hill, New York, 1974
2	Kadiyali, L. R. "Traffic Engineering and Transport Planning", Khanna Publishers, 1997
3	Michael, "Transportation Planning Models", Elsevier Science Publishers, B.V. Netherlands, 1984
4	Khanna, S.K., Arora, M.G. and Jain, S.S., "Airport Planning and design, Nem Chand & Bros.,

M.Tech- Transportation & Highway Engineering

	Roorkee, 1999
Course Name	COMPOSITE MATERIAL
Code :	CMAL403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures
1	Introduction , Historical background, Technological Applications, Composites – various reinforcement and matrix materials, Classification of composites	2
2	High performance concrete: Materials for high performance concrete, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.	6
3	Ferro cement: Constituent materials and their properties, Mechanical properties of Ferro cement, Construction techniques and application of Ferro cement	6
4	Fibre reinforced concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Application of fibre reinforced concrete	8
5	Polymer concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete	6
6	Fly ash concrete: Classification of Indian Fly ashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly ash concretes, Properties of Fly ash concrete in fresh and hardened state, Durability of fly ash concrete	6
7	Light weight concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete	6

Sr No	References
1	Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monterio
2	Ferrocement by B.K. Paul, and R.P. Pama
3	Fibre Reinforced Concrete by Bentur and Mindess
4	Flyash in Concrete by Malhotra and Ramezaniapour
5	Concrete Technology by M.L Gambhir

M.Tech- Transportation & Highway Engineering

Course Name :	THESIS
Course Code :	TETL404
Credits:	20
L T P A:	0-0-0-40

Course Details:	
1	Thesis in the specified Area (Transportation and Highway Engineering/Structural Engineering/Infrastructure development and Management and Environmental Engineering)
2	Thesis will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his thesis work and Viva-voce will be held

M.Tech- Infrastructure Development & Management

Course Name :	OPERATION RESEARCH AND METHODOLOGY
Structures Course:	ORML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction to Research: Meaning, Definition, Objective and Process</p> <p>Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental</p> <p>Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature</p> <p>Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.</p> <p>Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal</p>	10
2	<p>Sources of Data: Primary and Secondary, Validation of Data</p> <p>Data Collection Methods: Questionnaire Designing, Construction Sampling Design & Techniques – Probability Sampling and Non Probability Sampling</p> <p>Scaling Techniques: Meaning & Types</p> <p>Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability</p> <p>Validity: Content Validity, Criterion Related Validity and Construct Validity</p>	8
3	<p>Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation</p> <p>Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number</p> <p>Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA</p>	12
4	<p>Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling</p> <p>Report Writing: Essentials of Report Writing, Report Format</p>	10

S. No.	References:
1	R.I Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi..
2	N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3	Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers
4	Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.

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5	C.R.Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age Pub.
Course Name :	PRINCIPLES AND PRACTICES MANAGEMENT
Structures Course:	PPML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Management: Concept, Nature, Importance; Management: Art and Science, Management as a Profession, Management vs. Administration, Management Skills, Levels of Management, Characteristics of Quality Managers.	6
2	Evolution of Management: Early contributions, Taylor and Scientific Management, Fayol's Administrative Management, Bureaucracy, Hawthorne Experiments and Human Relations, Social System Approach, Decision Theory Approach. Social Responsibility of Managers and Ethics in Managing.	6
3	Introduction to Functions of Management Planning: Nature, Scope, Objectives and Significance of Planning, Types of Planning, Process of Planning, Barriers to Effective Planning, Planning Premises and Forecasting, Objective Setting: Concept, Types and Process of Setting Objectives; Operational Planning Tools, M.B.O. :Concept, Process and Managerial Implications, Decision Making: Concept, Process, Types and Styles of Decision Making, Decision Making in Risk and Uncertainty.	8
4	Organizing: Concept, Organization Theories, Forms of Organizational Structure, Combining Jobs, Departmentation, Span of Control, Delegation of Authority, Authority & Responsibility, Principles of Organizational Designing, Contingency Approach to Organization Design, Learning Organizations.	6
5	Staffing: Concept, System Approach, Manpower Planning, Job Design, Recruitment & Selection, Training & Development, Performance Appraisal Directing: Concept, Direction and Supervision.	4
6	Controlling: Concept, Types of Control, Methods: Pre-control: Concurrent Control: Post-control, An Integrated Control System, The Quality Concept, Factors affecting Quality, Developing a Quality Control System, Total Quality Control, Pre-control of Inputs, Concurrent Control of Operations, Post Control of Outputs. .	6
7	Cases study related to the entire syllabus.	4

S. No.	References:
1	Stoner, Freeman & Gilbert Jr -Management (Prentice Hall of India, 6th Edition)
2	Koontz Harold & Weihrich Heinz — Essentials of management (Tata McGraw Hill, 5th Edition 2008)
3	Robbins & Coulter -Management (Prentice Hall of India, 9th Edition) Robbins S.P. and Decenzo David A. -Fundamentals of Management: Essential Concepts

M.Tech- Infrastructure Development & Management

Course Name :	SEMINAR
Code :	IDSL401
Credits:	2
L T P A:	0-0-0-4

Course Details:
Seminar will be an independent study on the related topic and will be evaluated internally

M.Tech- Infrastructure Development & Management

Course Name :	LAB-I
Structures Course:	IDLP401
Credits:	02
L T P A:	0-0-4-0

Contents

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

*Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consist of Applications of Tests and Techniques Mentioned in The Research Methodology UNITS.

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ELECTIVE-I

Course Name :	MANAGEMENT IN ORGANIZATION
Structures Course:	MIOL401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Introduction to organizational management: Nature , scope and complexity, Longitudinal thinking and legacy factor, Theory and majors schools of thought and framework of organizational analysis, Systems contingency approach to organization theory and practice; techniques of organizational diagnosis, Theory of organizational structures - nature and consequence of structure	12
2	Impact of structure, organization change and intervention strategy: Socio-culture dimension of work and behavior. Impact of Environment and cultural variables on organization structure & Style, Organization change & Organization development, Intervention strategies for organization development - Individual, Group & Interpersonal Interventions, Total System Intervention & Stabilizing Change, MBO.	10
3	Environment Analysis & Impact: Automation, Interdependence & Evaluation Issues: Nature of Organizational Processes, Environmental analysis Techniques & impact for organizational growth, Issues of Mechanization, Automation & Computerization, Organization Interdependence, Organization Evaluation.	15
4	Case Studies: Introduction, Objectives of case study, Phases of case study, Steps of case study, Types of case studies.	3

S. No.	References:
1	NICMAR, "Management In Organization", NICMAR

M.Tech- Infrastructure Development & Management

Course Name :	DISASTER MANAGEMENT
Structures Course:	DIML401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.</p> <p>Disaster Mitigation and Preparedness: Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought. Man-made hazards: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.</p>	14
2	<p>Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.</p> <p>Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.</p> <p>Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.</p>	12
3	<p>Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.</p> <p>Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.</p> <p>Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.</p>	13

S. No.	References:
1	Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
2	Disaster Management, R.B. Singh (Ed), Rawat Publications
3	Disaster Management –Future Challenges & Opportunities by Jagbir Singh

M.Tech- Infrastructure Development & Management

Course Name :	MATERIAL & EQUIPMENT MANAGEMENT
Code :	MEML402
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of lectures
1	GENERAL MANAGEMENT: Introduction and characteristics of management, Principle and function of management, Scientific management.	4
2	Materials Management: Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management. Disposal of Surplus Materials	6
3	Earth Moving Equipment Crawler and wheel tractors their functions, types an specifications; Gradability Bull dozers and their use; tractor pulled scrapers, their sizes and output; effect of grade an rolling resistance on the output of tractor pulled scrapers Earth loaders; Placing and compacting earth fills. Power shovels-functions, selection, sizes, shovel dimension and clearances, output, Draglinesfunctions, types sizes, outputclamshells;Safe lifting capacities and working ranges cranes; Hoes, Trenching machine types and production rate calculation of producing rates of equipment.	10
4	Hauling Equipment : Trucks; Bottom dump wagons;capacities of trucks and wagons Balancing the capacities of hauling units with the size excavator; effect of grade, rolling resistance and altitude on the cost/performance of hauling equipment; balancing excavating hauling equipment examples.	8
5	Drilling, Blasting and Tunneling Equipment : Definition of terms, bits, Jackhammers, Drifters, wagon drills, che drills, piston drills, blast hole drills, shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; selecting drilling pattern; Rates for drilling rock, compressors.	8
6	Pile Driving Equipment : Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.	4

Sr No	References
1	Construction equipment and its planning and application Dr. Mahesh Verma.
2	Heavy construction planning equipment and methods -Jagman Singh Oxford and IBH.
3	Construction Planning equipement and Methods by RL Peuripo Tata McGraw Hill.
4	Mangement Machines and Methods in Civil Engineering-John,Christan, John Wiley and Sons
5	Rock Engineering-Ry John A Franklin and Maurice B Dusseault, Tata McGraw Hill.

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6	Modern Construction Equipment and Methods. Frank harris John Wiley and Sons.
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Course Name :	INFRASTRUCTURE DEVELOPMENT AND MANAGEMENT
Course Code :	IDML 402
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Introduction: Impact of Infrastructure development on economic development, standard of living and environment. Reasons for rise of public sector and government in infrastructural activities. Changed socio-economic scenario and current problems and related issues.	8
2	Policies on Infrastructure Development: A historical review of the Government policies on infrastructure. Current public policies on transportations, power and telecom sectors. Plans for infrastructure development. Legal framework for regulating private participation in roads and highways, Ports & Airports, Power and Telecom.	8
3	Construction and Infrastructure: Construction component of various infrastructure sectors. Highway, ports and aviation, oil and gas, power, telecom, railways, irrigation. Current scenario, future needs, investment needed, regulatory framework, government policies and future plans. Technological and methodological demands on construction management in infrastructure development projects	10
4	Infrastructure Management: Importance, scope and role in different sectors of construction. • Highway Sector: Repayment of Funds, Toll Collection Strategy, Shadow tolling, and direct tolls, Maintenance strategy, Review of toll rates & structuring to suit the traffic demand, • Irrigation Projects: Large / Small Dams - Instrumentation, monitoring of water levels, catchments area, rainfall data management, prediction, land irrigation planning & policies, processes Barrages, Canals. • Power Projects: Power scenario in India, Estimated requirement, Generation of Power distribution strategies, national grid, load calculation & factors, Hydropower - day to day operations, management structures, maintenance, Thermal Power, Nuclear Power. • Airports: Requisites of domestic & International airports & cargo & military airports, facilities available, Terminal management, ATC. • Railways: Mass Rapid Transport System MRTS, LRT, Multi-modal Transport System.	12

S. No.	References:
1	Chandra, Prassanna, "Projects, Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw-Hill, New Delhi, 2006.
2	Raghuram, G. & Jain, R., "Infrastructure Development & Financing Towards a Public-Private Partnership", Macmillan India Ltd., New Delhi, 2002.
3	NICMAR, "Construction Business Opportunities in Infrastructure Development in India",

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	NICMAR, Mumbai, 2001.
4	India Infrastructure Report 2001 & 2002, Oxford University Press, New Delhi, 2001/02.
5	Parikh Kirit S., "India Development Report, 1999-2000", Oxford University Press, New Delhi, 2002.
Course Name	PROJECT MANAGEMENT & SYSTEM TECHNIQUES
Code :	PMSL402
Credits :	4
L T P A:	3-1-0-1

Lecture wise break up		No of lectures
1	Project Management Concepts and Needs Identification Attributes of a Project, Project Life Cycle, The Project management Process, Global Project Management, Benefits of Project Management, Needs Identification, Project Selection, Preparing a Request for Proposal, Soliciting Proposals, Project organization, the project as part of the functional organization, pure project organization ,the matrix organization, mixed organizational systems	10
2	Project Planning and Scheduling: Design of project management system; project work system; work breakdown structure, project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ GERT, Resource allocation, Crashing and Resource Sharing	10
3	Project Monitoring and Control Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control,	10
4	Project Performance Performance Indicators; Project Audit; Project Audit Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager.	10

Sr No	References
1	Project Management – Gido / Clements – Cengage
2	Project Management, Meredith Mantel, Wiley
3	Project Management, S.Choudhury, TMH
4	Project Management for Business and Technology – Nicholas – PHI
5	Successful Project Management – Rosenau / Githens – Wile
6	International Project Management, K Kostar, Sag

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Course Name :	QUALITY , SAFETY AND ENVIRONMENT MANAGEMENT
Code	QSEL402
Credits:	04
L T P A:	3-1-0-1

Total No. of Lectures: 40

Lecture Wise Break Up:		No. of Lectures:
1	Introduction To Safety Philosophy: Sequence of Accident Occurrence, Occupational Injuries-Effects of Industrial Accidents, Analysis of Accidents, Injury Data, Accident Investigations & Reporting, Accident Constrigent.	6
2	Safety & Health Management: Employer & Employee Responsibilities, Record-keeping & Reporting Requirements, Safety Organization, Responsibilities of Safety Officer, Supervisors, Safety committees.	6
3	Risk Management: Definitions of Hazards, Risks, Evolution of Methodical Analysis, System safety Analysis techniques, Performance measurement, Operational Reviews - Internal & External.	8
4	Work Practices In Industries: Hazards in Chemical Operations, Material Handling Hazards, Lifting Machinery & Pressure Vessels, Material Safety Data Sheets, Classification of Chemicals, Hazardous Chemicals, Storage Practices, Radiation Safety, Petroleum Storage Requirements, Pesticide Safety.	3
5	Indian Statutes: Central Acts, Factory's Act, AP Factory Rules, Construction Safety Regulations, Petroleum Rules 2002, Electrical Act & Rules. Fire Safety: Basic Elements, Causes, Industrial Fires, Explosions, Effect On Environment, Property & Human Loss, Prevention Techniques, Building Design, Fire Protection Systems, Contingency Plan, Emergency Preparedness, Evacuation.	4
6	Industrial Best Practices: In Electrical, Mechanical, Fire, Machine Guarding, Personal Protective Equipment, Occupational Health, Ergonomics Ambulance, Noise Abatement Methods, Management Of Contractors.	9
7	Occupational Safety & Management Standards: Indian Standards, OHSAS 18001 Standard and its Elements, CE Certificate, Social Accountability Standards, System Implementation, Benefits.	4

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S. No.	References:
1	Industrial safety and health, David L. Goetsch, Macmillan Publishing Company, 1993.
2	Handbook of environmental health and safety, Vol I & II, Herman Kooren, Michael Bisesi, Jaico Publishing House, 1999.

Course Name :	LAB-2
Code :	IDLP402
Credits:	2
L T P A:	0-0-4-0

Course Details:
To work on various softwares such as PRIMAVERA and MS Project etc. Student has to submit a Minor Project report based on the learned software.

M.Tech- Infrastructure Development & Management

Course Name :	CONTRACTS MANAGEMENT
Course Code :	CM01403
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Construction Contracts : a)Standard forms of contracts, methods of inviting tenders, pre-bid meetings, pre-qualification system, scrutiny of tenders and comparative statement. b) Contract formation, conditions of contracts, contracts with various stakeholders on a major construction projects, contract pricing by the client, project management consultants and the contractor, contract performance, contract correspondence and contract closure.	8
2	Construction Claims : Extra items and causes of claims. Types of construction claims, documentation. settlement of claims, extension of time.	5
3	Dispute Resolution: Causes of disputes and importance of role of various stakeholders in prevention of disputes, Alternate Dispute Resolution methods- mediation, conciliation, arbitration and Dispute Resolution Boards.	5
4	Contract Conditions : a)General condition and Particular conditions, conditions of Ministry of Statistics and Program Implementation-Government Of India. Model forms of contract. Role of Planning Commission. b) ICE conditions-Introduction, FIDIC conditions-evolution of FIDIC document, types based on whether design is of employer or contractor, Design & Build contract, EPC contract, short forms of contract- Colour Code. Various conditions of Red Book.	8
5	Indian Contract Act (1872) : a)Definition of the contract as per the ACT. Valid, Voidable, Void contracts, Objectives of the act. b)Clauses 1 to 75- Contract formation, contract performance, valid excuses for nonperformance, Breach of contract, effects of breach- understanding the clauses and applying them to situations/scenarios on construction projects. Importance of the Workmen's Compensation Act on construction projects.	6

S. No.	References:
1	Civil Engineering Contracts and Estimates - B. S. Patil – Universities Press- 2006 Edition, reprinted in 2009.
2	The Indian Contract Act (9 of 1872), 1872- Bare Act- 2006 edition, Professional Book

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	Publishers.
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Course Name :	PRE-THESIS SEMINAR
Code :	IDSL403
Credits:	4
L T P A:	0-0-0-8

Course Details:
Following things to be included in Pre-thesis Seminar: <ol style="list-style-type: none">1. Literature survey.2. Gap Reflection.3. Objectives and Methodology4. Expected Outcomes Synopsis presentation through PPT will be evaluated internally.

M.Tech- Infrastructure Development & Management

Course Name :	PROJECT
Code :	IDPL403
Credits:	10
L T P A:	0-0-0-20

Course Details:

Students are required to work on project in any of the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering).

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

M.Tech- Infrastructure Development & Management

Course Name :	CONSTRUCTION AND MAINTENANCE MANAGEMENT
Code :	CMML 403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of lectures
1	Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control.	6
2	General & Material Management: Introduction and characteristics of management, Principle and function of management, Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management. Disposal of Surplus Materials	8
3	SAFETY IN CONSTRUCTION: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario	6
4	Maintenance Management : Definition, Organization structure, work force for Maintenance, Communication needs, Building inspections, Maintenance budget and estimates, Property inspections and reports, Specification for maintenance jobs, Health and safety in maintenance, Quality in Maintenance, maintenance Manual and their importance.	6
5	Investigation and diagnosis for Repair of structures: Basic Approach to investigations, Physical inspection, Material Tests, Non destructive testing for diagnosis, Estimation of actual, loads and environmental effects, Study of design and construction practices used in original construction, Retrospective analysis, and Confirmation and repair steps.	8
6	Building Defects and Remedial Measures : 6.1 Nature, types of problems, their causes, remedial measures and special treatment for building elements. –Foundation, - Basements – D.P.C. - Walls - Wall finishes – Chimney, stacks and shafts –Columns and beams – Roof and roof terraces – Floor and floor finishes – Joinery work – Decorative/decorative finishes –Services – Materials – Dampness	6

Sr No	References
1	Construction Planning equipment and Methods by RL Peuripo Tata McGraw Hill.
2	Mangement Machines and Methods in Civil Engineering-John,Christan, John Wiley and Sons.

M.Tech- Infrastructure Development & Management

3	Maintenance of Buildings A.C. Panchadari New age international (P) limited Publishers
4	Common Defects in Buildings -H.J.Eidridge, Her Majesty's Stationery Office, London
5	Appraising building defects : Properties on stability and hygro-thermal performances, Geoffrey K.Cook Dr. A John Hinks Longman Scientific & Technical.
6	Maintenace and Repair of Buildings and their internal environment B.D.HUTCHINSON. J.Barton. N.Ellis
7	IVOR H. Seeley, Building Technology Mac Millian

Course Name :	CONSTRUCTION FINANCE MANAGEMENT
Course Code :	CFML403
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Financial Planning: Long term finance planning, Stock, Borrowings, Debentures, Loan Capital, Public Deposit, Dividend Policies, Bonus Shares, Market value of shares, Reserves. Over and under capitalization, Introduction to Micro financing.	6
2	Budget: Budgetary control system. Types of budgets, Procedure for master budgets. Budget manual.	6
3	Corporate Sector: Corporate tax planning, Public policies on ICRA grading of exchange, World financial market, Role of financing institutes in Construction, CIDC-IRA grading of construction entities, Venture Capital Financing- Indian Venture Capital scenario, SEBI regulation.	8
4	Construction Accounts: Accounting process, preparation of profit and loss account and balance sheet as per the companies Act, 1956, preparation of contract accounts for each project, methods of recording and reporting site accounts between project office and head office, Ratio Analysis. Escrow Account for PPP Project.	6
5	Case Studies: Case studies for 1)BOT 2)Dams 3)Mass Transit System 4)Infrastructure Projects 5)Government Funded Projects with respect to a) Project Appraisal b) Raising of funds c) Cost to complete analysis	6

S. No.	References:
1	Construction Management & PWD Accounts --- D Lal, S. K. Kataria & Sons, 2012
2	Principles of Corporate Finance, Brealey R.A. Tata McGraw Hill, New Delhi, 2003.
3	“Financial Management” – Indian Institute of Banking and Finance – Macmillan Publications.

M.Tech- Infrastructure Development & Management

Course Name	JOINT VENTURE AND PRIVATIZATION IN INFRASTRUCTURE PROJECTS
Code	JVPL403
Credits	4
LTP A	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	The joint ventures concept. Motives and kinds of Joint Ventures	8
2	Requirements for Joint Venture project Negotiation and its organization.	8
3	Arrangement between joint venture partners and kinds of agreements for transfer of technology	10
4	Bilateral investment Treaties and legal framework and settlement of Disputes and Indian Law on Intellectual Property. Joint Ventures abroad	12

S. No.	References:
1	NICMAR, “ Joint Venture and Privatisation in Infrastructure Projects ”, NICMAR

M.Tech- Infrastructure Development & Management

Course Name	COMPOSITE MATERIAL
Code :	CMAL403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of lectures
1	Introduction , Historical background, Technological Applications, Composites – various reinforcement and matrix materials, Classification of composites	2
2	High performance concrete: Materials for high performance concrete, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.	6
3	Ferro cement: Constituent materials and their properties, Mechanical properties of Ferro cement, Construction techniques and application of Ferro cement	6
4	Fibre reinforced concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Application of fibre reinforced concrete	8
5	Polymer concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete	6
6	Fly ash concrete: Classification of Indian Fly ashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly ash concretes, Properties of Fly ash concrete in fresh and hardened state, Durability of fly ash concrete	6
7	Light weight concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete	6

Sr No	References
1	Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monterio
2	Ferrocement by B.K. Paul, and R.P. Pama
3	Fibre Reinforced Concrete by Bentur and Mindess
4	Flyash in Concrete by Malhotra and Ramezaniapur
5	Concrete Technology by M.L Gambhir

M.Tech- Infrastructure Development & Management

Course Name :	THESIS
Code :	IDTL404
Credits:	20
L T P A:	0-0-0-40

Course Details:	
1	Thesis in the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering)
2	Thesis will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his thesis work and Viva-voce will be held

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M.Tech -Environmental Science and Engineering

Course Name :	OPERATION RESEARCH AND METHODOLOGY
Subject Code:	ORML401
Credits:	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Introduction to Research: Meaning, Definition, Objective and Process Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design. Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal	10
2	Sources of Data: Primary and Secondary, Validation of Data Data Collection Methods: Questionnaire Designing, Construction Sampling Design & Techniques – Probability Sampling and Non Probability Sampling Scaling Techniques: Meaning & Types Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability Validity: Content Validity, Criterion Related Validity and Construct Validity	8
3	Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA	12
4	Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling Report Writing: Essentials of Report Writing, Report Format	10

S. No.	References:
1	R.I Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi..
2	N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3	Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers
4	Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
5	C.R.Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age Pub.

M.Tech -Environmental Science and Engineering

Course Name :	ENVIRONMENTAL CHEMISTRY
Structures Course:	ECHL401
Credits:	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Concept of Green Chemistry rates of chemical and biochemical reactions with applications in disinfection and biological treatment	6
2	Acid-base reactions and the carbonate system with applications in neutralization and pH control	6
3	Complexation reactions and chelation with applications in chemical coagulation and metals bioavailability	8
4	Precipitation and dissolution phenomena with applications in iron and phosphate removal and carbonate scaling	3
5	Oxidation-reduction reactions with applications in metals removal processes (e.g., hexchrome reduction), biochemical reactions and acid mine drainage	4
6	A survey of organic chemistry and how organic compounds react and behave in the environment, including principles associated with air-water partitioning, solvent-water partitioning, and sorption phenomena with application in air stripping and adsorption	9
7	A survey of environmental laboratory procedures and analytical techniques in environmental chemistry for both inorganic and organic compounds ; the ozone, oxide of nitrogen, and hydrocarbon chemical cycles; chemistry of toxic organic compounds in the atmosphere gas and aqueous phase chemistry of sulfur dioxide; size distributions, lifetimes, origins and formation mechanisms of aerosols; and control of atmospheric.	4

S. No.	References:
1	Environmental ChemistryBook by Colin Baird and Michael Cann
2	Environmental Chemistry: Microscale Laboratory ExperimentsBook by Jorge G. Ibanez, Margarita Hernandez-Esparza, and Mono Mohan Singh
3	Elements of environmental chemistryTextbook by R. A. Hites

M.Tech -Environmental Science and Engineering

Course Name :	SEMINAR
Code :	ESSL401
Credits:	2
L T P A:	0-0-0-4

Course Details:
Seminar will be an independent study on the related topic and will be evaluated internally

M.Tech -Environmental Science and Engineering

Course Name :	LAB-I
Structures Course:	ELIP401
Credits:	02
L T P A:	0-0-4-0

Contents:

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

*Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consist of Applications of Tests and Techniques Mentioned in The Research Methodology UNITS.

Course Name	HYDROLOGY & WATER HARVESTING
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M.Tech -Environmental Science and Engineering

Structures Course:	HWHL401
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Water, Nature & Properties, Water Sources their Management, Ground Water, Movement Nature	10
2	Geological Activity, Streams & Drainage, Depositional Features, Glacier, Ocean, Topography & Circulation Shaping	10
3	Water Harvesting, Canals, Barrage & Dams, Environmental Impacts & Economics, Rain Water Management, Rain Water Harvesting Techniques	10
4	Atmospheric Water, Water Estates & Heat, Cloud, Foe, Thunder Storms, Orographic Precipitation, Global Balances of Energy & Water, Pollution Dome & Plume	10

S. No.	References:
1	Hydrology and Water Resources Engineering , K.C Patra
2	Elements of Water Resources Engineering , K.N. Duggal
3	Irrigation and Water Resources Engineering , G.L Asawa
4	Modern Hydrology and Sustainable Water Development , S.K Gupta

M.Tech -Environmental Science and Engineering

Course Name :	DISASTER MANAGEMENT	
Structures Course:	DIML401	
Credits:	04	
L T P A:	3-1-0-1	
Lecture Wise Break Up:		No. of Lectures:
1	<p>Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.</p> <p>Disaster Mitigation and Preparedness: Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought. Man-made hazards: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.</p>	14
2	<p>Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.</p> <p>Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.</p> <p>Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.</p>	12
3	<p>Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.</p> <p>Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.</p> <p>Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.</p>	13

S. No.	References:
1	Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
2	Disaster Management, R.B. Singh (Ed), Rawat Publications
3	Disaster Management –Future Challenges & Opportunities by Jagbir Singh

M.Tech -Environmental Science and Engineering

Course Name :	PHYSICS OF ENVIRONMENT
Course Code :	POEL-402
Credits:	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Radiation Science:Radiation spectrum (ionizing & non ionizing radiation), Laws of radioactive disintegration, Interaction of nuclear radiation with matter (qualitative discussion only), Dosimetry and effects of radiations,	5
2	Radiation detectors (GM counter, Ionization counter, Proportional counter and Scintillation counter), Radioactive waste management.	6
3	Atmospheric Physics :Basic structure of atmosphere, Stefan Law, Wien's displacement law, Planck's Temperature, Earth's radiation budget, Atmospheric photosensitivity	8
4	Fundamental forces and apparent forces, mass, momentum and energy conservation, Hydrostatic equilibrium.	8
5	Adiabatic lapse rates and stability, Geostrophic balance, Planetary atmospheres.	3
6	Climate Physics :Green-house effect, Feedback mechanisms, Ozone layer depletion and Global warming	5
7	Aerosols & Cloud formation, Precipitation, Ice age, Climate effects of ocean (Convection, Thermal Inertia & Ocean circulation), Remote sensin	5

S. No.	References:
1	Nuclear Physics, D.C. Tayal, Himalaya Pub. House
2	Physical Geography, Strahler & Strahler, J. Wiley Pub.
3	Introduction to Health Physics, H. Cember, McGraw-Hill
4	Mid-Latitude Atmospheric Dynamics, J. E. martin, J. Wiley Pub.

M.Tech -Environmental Science and Engineering

Course Name :	AIR POLLUTION AND CONTROL
Course Code :	APCL 402
Credits:	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Air pollutants – Sources and classification of pollutants and their effect on human health, vegetation and property- Effects - Reactions of pollutants and their effects-Smoke, smog and ozone layer disturbance - Greenhouse effect – Ambient and stack sampling.	4
2	Atmospheric Phenomena - Dynamism of atmosphere, Energy balance of atmosphere, Meteorological aspects, Wind and wind roses, Environmental and adiabatic lapse rates, Derivations of DALR, WALR and ELR, Atmospheric stability, Factors influencing stability, Temperature inversions, Mixing height.	5
3	Atmospheric diffusion of pollutants: Transport, transformation and deposition of air	6
4	Contaminants - Air sampling & pollution measurement methods - Ambient air quality, and emission standards, Modelling- Gaussian model and equation, Air quality index.	5
5	Particulate emission control: Settling chambers, cyclone separation, Wet collectors, fabric filters, and electrostatic precipitators.	5
6	Control of gaseous pollutants: Removal of gaseous pollutants by adsorption, absorption, reaction and other methods.	4
7	Biological air pollution control technologies: Bio-scrubbers, bio-filters, and Indoor air quality.	5

S. No.	References:
1	Wark Kenneth and Warner C.F, Air pollution its origin and control. Harper and Row Publishers,
2	Rao C.S., Environmental Pollution Control Engineering, New age international Ltd, New Delhi.
3	Perkins, H.C., Air Pollution, McGraw-Hill (2004).
4	Rao M.N. and Rao H.V.N., Air Pollution, Tata McGraw-Hill (2006).

M.Tech -Environmental Science and Engineering

Course Name :	INDUSTRIAL AND HAZARDOUS WASTE MANAGEMENT
Course Code :	IHWL 402
Credits:	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Hazardous Waste Treatment and Disposal: Biological and chemical treatment of hazardous wastes; Solidification and stabilization of wastes; Incineration for the treatment and disposal of hazardous wastes; Land farming; Landfill disposal of hazardous waste; Bioremediation of hazardous waste disposal sites. Sanitary Landfills: Site selection and approval; design, development, operation and closure of landfills, Management of leachate and landfill gases, environmental monitoring of landfill sites.	8
2	Legal Requirements: Municipal solid waste rules; Hazardous waste rules; Biomedical waste rules; E-waste rules; Rules related to recycled plastics, used batteries, flyash, etc.	8
3	Sources and types of industrial wastewater: Environmental impacts, Regulatory requirements, generation rates, characterization, Toxicity and Bioassay tests. Prevention vs Control of Industrial Pollution, Source reduction techniques, Waste Audit Evaluation of pollution prevention options.	5
4	Waste minimization – Equalization, Neutralization, Oil separation, Flotation, Precipitation, Heavy metal Removal, adsorption, Aerobic and anaerobic biological treatment, Sequencing batch reactors, High Rate reactors, Chemical oxidation, Ozonation, Photocatalysis, Wet Air Oxidation, Evaporation, Ion Exchange, Membrane Technologies, Nutrient removal	7
5	Individual and Common Effluent Treatment Plants – Zero effluent discharge systems Wastewater reuse – Disposal of effluent on land – Quantification, characteristics and disposal of Sludge.	4
6	Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles, Tanneries, Pulp and paper, metal, finishing, Petrochemical, pharmaceuticals, Sugar and Distilleries, Food Processing, fertilizers, Thermal Power Plants and Industrial Estates, ISO 14000:2003 Waste Audit.	6

S. No.	References:
1	“Environmental Engg.” By Howard S. Peavy, Donald R. Rowe & George Tehobanoglous, McGraw Hill, International Edition
2	Arceivala, S. J. and Asolekar, S. R., Wastewater Treatment for Pollution Control, 3rd ed., McGraw-Hill Education (India) Pvt. Ltd.
3	Eckenfelder, W.W., Industrial Water Pollution Control, McGraw Hill
4	Frank Woodard, Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi
5	Industrial Pollution Prevention Handbook, Freeman H.M., McGraw Hill Inc.

M.Tech -Environmental Science and Engineering

Course Name :	UNIT PROCESS OPERATION-1
Structures Course:	UPOL402
Credits:	4
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Water Quality: Physical, chemical and biological parameters of water- Water Quality requirement - Potable water standards -Wastewater Effluent standards -Water quality indices.	7
2	Water purification systems in natural systems: Physical processes- chemical processes and biological processes-Primary, Secondary and Tertiary treatment-Unit operations-unit processes.	7
3	Sedimentation: Types, Aeration and gas transfer, Coagulation and flocculation, coagulation processes - stability of colloids - destabilization of colloids transport of colloidal particles, Clariflocculation.	7
4	Filtration : theory of granular media filtration; Classification of filters; slow sand filter and rapid sand filter; mechanism of filtration; modes of operation and operational problems; negative head and air binding; dual and multimedia filtration, pressure filters, principle of working and design.	8
5	Theory of disinfection: Factors affecting disinfection, Disinfection - chlorine dioxide; chloramines; ozonation; UV radiation.	6
6	Miscellaneous methods: Ion Exchange-processes, Application of Membrane Processes, Reverse Osmosis, Micro-filtration, Nano- filtration, Ultra filtration and Electrodialysis.	5

S. No.	References:
1	Weber, W.J., Physicochemical processes for water quality control, John Wiley and sons, Newyork, 1983.
2	Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York 1985
3	Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGrawHill Publication, New Delhi, 2003

M.Tech -Environmental Science and Engineering

Course Name :	Lab-2
Code :	EL2P402
Credits:	4
L T P A:	0-0-4-0

Course Details:
Determination of chlorine demand, break-point chlorination and free residual chlorine
Estimation of Na and K in water
Determination of Nitrate-nitrogen of nitrate nitrogen
Determination of iron in given sample of water
Determination of the Optimum Alum Dose for a given sample of water through Jar Test.
Estimation of fecal coliform (total coliform) from drinking water sample and sewage sample.
Design of water and sewage treatment plant
Determination of BOD
Determination of COD

M.Tech -Environmental Science and Engineering

Course Name :	UNIT PROCESS OPERATION-2
Structures Course:	UPOL403
Credits:	4
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Principles: Objectives of biological treatment - significance - aerobic and anaerobic treatment kinetics of biological growth - factors affecting growth - attached and suspended growth. Determination of kinetic coefficients for organics removal - Biodegradability assessment – selection of process – reactors – batch - continuous type - kinetics.	7
2	Waste Water Characteristics: Physical, Chemical, Biological characteristics of waste water, sampling, flow measurement.	7
3	Physical and Chemical Treatment of Waste Water: Screening, Grit removal, Flow equalization, Chemical precipitation, other solids removal operations. Disinfection with Chlorine compound, Aeration, Control of odour, Control of volatile organic compounds.	7
4	Aerobic Treatment of Waste Water: Design and construction aspects and the relevant parameters of significance of the following units. Activated Sludge Process, Trickling Filters, Aerated Lagoons, Rotating Biological Contactors, Sequential Batch Reactors (SBR) and Stabilization pond.	8
5	Anaerobic Treatment of Waste Water: Sludge digestion theory and principles, Septic tank design and Effluent disposal. Disposal of digested sludge, Anaerobic ponds, UASB reactors and various modifications in UASB process and anaerobic filters.	6

S. No.	References:
1	Arceivala S. J. Wastewater Treatment for Pollution Control, TMH, New Delhi, Second Edition, 2000.
2	Qasim S. R. Wastewater Treatment Plant, Planning, Design & Operation, Technomic Publications, New York, 1994.
3	Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGrawHill Publication, New Delhi, 2003
4	Water & Waste Water Engineering by Fair and Gayer.

M.Tech -Environmental Science and Engineering

Course Name :	Pre-thesis Seminar
Code :	ESSL403
Credits:	4
L T P A:	0-0-0-8

Course Details:
Following things to be included in Pre-thesis Seminar: Literature survey. Gap Reflection. Objectives and Methodology Expected Outcomes Synopsis presentation through PPT will be evaluated internally.

M.Tech -Environmental Science and Engineering

Course Name :	Project
Code :	ESPL403
Credits:	10
L T P A:	0-0-0-20

Course Details:

Students are required to work on project in any of the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering).

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

M.Tech -Environmental Science and Engineering

Course Name :	CONSTRUCTION AND MAINTENANCE MANAGEMENT
Code :	CMML 403
Credits :	04
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures
1	Construction Planning: Need of construction planning, Constructional Resources, construction team, stages in construction, preparation of construction schedule, Job layout, inspection and quality control.	6
2	General & Material Management: Introduction and characteristics of management, Principle and function of management, Scope, Objective and functions of material management, Procurement and store management, Materials handling management, Inventory control and management. Disposal of Surplus Materials	8
3	SAFETY IN CONSTRUCTION: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario	6
4	Maintenance Management : Definition, Organization structure, work force for Maintenance, Communication needs, Building inspections, Maintenance budget and estimates, Property inspections and reports, Specification for maintenance jobs, Health and safety in maintenance, Quality in Maintenance, maintenance Manual and their importance.	6
5	Investigation and diagnosis for Repair of structures: Basic Approach to investigations, Physical inspection, Material Tests, Non destructive testing for diagnosis, Estimation of actual, loads and environmental effects, Study of design and construction practices used in original construction, Retrospective analysis, and Confirmation and repair steps.	8
6	Building Defects and Remedial Measures : 6.1 Nature, types of problems, their causes, remedial measures and special treatment for building elements. –Foundation, - Basements – D.P.C. - Walls - Wall finishes – Chimney, stacks and shafts –Columns and beams – Roof and roof terraces – Floor and floor finishes – Joinery work – Decorative/decorative finishes –Services – Materials – Dampness	6

Sr No	References
1	Construction Planning equipment and Methods by RL Peuripo Tata McGraw Hill.
2	Mangement Machines and Methods in Civil Engineering-John,Christan, John Wiley and Sons.
3	Maintenance of Buildings A.C. Panchadari New age international (P) limited Publishers
4	Common Defects in Buildings -H.J.Eidridge, Her Majesty's Stationery Office, London
5	Appraising building defects : Properties on stability and hygro-thermal performances, Geoffrey K.Cook Dr. A John Hinks Longman Scientific & Technical.
6	Maintenace and Repair of Buildings and their internal environment B.D.HUTCHINSON.

M.Tech -Environmental Science and Engineering

	J.Barton. N.Ellis
7	IVOR H. Seeley, Building Technology Mac Millian

Course Name :	ENERGY THROUGH WATER UTILIZATION
Code	EWUL403
Credits:	04
L T P A:	3-1-0-1

Lecture Wise Break Up:		No. of Lectures:
1	Bioenergy, Future Supply in Developing Countries, Energy Planning, Energy Technologies and Development.	6
2	Observations on Producer Gas Development with Particular Reference to Thailand.	6
3	Biomass Utilization in India, Stoves and Kilns, A Study of Ethanol Production in Kenya.	8
4	The Economics of Bioenergy in Developing Countries, Aforestation and Public Participation.	3
5	Bioenergy Research and Development in Developing countries. Energy by Rice Husk utilization	4
6	Energy Conversion Considerations, Burning in a Controlled Atmosphere, Destructive Distillation, Pyrolysis, Gasification – Producer Gas, Other Chemicals.	9
7	Thermo chemical and Biochemical Processes, Physical and Chemical Characteristics of Rice Husk, Use of Rice Husk as Fuel, Processes Using Husk as an Energy Source, Equipment and Machinery to Convert Rice-Husk to Energy and for other related Functions.	4

S. No.	References:
1	Energy Conservation Through Effective Energy Utilization: Jesse C. Denton, Stephen Webber, John E. Moriarty - 1976
2	Handbook of Water and Energy Management in Food Processing : Jiri Klemes, Robin Smith, Jin-Kuk Kim - 2008
3	Renewable Energy in the Middle East: Michael Mason, Amit Mor - 2009

M.Tech -Environmental Science and Engineering

Course Name :	Environment Standards and Laws
Structures Course:	ESLL403
Credits:	4
L T P A:	3-1-0-1

Lecture wise break up		No of Lectures :
1	Introduction : Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration – Environmental Protection Act, Water (P&CP) Act, Air (P&CP) Act – Institutional framework (SPCB/CPCB/MOEF)	7
2	Water (P & Cp) Act, 1974: Power & functions of regulatory agencies - responsibilities of Occupier, Provision relating to prevention and control, Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.	7
3	Air (P & Cp) Act, 1981: Power & functions of regulatory agencies - responsibilities of Occupier, Provision relating to prevention and control, Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.	7
4	Environment (Protection) Act 1986: Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorization – Biomedical waste rules –	10
5	Fundamentals of Environmental Management and ISO 14000 series: Background and development of ISO 14000 series. Environmental management Plans, principles and elements. The ISO 14001- Environmental management systems standard. Environmental law in India: Environmental policy and laws.	9

S. No.	References:
1	CPCB, “Pollution Control acts, Rules and Notifications issued there under “Pollution Control Series – PCL/
2	Pares Distn. Environmental Laws in India (Deep, Lated edn.)
3	Central Pollution Control Board, Delhi, 1997. 2. Shyam Divan and Armin Roseneranz “Environmental law and policy in India “Oxford University Press, New Delhi, 2001.
4	Handbook of environmental management and technology: Gwendolyn Holmes, Ben

Course	Composite Materials
Code:	CMPMP201
Credits:	4
L T P A:	Ramhari Singh, Louis Theodore.

Lecture wise break up		No of Lectures
1	Introduction , Historical background, Technological Applications, Composites – various reinforcement and matrix materials, Classification of composites	2
2	High performance concrete: Materials for high performance concrete, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.	6
3	Ferro cement: Constituent materials and their properties, Mechanical properties of Ferro cement, Construction techniques and application of Ferro cement	6
4	Fibre reinforced concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Application of fibre reinforced concrete	8
5	Polymer concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete	6
6	Fly ash concrete: Classification of Indian Fly ashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly ash concretes, Properties of Fly ash concrete in fresh and hardened state, Durability of fly ash concrete	6
7	Light weight concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete	6

Sr No	References
1	Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monterio
2	Ferrocement by B.K. Paul, and R.P. Pama
3	Fibre Reinforced Concrete by Bentur and Mindess
4	Flyash in Concrete by Malhotra and Ramezaniapour
5	Concrete Technology by M.L Gambhir

M.Tech -Environmental Science and Engineering

Course Name :	Thesis
Code :	ESTL404
Credits:	20
L T P A:	0-0-0-40

Course Details:	
1	Thesis in the specified Area (Transportation and Highway Engineering/Structural Engineering/ Infrastructure development and Management and Environmental Engineering)
2	Thesis will be evaluated by the external examiner and the internal guide. The candidate is required to make presentation of his thesis work and Viva-voce will be held

