Course Structure

for Degree Program

M. Tech. in Civil Engineering

with Specialization in

Infrastructure Engineering and Management

In line with National Education Policy 2020
(Effective from AY 2024-25)

Dr. Babasaheb Ambedkar Technological University

Lonere 402 103, Dist- Raigad, Maharashtra, INDIA

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Course Structure, Guidelines, Rules and Regulations

Preamble

Economic advancement of a country is closely tied to the quality of technical education it offers. Engineering education is reaching new heights and plays a significant role in the overall education system. The preparation of engineering graduates should focus on enhancing their employability and sustainability in response to evolving industry and societal needs. As technology advances and expectations change rapidly, updating the curriculum to be contemporary and relevant is imperative.

In order to align our technical education system with global standards and practices, based on performance and assessment system was implemented earlier for all Undergraduate Programs (UG). Now as per National

Education Policy-2020 framework we are incorporating project-based learning. The realm of engineering and technology, characterized by its interdisciplinary nature, demands the synthesis of knowledge from a wide array of domains including humanities, arts, and advanced technologies. However, what distinguishes technologists is their proficiency in design and their ability to adeptly apply this knowledge across diverse disciplines to achieve effective problem solving.

In response to these needs, aspiring engineers need thorough preparation and a deep understanding of the latest technological trends and industrial requirements. This calls for studying under a modern and adaptable curriculum that mirrors the global environment. As part of this initiative, there is a push to integrate recent advancements and enrich course content with pertinent and up-to-date subjects. Consequently, a revised structure and curriculum will debut from the academic year 2023-24 for First Year Civil Engineering, with intentions to progressively implement these updates across second, third- and fourth-year engineering programs.

Project-based learning has been introduced alongside traditional classroom teaching and laboratory-based learning to enhance the overall learning experience. The objective is to encourage students to learn collaboratively in groups of 3 to 4, focusing on solving meaningful problems. These problems can be theoretical, practical, social, technical, symbolic, cultural, or scientific, arising from students' curiosity across various disciplines and professional contexts. The selected problems should be exemplary and may require an interdisciplinary approach for both analysis and resolution. This approach aims to develop students' capacity for learning through shared cognition.

- Laboratory Course:

This is focused on completing experiments and assignments related to the courses of the Semester.

- Seminar: This aspect will revolve around state-of-the-art topics selected by students and approved by the authority. Students are required to submit a certified seminar report in a standard format, evaluated by their assigned guide and the department/institute head for satisfactory completion of the work.
- Project Work in Final Year: Project work in the seventh Semester is integral to the curriculum. It involves applying knowledge gained throughout the graduation program, ideally addressing societal needs. The project provides an opportunity for students to design and construct complete systems or subsystems, specializing in areas of their interest. Students must prepare a certified final project report in standard format, evaluated by their guide and the department/institute head for satisfactory completion of the work.
- Internship: Internships are crucial for educational and career development, offering practical experience in field of discipline. It plays a significant role as employers seek well-trained employees. The primary objective is to expose technical students to real-world industrial environments, providing insights into the social, economic, and administrative factors influencing organizational operations. Students may choose internships in industries, government agencies, NGOs, MSMEs, rural settings, innovation hubs, intellectual property rights (IPR), or entrepreneurship initiatives. They can opt to focus on innovation, leading to start-up's, or gain experience in industry/NGO/government/MSME settings to prepare for professional roles. The conduction, monitoring, assessment, and evaluation of internships follow guidelines provided by AICTE.

Definition of Credit **

1 Hour Lecture (L) per week	1 credit for 1 Hour
Tutorial (T) per week	1 credit for 1 Hour
Practical(P) per week 2 Hours Practical (Lab)/week	1 credit for 2 Hours

** The head of Tutorial and Practical (as a special case) may be merged for common credit with the permission of authority.

Rule No. 1: Eligibility for Admission

Eligibility Criteria

Students seeking admission to the first year of the Bachelor's degree course in Engineering and Technology must fulfil the eligibility criteria as laid down from time to time by the following authorities:

- **Dr. Babasaheb Ambedkar Technological University (DBATU)**
- **Government of Maharashtra**
- **All India Council for Technical Education (AICTE)**

Rule No. 2: Scheme of Assessment

Eligibility for the Degree of Master of Technology

To be eligible for the degree of Master of Technology, a candidate must:

1. **Appearing for Examinations**:
    - A candidate is required to appear for all prescribed examinations during the course of study. This includes theory exams, practical exams, term-work assessments, project evaluations, and any other form of examination as specified in the syllabus.
2. **Passing of Examinations**:
    - A candidate must pass all the prescribed examinations. The passing criteria, including minimum marks required in theory, practical, term-work, and other components, will be as per the rules laid down by the university.

Components of Assessment

The scheme of assessment typically includes the following components:

1. **Theory Examinations**:
    - Conducted at the end of each Semester.
    - Assess the theoretical understanding of the subjects.
2. **Practical Examinations**:
    - Conducted to assess the practical skills and application of knowledge.
    - Includes laboratory work, experiments, and practical assignments.
3. **Term-Work Assessments**:
    - Continuous assessment of assignments, tutorials, and project work throughout the Semester.
    - Includes the evaluation of written assignments, presentations, and project reports.
4. **Project Work**:
    - Assessment of project-based learning and final year projects.
    - Includes continuous assessment by the faculty and final evaluation through project reports, presentations, and viva-voce.
5. **Internal Continuous Assessment**:
    - Regular assessments conducted throughout the Semester.
    - Includes quizzes, class tests, mid-term exams, and participation in class activities.

Program Objectives

Goal of the Civil engineering with a specialization in Infrastructure Engineering and Management (IEM) at Dr. Babasaheb Ambedkar technological University, Lonere (BATU) is to provide students with preparation to become worthy of professional careers in the field and to be motivated for lifelong learning. All prescribed courses have definite objectives and outcomes. Program objectives are expected qualities of engineers as under:

a) Preparation: To prepare students to excel in various educational program or to succeed in industry / technical profession through further education/training;

b) Core Competence: To provide students with a solid foundation in mathematical, scientific fundamentals required to solve E&T related problems;

c) Breadth: To train students with a breadth of scientific knowledge to comprehend, analyze, design & create novel products and solutions for real life problems;

d) Professionalism: To inculcate in students professional/ethical attitude, effective team work skills, multidisciplinary approach and to relate engineering issues to a broader context;

e) Learning Environment: To provide students with academic environment of excellence, leadership, ethical guidelines and life-long learning needed for a long / productive career.

In addition to above DBATU graduate is expected to be

1. Taking pride in their profession and have commitment to highest standards of ethical practices,
2. Able to design structural system that is safe, economical and efficient.
3. Capable of using modern tools efficiently in all aspects of professional practices.
4. Dealing successfully with real life civil engineering problems and achieve practical solutions based on a sound science and engineering knowledge.
5. Shall represent the highest standards of Structural engineering and related technical disciplines.
6. Shall be engage in continuous research, development and exchange of knowledge for professional development.
7. Be honest in their control and performing their duties and promote effective use of resources through open, honest and impartial services to the public.
8. Act in such a manner which will uphold the honour, integrity, or dignity of the engineering profession, and avoid knowingly engaging in business or professional practices of a fraudulent, dishonest or unethical nature.
9. Recognize that the lives, safety, health and welfare of the general public are dependent upon engineering, decision and practices.
10. Continue their professional development throughout their careers and provide opportunities for the professional development.

Table A: Credit Structure for PG program in Engineering

Course Category	Provided
Program Core Course (PCC)	15
Program Elective Course (PEC)	12
Experiential Learning Courses (ELC)	42
Humanities Social Science and Management (HSSM-IKS/VEC/AEC)	5
Open Elective (OE) Other than a particular program	3
Multidisciplinary Minor Courses	6
TOTAL	**83**

Teaching & Evaluation Scheme for M. Tech. in Civil Engineering with Specialization in Infrastructure Engineering and Management

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester- I										
1	MCVIEMPCT 101	Infrastructure Planning	3	--	--	20	20	60	100	3
2	MCVIEMPCT 102	Life Cycle Cost Analysis of Infrastructure	3	--	--	20	20	60	100	3
3	MCVIEMPCT 103	Construction Management Practices	3	--	--	20	20	60	100	3
4	MCVIEMPET 104	Program Elective-I	3	--	--	20	20	60	100	3
5	MCVIEMPET 105	Program Elective-II	3	--	--	20	20	60	100	3
6	MCVIEMELL 106	PG Lab-I	--	--	4	25	--	25	50	2
7	MCVIEMHMP 107	Communication Skills	2	--	--	25	--	25	50	2
8	MCVIEMAUP 108	YOGA for Stress Management	--	--	2	AU	--	--	--	AU
		Total	**17**	**00**	**06**	**150**	**100**	**350**	**600**	**19**
Semester- II										
1	MCVIEMPCT 201	Construction Equipment Management	3	--	--	20	20	60	100	3
2	MCVIEMPCT 202	Infrastructure Development	3	--	--	20	20	60	100	3
3	MCVIEMPET 203	Program Elective -III	3	--	--	20	20	60	100	3
4	MCVIEMPET 204	Program Elective-IV	3	--	--	20	20	60	100	3
5	MCVIEMPET 205	Open Elective-V	3	--	--	20	20	60	100	3
6	MCVIEMELP 206	PG Lab-II	--	--	4	25	--	25	50	2
7	MCVIEMELP 207	Mini -Project	--	--	4	25	--	25	50	2
8	MCVIEMHMP 208	Indian Knowledge System	2	--	--	20	20	60	100	2
		Total	**17**	**00**	**08**	**170**	**170**	**410**	**750**	**21**

Type of course:

Program Core: **PC**	Program Elective: **PE**
Open Elective: **OE** (Other than particular program)	Ability Enhancement Course: **AE**
Modern Indian Language: **MIL**	Humanities, Management, language and Commerce: **HM**
Experiential Learning Courses: **EL**	Multidisciplinary Minor Courses: **MD**
ABBRIVATIONS: **ISE**-INSEMESTER EVALUATION, **MSE**-MID SEMESTER EVLUATION, **ESE** -END SEMESTER EVALUATION	

Teaching & Evaluation Scheme for M. Tech. in Civil Engineering with Specialization in Infrastructure Engineering and Management

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester-III										
1	MCVIEMMDP 301	MOOC/SWAYAM/ NPTEL PLATFORM COURSES/Self Study. (It is desirable to choose one course from each of PE,OE &AE)	3	--	--	20	20	60	100	3
2	MCVIEMMDP 302		3	--	--	20	20	60	100	3
3	MCVIEMHMP 303		3	--	--	20	20	60	100	3
4	MCVIEMELP 304	Seminar-I	--	--	4	25	--	25	50	2
5	MCVIEMELP 305	Dissertation Stage -I	--	--	20	50	--	50	100	10
		TOTAL	**9**	**--**	**24**	**135**	**60**	**255**	**450**	**21**
Semester-IV										
1	MCVIEMELP 401	Dissertation Stage-II	--	--	40	100	--	100	200	20
		TOTAL	**--**	**--**	**40**	**100**	**--**	**100**	**200**	**20**

Internship
Students can take Industry Internship along with Dissertation Stage –I. Students must maintain regular reporting with Dissertation supervisor regarding status of Dissertation **Dissertation Stage I and Synopsis Approval Presentation:** It is a course requirement under the guidance of faculty Supervisor. PG student from second year is required to do innovative and research oriented applied work related to various theory and laboratory courses. Dissertation work may cover analytical formulation, experimentation or survey based project or combination of these. Student are encouraged to undertake an interdisciplinary type project.

Sr.No.	Multidisciplinary Minor Courses
A	MOOC/SWAYAM/ NPTEL -Project Management and Intellectual Property Rights (Self Study) Student may select this course either from MOOC/SWAYAM/ NPTEL pool or any other approved reputed source. The submission of course completion certificate is mandatory. **MCVENEMDT301/302,MCVENEHMT 303 -** Institute has to take care of registration of subjects with detailed syllabus in first two weeks of beginning of the semester with exam department of DABATU.

Sr.No.	Program Elective-I	Program Elective-II
A	Building Environment and Services	Highway Infrastructure
B	Ports and Harbor Structures	Contracts, Administration and Arbitration
C		Operation Research

Sr.No.	Program Elective-III	Program Elective-IV	Open Elective
A	Environment & Energy Management	Resource Management	Safety Management in Construction
B	Value Engineering and Valuation	Urban Hydrology and Storm Water Management	Research Methodology

Sr.No.	Multidisciplinary Minor	Indian Knowledge System
A	MOOC/SWAYAM/ NPTEL	Concepts and Applications in Engineering
B	Project Management and Intellectual Property Rights (Self Study)	Humanities and Social Sciences

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			L	T	P	ISE	MSE	ESE	Total	
Semester- I										
1	MCVIEMPCT 101	Infrastructure Planning	3	--	--	20	20	60	100	3
2	MCVIEMPCT 102	Life Cycle Cost Analysis of Infrastructure	3	--	--	20	20	60	100	3
3	MCVIEMPCT 103	Construction Management Practices	3	--	--	20	20	60	100	3
4	MCVIEMPET 104	Program Elective-I	3	--	--	20	20	60	100	3
5	MCVIEMPET 105	Program Elective-II	3	--	--	20	20	60	100	3
6	MCVIEMELL 106	PG Lab-I	--	--	4	25	--	25	50	2
7	MCVIEMHMP 107	Communication Skills	2	--	--	25	--	25	50	2
8	MCVIEMAUP 108	YOGA for Stress Management	--	--	2	AU	--	--	--	AU
		Total	**17**	**00**	**06**	**150**	**100**	**350**	**600**	**19**

Type of course:

Program Core: **PC**	Program Elective: **PE**
Open Elective: **OE** (Other than particular program)	Ability Enhancement Course: **AE**
Modern Indian Language: **MIL**	Humanities, Management, language and Commerce: **HM**
Experiential Learning Courses: **EL**	Multidisciplinary Minor Courses: **MD**
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SUBJECT CODE	Infrastructure Planning						CREDITS
MCVIEMPCT 101							3
Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To understand the fundamental concepts and components of infrastructure and its role in economic and social development.
CO2	To explore infrastructure planning, budgeting, and regulatory frameworks, including procurement strategies and project appraisal.
CO3	To develop skills in financial management related to infrastructure projects, including cost estimation, cash flow, and risk analysis.
CO4	To analyze economic evaluation techniques for public infrastructure projects, emphasizing cost-benefit analysis, NPV, and IRR.

Course Outcomes: Students will be able to	
CO1	Define and classify various infrastructure sectors, understanding their characteristics and development trends in India.
CO2	Formulate and appraise infrastructure project plans, considering budgeting, scheduling, and regulatory requirements.
CO3	Apply financial management concepts, including cash flow estimation, cost of capital, and risk analysis, in evaluating infrastructure projects.
CO4	Evaluate infrastructure projects economically using methods like net present value, benefit-cost ratio, and shadow pricing, accounting for risk and uncertainty.

Course Contents

Module 1	**Infrastructure**	**Hrs. 8**
Definitions of infrastructure, Governing Features, Infrastructure organizations & Systems, Overview of Infrastructure development in India - Power Sector, Water Supply and Sanitation Sector, Transportation, Urban and Rural		
Module 2	**Infrastructure Planning**	**Hrs. 8**
Planning and appraisal of major infrastructure projects, Infrastructure Project budgeting and funding, Regulatory Framework, Sources of Funding, Procurement strategies, Scheduling and management of planning activities, Screening of project ideas		
Module 3	**Financial management**	**Hrs. 6**
Inflation - depreciation, taxes, Personnel cost, Equipment costs, overheads. Time value of money, Investment criteria, Project cash flows – elements and basic principles of estimation, Financial estimates and projections, Cost of capital, Rate of return, Project risk analysis, Life cycle analysis		
Module 4	**Challenges**	**Hrs. 6**
Challenges in Construction and Maintenance of Infrastructure, Multi-criteria analysis for comparison of		

infrastructure alternatives, Political and social perspectives of infrastructure planning, Procurement strategies, Efficient use of resources, Mapping and Facing the Landscape of Risks in Infrastructure Projects		
Module 5	**Economic Analysis and Evaluation Techniques**	**Hrs. 8**
Concepts and Applications, Principles of methodologies for economic analysis of public works, Social welfare function, indifference curves and tradeoffs, Demand curves and price elasticity's. Net present value method, Benefit-cost ratio and internal rate of return, Shadow pricing; Accounting for risk and uncertainty		

Reference Books:	
1	S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
2	J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
3	P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
4	J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, New York, 1996.
5	S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
6	J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
7	L. Squire and H. G.van der Tak, Economic analysis of projects, John Hopkins University Press, London, 1975.
8	T. J. Webster, Managerial economics: Theory and practices, Elsevier, New Delhi, 2003.

SUBJECT CODE	Life Cycle Cost Analysis of Infrastructure	CREDITS
MCVIEMPCT 102		3

Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To introduce the fundamentals and applications of Life Cycle Costing (LCC) in infrastructure and asset management.
CO2	To equip students with skills for collecting and analyzing relevant data for LCC, including discounting, inflation, and modeling.
CO3	To develop cost estimation techniques that account for initial, operational, and replacement costs over the asset's life cycle.
CO4	To provide knowledge on advanced LCC evaluation methods, including sensitivity analysis, risk assessment, and implementation strategies.

Course Outcomes: Students will be able to

CO1	Define Life Cycle Costing, understand its objectives, and describe its uses and implementation strategies in economic decision-making.
CO2	Identify and apply appropriate data requirements and parameters for accurate Life Cycle Costing Analysis, including discount rates and inflation.
CO3	Estimate and categorize costs related to investment, operations, maintenance, and replacement for LCC of projects.
CO4	Analyze and implement LCC using various evaluation techniques, assess risks and uncertainties, and understand implementation stages and tools.

Course Contents

Module 1	**Introduction**	**Hrs. 8**
Background, Definition of Life Cycle costing, Uses of Life Cycle costing, Implementation of LCC, Aim and Objectives, Economic Indicators.		
Module 2	**Data requirements**	**Hrs. 8**
Introduction, LCCA Parameters, Discounting-related data, Real Discount Rate, Constant Dollars/INR, Present Value, Salvage Value, Residual Value, Discount Rate, Discount Formula &Discount Factors, Cost and time data – Analysis/Study Period, Rehabilitation Timings, Other data requirements - Discounting & Inflation in LCC Analysis, Mathematical modeling: Introduction, LCC decision rules, Mathematical LCC models.		
Module 3	**Cost Estimates**	**Hrs. 6**
Relevant Effects, Cost Categories, Timing of Cash Flow, Using Base Rate Prices to Estimate Future Cost, Estimating Investment Related Cost, Estimating Operational Costs, Initial Investment Costs, Operations Costs, Maintenance & Repair Costs, Replacement Costs.		
Module 4	**Supplementary Measures**	**Hrs. 6**
LCC Methods, Net Savings, Saving to Investment Ratio (SIR), Adjusted Internal Rate of Return(AIRR), Simple Payback And Discounted Payback, Break even analysis, Benefit cost analysis, Payback period analysis, Present worth analysis, Equivalent annual cost analysis		
Module 5	**Aspects of Implementation and Uncertainty and risk assessment**	**Hrs. 8**
Introduction, Stages of implementation, Logic of implementation, Cost break down structure, WLC software. Introduction, The sensitivity analysis, Deterministic & Probability-based techniques, the fuzzy approach, The integrated approach		

Reference Books:	
1	Ashworth A, Cost studies of buildings, Longman
2	Byrne P, Risk, uncertainty and decision-making in property development, E & F N Spon, London
3	Dale S J, Introduction to life cycle costing, in Bull J W (ed) Life cycle costing for construction, Blackie Academic & Professional, Glasgow.
4	Fabrycky W J and Blanchard B S, Life-cycle cost and economic analysis, Printice-Hall Inc, NJ

5	Flanagan R, Norman G and Furbur D, Life cycle costing for construction, Surveyors Publications
6	Flanagan R, Norman G, Meadows J and Robinson G, Life cycle costing - theory and practice, BSP Professional Books (1989)
7	Kirk S J and Dell'Isola A J, Life cycle costing for design professionals, McGrew-Hill Book Company, New York

SUBJECT CODE	Construction Management Practices	CREDITS
MCVIEMPCT 103		3

Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To familiarize students with foundational and modern principles of management and their applications in construction project planning and scheduling.
CO2	To equip students with network scheduling techniques and proficiency in software tools for efficient construction management.
CO3	To impart advanced knowledge on project control strategies, including resource management, project updating, and cost-time trade-offs.
CO4	To introduce work study and measurement techniques for optimizing construction processes, improving productivity, and ensuring cost-effective project delivery.

Course Outcomes: Students will be able to	
CO1	Apply management principles and methods for effective planning, scheduling, and job layout in construction projects.
CO2	Utilize network techniques like CPM, PERT, and construction scheduling software (MSP, Primavera) to plan and optimize project timelines.
CO3	Analyze and implement project monitoring and control measures, including network crashing, resource leveling, and project updates.
CO4	Conduct work studies using time and motion studies, activity sampling, and other work measurement tools to enhance project efficiency and productivity.

Course Contents

Module 1	**Management**	**Hrs. 8**
Traditional, modern scientific management, Principles and functions of management, Management Styles with special focus on the contributions of Taylor, Fayol, Mayo, McGregor, Weber, Gilbreth. Introduction to project planning, scheduling, methods of scheduling, controlling, Job layout work break down structure, LOB technique. Role of planning department in construction project.		
Module 2	**Network techniques**	**Hrs. 8**
Construction management network schedule, rules and advantages of networks, Precedence Network Analysis, different software in Construction scheduling (MSP, Primavera, Construction manager) and their applications,		

Advantages and applications of precedence networks.		
Module 3	**Construction scheduling**	**Hrs. 6**
Advance level applications of Networks techniques like Gantt chart, milestone chart, CPM, PERT, Mass haul diagrams, objectives, means and importance of cost control		
Module 4	**Project Controlling**	**Hrs. 6**
Monitoring and Control of construction project, Network Crashing, Resource constrained scheduling, Resource Leveling and Smoothening, Project Updating, Non-linear cost time trade off, Project updating – methods of updating, Site layout and mobilization.		
Module 5	**Cost optimization and Work Study**	**Hrs. 8**
Project cost formulation, Optimization of cost through network contraction, linear programming and Project life cycle cost. Definition, Objectives, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, and string diagrams Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating. Activity sampling, time-lapse photography technique.		

Reference Books:	
1	Roy, Pilcher Construction Management.
2	Moder J.J. Philips, C.R. and Davis, E.W. "Project Management with CPM and PERT, and Precedence Diagramming", C.B.S. publishers and distributors, New Delhi, 1986.
3	Pilcher, R. "Project Cost Control in Construction", Collins, London, 1992.
4	O'Brien J.J. CPM in "Construction Management", Mc. Graw Hill Book Company, Inc. NY, 1971.
5	S. Seetharaman, "Construction Engineering and Management", (4th Edition) Umesh Publications, New Delhi.
6	Kumar Neeraj Jha, "Construction Project Management Theory & practice," Pearson Publication
7	Harris, "Modern construction management," Wiley India.
8	Sengupta and Guha, "Construction Management and Planning", Tata McGraw Hill publication.
9	K Nagrajan , Project Management , New age International Limited.
10	Ahuja H.N. , "Professional Construction Management Barrie", Paulson-McGraw Hill Institute Edition.
11	John Wiely, "Project Management", New York.
12	Chitakara, "Construction Project Management Planning, Scheduling and Controlling", Tata McGraw Hill, New Delhi.
13	Rory Burkey 4th ed., "Project Management-Planning and Control", Wiley Publication.
14	Sengupta and Guha, Construction Management and Planning, Tata McGraw Hill Publication.
15	Barrie & Paulson, Professional Construction Management, McGraw Hill Institute Edition.

SUBJECT CODE	(Program Elective-I)	CREDITS
MCVIEMPET 104 A	Building Environment and Services	3

Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To understand the principles of acoustics and lighting in buildings for effective sound management and optimal lighting design.
CO2	To impart knowledge on energy conservation methods, including thermal design and HVAC systems in buildings.
CO3	To familiarize students with essential electrical and water supply systems, drainage, and sewage management in multi-storey buildings.
CO4	To educate students on fire safety standards, prevention, and mitigation measures in building design and the significance of additional services, including gas piping and water conservation.

Course Outcomes: Students will be able to	
CO1	Design and implement acoustical and lighting solutions for various building types, ensuring optimal sound control and lighting efficiency.
CO2	Apply principles of thermal insulation, heating/cooling load calculations, and energy conservation for sustainable building design.
CO3	Plan and manage essential electrical, water supply, and drainage systems, incorporating regulatory standards and sustainable practices.
CO4	Evaluate and integrate fire safety norms, firefighting systems, and additional services, such as gas distribution and rainwater harvesting, to ensure building safety and resource conservation.

Course Contents

Module 1	**Acoustics and lighting**	**Hrs. 8**
Acoustical Designs, Noise and its control, Natural and artificial Light in Building, Lighting, Measurement, Design of Lighting system.		
Module 2	**Energy conservation in Buildings**	**Hrs. 8**
Thermal properties of buildings, Thermal insulation and insulating material, Thermal design of enclosures, Thermal environment inside building, cooling & heating loads, Centralized Systems of air-conditioning		
Module 3	**Electrical services**	**Hrs. 6**
Electric wiring system in building, conductor, cable & conduits, Elevators, Escalators and conveyer, Design, Type, Location, byelaws etc.		
Module 4	**Water supply systems**	**Hrs. 6**
Domestic and commercial Hot water and water supply system for multi-storeyed buildings, Swimming pools-Design criteria, Springboards, pressure filters for recirculation, maintenance. **Drainage system:** Nature of Drainage phenomenon, Ant siphon & vent piping - Installation, pipe joinery,		

External drainage system in building. Design aspects of Sewage Treatment Plants.		
Module 5	**Fire Fighting in Buildings and Other services and approvals**	**Hrs. 8**
Controlling features in architectural planning Norms for fire prevention and mitigation measures, Fire rating of materials, Fire control devices. Gas services & distribution piping, Roof water harvesting & water conservation, Approval of authorities for water supply.		

Reference Books:	
1	National Building code, Bureau of Indian standard
2	Acoustical designing in Architecture, by V .O.Kusen & C.M.Harris, John.Wiley&Son .
3	Acoustic designing & practice, by R.L.Suri, Asia Publishing House.
4	Architecture acoustics, by Anita Lawrence.
5	Main climae & architecture B.Govoni, Elsvire Publishing co.
6	Thermal Performance of Building by J.P Van Stratten, Elsvier Publishing Co.
7	Functional requirement of building (other than Industrial Building) ,BIS Handbook

SUBJECT CODE	(Program Elective-I)						CREDITS
MCVIEMPET 104 B	Ports and Harbour Structures						3
Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To introduce the role of ports and harbors as critical infrastructure bridging water and land transport systems.
CO2	To provide insight into the design issues and considerations in port infrastructure, focusing on wave action, navigability, and cargo handling.
CO3	To explore operational dynamics in ports, including wave forecasting, safety protocols, and environmental impact management.
CO4	To impart knowledge on the sustainable development and maintenance of inland waterways and the construction aspects of port expansions.

Course Outcomes: Students will be able to	
CO1	Analyze and design port layouts, addressing wave dynamics, siltation, and navigational safety to optimize functionality.
CO2	Develop solutions for efficient cargo handling and storage while integrating seamless transport operations within multipurpose terminals.
CO3	Implement safety and environmental management practices in port operations, including the handling of hazards like oil spills and the operation of VTMS systems.

CO4	Apply sustainable development strategies in the planning, expansion, and renovation of inland ports and waterways, considering environmental and climate change impacts.

Course Contents

Module 1	**Introduction**	**Hrs. 8**
Ports and harbours as the interface between the water and land infrastructure – an infrastructure layer between two transport media. **The Fundamentals:** Wave conditions inside harbour, water circulation; breakwaters, jetties & quay walls; mooring, berthing and ship motion inside the port; cargo handling – bulk material storage & handling.		
Module 2	**Design Issues**	**Hrs. 8**
Sea port layout with regards to (1) wave action (2) siltation (3) navigability berthing facilities		
Module 3	**Design of Port Infrastructures**	**Hrs. 6**
Design of port infrastructures with regards to (1) cargo handling (2) cargo storage (3) integrated transport of goods, planning multipurpose port terminals.		
Module 4	**Port Operations**	**Hrs. 6**
Allowable wave conditions for cargo handling, wave conditions for human safety on quays and breakwaters, forcecasting/nowcasting of wave & current conditions for port operations, dredging and navigability, hazard scenarios; VTMS & management of computerized container terminal, safety & environment (handling of fire, oil spill, rescue, etc.).		
Module 5	**Inland Waterways and Ports and Construction Aspects**	**Hrs. 8**
Maintenance of waterways, construction of environmentally engineered banks, dredging, processing and storing of polluted dredged materials, development of river information services. Planning and construction of expansion and renovation of existing Inland Port Infrastructure, Sustainability: Global trade and port structuring/reforms, impact of possible climate change scenarios, sustainable development strategies for cities and ports.		

Reference Books:	
1	Muir Wood, A.M., and Fleming. C.A.,"Coastal Hydraulics Sea and Inland Port Structures", Hall stead press.
2	Ozha & Ozha, "Dock and Harbour Engineering", Charoter Books, Anand.
3	Seetharaman, S.," Dock and Harbour Engineering", Umesh Publications.
4	Richand L. Silister, "Coastal Engineering Volume I & II, Elsevier Publishers.
5	Main climae & architecture B.Govoni, Elsvire Publishing co.
6	Pera Bruun, "Port Engineering", Gulf Publishing Company

SUBJECT CODE	(Program Elective-II)	CREDITS
MCVIEMPET 105 A	Highway Infrastructure	3

Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To understand the fundamental role of transportation and its impact on economic development, including modes, planning, and funding mechanisms for highways.
CO2	To equip students with knowledge of highway project preparation, encompassing traffic surveys, alignment, and road design.
CO3	To familiarize students with principles of traffic engineering, geometric highway design, and drainage considerations for effective roadway infrastructure.
CO4	To introduce pavement design, reinforced earth structures, and highway economic analysis to foster sustainable and cost-effective highway projects..

Course Outcomes: Students will be able to	
CO1	Analyze and apply transportation planning processes, addressing key elements such as trip generation, distribution, and modal splits in highway development.
CO2	Conduct various traffic and alignment surveys to support the preparation and planning of highway projects effectively.
CO3	Design highway geometries, traffic control systems, and drainage plans in line with current standards and safety requirements.
CO4	Evaluate the economic and financial viability of highway projects, utilizing methods such as NPV, IRR, and benefit-cost ratios, and assess sustainable funding options including PPP models.

Course Contents

Module 1	**Introduction and planning**	**Hrs. 8**

Roll of transport in modern society and in countries economy, modes of transport and their characteristics, need for transport planning, goals and objectives, transportation planning process -stages in transport planning - inventories, trip generation, trip distribution, modal split, and traffic assignment. Scope of highway infrastructure, Road development plans, Recent developments – NHAI,NHDP,PMGSY,MSRDC, Highway finance –BOT,BOT, Annuity, PPP, DBFO.

Module 2	**Highway project preparation**	**Hrs. 8**

Importance of surveys and investigation, types, traffic surveys-classified volume count, traffic growth rate, axle load surveys, speed and delays surveys, origin and destination surveys, Conventional ground surveys, alignment and root locations, drainage studies, soil and pavement design investigations

Module 3	**Traffic Engineering and Highway Geometric Design**	**Hrs. 6**

Traffic characteristics, traffic studies and analysis, traffic control devices, road marking, traffic sign, traffic signal, intersections, Terrain classification, Highway Alignment-Definition, requirements, factors controlling alignment, alignment of hill roads. Crosssectional elements, sight distances, concept of level of service, PCU, parking studies,

accident studies and highway safety. Highway Drainage: Necessity, surface and subsurface drainage, maintenance and repairs.		
Module 4	**Pavement design**	**Hrs. 6**
Pavement types, components, functions, design factors, Design of flexible pavements, CBR Method, IRC: 37-2001. Design of rigid pavement: Westergaard's analysis of wheel load stress, temperature stresses. Highway Construction: Highway materials, WMM roads, bituminous roads-BC, SDBC, DBM; concrete roads-DLC, PQC; soil stabilized road, MOST specifications. Deficiency in flexible and rigid pavement, methods of pavement evaluation, strengthening of existing pavements, highway maintenance, related IRC specifications.		
Module 5	**Reinforced earth Structures and Highway economics and finance**	**Hrs. 8**
Reinforced earth structures to improve bearing capacity and stability of embankment slopes, Types and applications of geosynthetic reinforcements, Bearing, Internal and external stability of reinforced earth structures, Reinforcing of earth using geosynthetics, soil nailing (SNART) to protect land sliding, Waste utilization with reinforcements in road and rail track embankment fill. Methods of highway finance, economical and financial evaluation of project, distinction between economic and financial analysis, commonly used terms in economic and financial analysis, total transportation cost, shadow pricing, treatment of inflation, methods of economic evaluation. Net present value (NPV), internal rate of return method, benefit cost ratio method, stages in economic evaluation, P P P Model Highway Project.		

Reference Books:	
1	Khanna S.K. and C.E.G. Justo (2000): Highway Engineering, Nem Chand & Bros., Roorkee.
2	Partha Chakroborty and Animesh Das (2003): Principles of Transportation Engineering, Prentice-Hall India, New Delhi.
3	Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.
4	Hutchinson B.G. (1974): Principles of Urban Transport Systems Planning. McGraw-Hill Book Co., New York.
5	Yang H. Huang (1993): Pavement Analysis and Design, PrenticeHall.
6	L. R. Kadiyali " Traffic Engineering and transport planning", Khanna Publishers.
7	Annual on Economic Evaluation of Highway Projects in India.
8	Foundation Engineering by P.C. Varghese, Prentice Hall of India.
9	Foundation Analysis and Design by J.E.Bowles, Mc Graw Hill

SUBJECT CODE	(Program Elective-II)	CREDITS

MCVIEMPET 105 B	Contracts, Administration And Arbitration				3		
Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To provide an understanding of contract administration, including legal frameworks, rights, and obligations of parties involved in construction projects.
CO2	To equip students with knowledge of the tendering process, document preparation, and professional ethics in project bidding and contracting.
CO3	To introduce key labor laws and industrial acts relevant to the construction industry and to explain their application in workplace management.
CO4	To familiarize students with dispute resolution methods, including arbitration, and the role of incentive schemes in construction projects.

Course Outcomes: Students will be able to	
CO1	Interpret and apply contract laws and standard contract forms to manage rights and obligations in construction projects.
CO2	Prepare comprehensive tender documents and manage tendering processes, including understanding penalties, incentives, and global tendering systems.
CO3	Apply knowledge of industrial acts and labor laws to ensure compliance with legal requirements in workplace administration.
CO4	Implement arbitration procedures for resolving contract disputes and design effective incentive schemes to enhance productivity and project success.

Course Contents

Module 1	**Contracts Administration**	**Hrs. 8**
The standard forms of building contracts, the rights of building owners, adjoining owners and third parties. The Indian Contract Act Preparation of tender documents, Issues related to tendering process –Awarding contract, Incentives and penalties in specifications, Sale of Goods Act. Professional ethics, Global tenders and B.O.T. System.		
Module 2	**Time of Performance**	**Hrs. 8**
Provisions of contract law – Breach of contract. Contracts for projects under International AID.		
Module 3	**Industrial Act and Labour Laws**	**Hrs. 6**
Industrial Dispute Acts, payment of wages act, Minimum Wages Act, Indian Trade Union Act, and Workmen's Compensation Act.		
Module 4	**Arbitration of Engineering Contracts**	**Hrs. 6**
Indian Arbitration Act, arbitration agreement, conduct of arbitration, power and duties of arbitrator, rules of evidence/ preparation and publication of awards, methods of enforcement, impeding and award. Limitations of arbitration in the Indian context, Dispute resolving boards-necessity, formation, functioning advantages.		

Module 5	Administration of Incentive schemes	Hrs. 8
Necessity, merit rating, Job evaluation installation, modification and maintaining, incentive scheme based on implementation experience.		

Reference Books:	
1	"Codes of Practice and Standard Specifications" of AP PWD,. CP WD, MES etc, Anupbhai Publications,
2	"Engineering Contracts and Arbitration", by B.J. Vasavada (March 1996). .
3	"Laws relating to Building and Engineer's Contracts" by G.T. Gajaria – M.M. Tripathi Pvt. Ltd.,Mumbai, 1985.
4	"Professional Practice" by Roshan Namavat", published by Anupbhai Publications.
5	K. Collex, "Managing Construction Contracts", Reston publishing Co, Virginia, 1982.
6	W.B. Park "Construction Bidding for Projects", John Wiley, Ny, 1978.
7	"Latest Amendments to latest versions of Building Bye-Laws and Engineering Contract Laws".
8	"Estimating and Costing" by B. S. Patil (Vol 1 & 2).
9	Construction contracts and claims – Simon M.S. (McGraw Hill, New York)
10	Construction Contract Management-NICMAR publication
11	Handbook of estimating & costing for Quantity Surveyors - P. T. Joglekar

SUBJECT CODE	(Program Elective-II)	CREDITS
MCVIEMPET 105 C	Operation Research	3

Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
CO1	To introduce the fundamentals and applications of Life Cycle Costing (LCC) in infrastructure and asset management.
CO2	To equip students with skills for collecting and analyzing relevant data for LCC, including discounting, inflation, and modeling.
CO3	To develop cost estimation techniques that account for initial, operational, and replacement costs over the asset's life cycle.
CO4	To provide knowledge on advanced LCC evaluation methods, including sensitivity analysis, risk assessment, and implementation strategies.

Course Outcomes: Students will be able to	
CO1	Define Life Cycle Costing, understand its objectives, and describe its uses and implementation strategies in economic decision-making.
CO2	Identify and apply appropriate data requirements and parameters for accurate Life Cycle Costing Analysis, including discount rates and inflation.
CO3	Estimate and categorize costs related to investment, operations, maintenance, and replacement for LCC of projects.

CO4	Analyze and implement LCC using various evaluation techniques, assess risks and uncertainties, and understand implementation stages and tools.

Course Contents

Module 1	**Introduction to Operations Research**	**Hrs. 8**
Introduction, Structure of the Mathematical Model, Limitations of Operations Research, Identification of civil engineering systems and their methods of analysis		
Module 2	**Linear Programming**	**Hrs. 8**
Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Sensitivity Analysis		
Module 3	**Transportation Problem**	**Hrs. 6**
Formulation, solution, unbalanced Transportation problem, finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method		
Module 4	**Integer Programming Problem**	**Hrs. 6**
Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique, Introduction to Decomposition algorithms		
Module 5	**Simulation and Game Theory**	**Hrs. 8**
Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation. Competitive games, rectangular game, saddle point, minimax, maximin method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.		

Reference Books:	
1	Hamdy A. Taha, "Operations Research", Pearson Publisher
2	S.S. Rao, "Engineering Optimization Theory & Practice", Wiely.
3	Ravindran, "Engineering Optimization, Methods and Applications", Wiely.
4	J.K.Sharma, "Operations Research," Macmillan India Ltd. 2006.
5	N.D.Vohra, "Quantitative Techniques in Management," Mcgraw hill Publication
6	R.Pilcher, "Principles of Construction Management"
7	E.S.Buffa, "Operations Management" Wiley,India
8	H.M.Wangner, "Principles of Operation Research" Prentice Hall Publication.
9	Hira and Gupta, "Operation Research" S.Chand Publication
10	Ravindrav,Philip & Solberg, "Operations Research: Principles and Practice," Wiley,India

SUBJECT CODE		CREDITS

MCVIEMELL 106	PG Laboratory –I						2
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	4	0	20	20	60	100

Course Contents

Laboratory Work:
Laboratory Work shall consist of assignments in form of theoretical work / analytical work may be done with spreadsheet applications / software module / site visit reports case study of specific construction event or relevant lab experiments. Term work should consist of minimum six assignments.

SUBJECT CODE	Communication Skills						CREDITS
MCVIEMHMP 107							2
Teaching Work Load/week (Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	3	20	20	60	100

Course Objectives	
CO1	To develop technical communication skills, focusing on vocabulary, sentence structures, and effective use of presentation tools.
CO2	To develop skills in designing prestressed concrete flexural members, focusing on codal provisions, flexural strength, and the transfer of prestress in box girders.
CO3	To enhance students' formal written communication skills for drafting professional documents such as letters, emails, memos, and notices.
CO4	To cultivate leadership and team-building skills, as well as the ability to effectively conduct and participate in business meetings and presentations.

Course Outcomes: Students will be able to	
CO1	Students will demonstrate the ability to effectively use technical vocabulary, sentence structures, and presentation tools for clear and concise communication.
CO2	Students will be able to draft a variety of formal documents, such as emails, memos, and notices, with professionalism and clarity.
CO3	Students will produce structured research proposals and project reports with proper organization, purpose, and style.
CO4	Students will exhibit effective leadership, team collaboration, and presentation abilities, with confidence in handling meetings, audience interactions, and nonverbal communication.

Course Contents

Module 1	**LANGUAGE FOR TECHNICAL PURPOSE AND PRESENTATION TOOLS**	**Hrs. 8**
Technical vocabulary, Sentence structures, Microsoft office, Graphical presentations		

Module 2	FORMAL WRITTEN COMMUNICATION	Hrs. 8
Drafting Letters, e-Mails, Memos, Notices, Circulars, Schedules.		
Module 3	**Project Research Proposals and Reports**	**Hrs. 6**
Research Proposal: Essentials, Abstract, Aims, Background & significance, Design & methods, Writing a sample proposal. Project Report: Types of reports, planning a report, Collection & organization of information, Structure & style, Proofreading etc. Writing a sample report.		
Module 4	**LEADERSHIP SKILL AND TEAM BUILDING, WORKING.**	**Hrs. 6**
Leadership Skills**:** Leadership quality and styles, Emotional intelligence, Diplomacy and Tact and effective communication, Case studies. Need of team, Effective teams, Group development, Roles in group, Case studies.		
Module 5	**BUSINESS MEETINGS AND PRESENTATION SKILLS**	**Hrs. 8**
Understanding role of meetings, planning meetings, developing meeting agendas, scheduling meetings, conducting meetings effectively, Taking notes and publishing minutes and concluding meetings, action plans, Demo meetings. Preparation, Understanding audience, Use of presentation tools, Presentation, nonverbal techniques, handling questions, Demo presentations.		

Reference Books:	
1	S. Hariharan, et.al. Soft Skills; MJP Publishers, 2010.
2	John Seely, Oxford Guide to Effective Writing and Speaking; Oxford University Press, 2009.
3	Thomas N. Huckin and Leslie A. Olsen, Technical Writing and Professional Communication
4	for Nonnative Speakers of English; Tata McGraw Hills, International Edition, 1991.
5	Jeff Butterfield,Soft Skills for Everyone,cengage Learning India Private Limited,2010.
6	L. Ann Masters & Harold R. Wallace, Personal Development for Life & Work,10e,Cengage
7	Learning India Private Limited,2011.

SUBJECT CODE	YOGA for Stress Management			CREDITS			
MCVIEMAUP 108				AUDIT			
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	2	2	AU	AU	AU	AU

Course Objectives	
CO1	Understand the physiological and psychological aspects of stress and its impact on overall well-being.

CO2	Learn and practice specific yoga postures, breathing exercises, and relaxation techniques to alleviate stress.
CO3	Explore the connection between mindfulness, meditation, and stress reduction, fostering mental clarity.
CO4	Discover holistic practices that promote better sleep, nutrition, and overall lifestyle habits for stress management.
CO5	Develop practical skills to manage stress in daily life, enhancing resilience and promoting emotional balance.

Course Outcomes: Students will be able to	
CO1	Recognize the signs and sources of stress, understanding its effects on mental and physical well-being.
CO2	Master a variety of yoga techniques, including postures, breathing, and meditation, to effectively manage stress.
CO3	Acquire relaxation strategies that promote calmness, reduce anxiety, and enhance overall mental clarity.
CO4	Incorporate healthy habits inspired by yoga principles to foster better sleep, nutrition, and self-care routines.
CO5	Develop practical skills to navigate and cope with stress, enhancing emotional balance and promoting a more harmonious life.

Course Contents

Module 1	**Introduction to Yoga for Stress Management**	**Hrs. 6**
Stress according to Western perspective Stress Eastern Perspective Developmental process: Western and Eastern Perspective Stress Hazards and Yoga		
Module 2	**Meeting the challenges of Stress**	**Hrs. 6**
Introduction to Stress Physiology Stress, Appetite and Dietary management- Modern and Yogic perspective Sleep and Stress: understanding the relationship for effective management of stress		
Module 3	**Stress Assessment methods**	**Hrs. 6**
A valuable tool toward stress management Role of Yoga in prevention and management of stress related disorders – a summary of research evidence Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 1/Part 2/ Part 3		
Module 4	**Stress Management**	**Hrs.6**
Concept of stress and its management - perspectives from Bhagavad Gita - Part 1 / Part 2 / Part 3		
Module 5	**Yoga practices for Stress Management**	**Hrs. 8**
Bio-Psycho-Socio-Spiritual model of stress management Yoga practices for Stress Management Breathing practices , Asana practices- Tadasana, Ardhakati Chakrasana, Ardha Chakrasana, Trikonasana, Vrikshasana, Vakarasana, Janu Sirshasana, Ushtrasana, Sashankasana, Ardhamatseyndrasana, Paschimottanasana, Poorvottanasana, Gomukhasana, Makarasana, Bhujangasana, Salambha Shalabahasana, Dhanurasana, Setubandhasana, Sarvangasana, Mastyasana, Deep Relaxation Technique (DRT),etc.		

Text Books:	
1	H R Nagendra and R Nagarathna. Yoga for Promotion of Positive Health. Swami Vivekananda Yoga Prakashana. 2011.
2	Contrada, R., & Baum, A. (Eds.). The handbook of stress science: Biology, psychology, and health. Springer Publishing Company. 2010
3	Al'Absi, M. (Ed.). Stress and addiction: Biological and psychological mechanisms. Elsevier. 2011.
4	Van den Bergh, O. Principles, and practice of stress management. Guilford Publications. 2021.
5	Swami Muktibodhananda, Hatha Yoga Pradipika, Bihar Scool of Yoga, 1998

Reference Books:	
1	Swami Satyananda Saraswati, Four Chapters on Freedom, Bihar Scool of Yoga, 1975
2	Swami Tapasyananda, Srimad Bhagavat Gita, Sri Ramakrishna Math, 2012
3	**NPTEL Course-**Yoga for Stress Management-Dr H R Nagendra, Dr Mithila M V, Dr Rajesh Nair,Swami Vivekananda Yoga Anusandhana Samsthana https://onlinecourses.swayam2. ac.in/aic23_ge10/preview#:~:te xt=In%20this%20course%20we %20intend,meeting%20the%20 challenges%20of%20stress

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester- II										
1	MCVIEMPCT 201	Construction Equipment Management	3	--	--	20	20	60	100	3
2	MCVIEMPCT 202	Infrastructure Development	3	--	--	20	20	60	100	3
3	MCVIEMPET 203	Program Elective -III	3	--	--	20	20	60	100	3
4	MCVIEMPET 204	Program Elective-IV	3	--	--	20	20	60	100	3
5	MCVIEMPET 205	Open Elective-V	3	--	--	20	20	60	100	3
6	MCVIEMELP 206	PG Lab-II	--	--	4	25	--	25	50	2
7	MCVIEMELP 207	Mini -Project	--	--	4	25	--	25	50	2
8	MCVIEMHMP 208	Indian Knowledge System	2	--	--	20	20	60	100	2
		Total	**17**	**00**	**08**	**170**	**170**	**410**	**750**	**21**

Type of course:

Program Core: **PC**	Program Elective: **PE**
Open Elective: **OE** (Other than particular program)	Ability Enhancement Course: **AE**
Modern Indian Language: **MIL**	Humanities, Management, language and Commerce: **HM**
Experiential Learning Courses: **EL**	Multidisciplinary Minor Courses: **MD**
ABBRIVATIONS: **ISE**-INSEMESTER EVALUATION, **MSE**-MID SEMESTER EVLUATION, **ESE** -END SEMESTER EVALUATION	

SUBJECT CODE	Construction Equipment Management	CREDITS
MCVIEMPCT 201		3
Teaching Work Load/week(Hrs.)		Examination Scheme(Marks)

Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Understand Excavation and Foundation Techniques
CO2	Demonstrate Knowledge of Earthmoving and Compacting Equipment.
CO3	Apply Safety and Operational Standards for Hoisting and Conveying Equipment.
CO4	Evaluate Concrete Production and Placement Techniques.
CO5	Develop Strategies for Construction Equipment Management.

Course Contents

Module 1	**Substructure**	**Hrs. 8**
Digging and excavation of trenches, Grading, Special earth work excavation, Drilling and blasting techniques, Pile driving techniques, sinking wells. Superstructure: Concrete and reinforced concrete works – forms work –reinforcement –concreting – mechanized methods of erection of Buildings and installations, Cast-in-situ and pre-cast concrete. Concreting below G.L. – wall in situ method for cast in situ and precast concrete – under water concreting design of forms.		
Module 2	**Construction Equipment and Machinery**	**Hrs. 8**
Earthmoving Equipment Power shovels, Back hoe, Dragline, Clam shell, tunneling machine – types. **Excavating & Compacting Equipment:** Scraper, Bulldozer. Smooth wheel roller sheep-foot roller – Pneumatic typed rollers.		
Module 3	**Hauling & Conveying Equipment**	**Hrs. 6**
Hoisting equipment, such as hoist winch, hoisting chains, and hooks and slings, various types of cranes –tower crane, mobile crane and derrick crane, Their characteristics, performance and safety in operation. Dump trucks and dumpers, Belt Conveyors, Screw conveyor, Bucket conveyor.		
Module 4	**Agreement and Concrete Production Equipment**	**Hrs. 6**
Concrete mixers, truck mixers, pneumatic concrete placer, concrete vibrators. Pile Driving Equipment, Tunneling and rock drilling equipment – Pumps and dewatering equipment.		
Module 5	**Management of Construction Equipment**	**Hrs.7**
Need for mechanization of construction, planning and financing construction plant and equipment, Owning and operating equipment versus hiring, planning for infrastructure mechanization equipment management, equipment maintenance and repair		

Guidelines for Assignments:	
	The candidate shall perform minimum six assignments consisting of theoretical as well as numerical aspects of the course.

Text Books:	
1	Mahesh Varma (1997) "Construction Equipment and its Planning and Applications" Metropolitan Book Co.(P) Ltd., New Delhi. India.
2	B. Sengupta and H. Guha : "Construction Management and Planning " (TMH Publication)
3	S. Seetharaman, "Construction Engineering and Management" Umesh Publications, Delhi.
4	Rangwala "Construction of Structures and Management of Works" (Charotar publishers)
5	U.K. Srivatsava (1999) "Construction Planning and Management "Galgotia Publications Pvt. Ltd., New Delhi,India

Reference Books:	
1	Peurify, R.L. (1996) "Construction Planning, Equipment and Methods".
2	Jay P.K. "Handbook of Construction Management" – Macmillan India Ltd., New Delhi, 1990.

SUBJECT CODE	Infrastructure Development			CREDITS			
MCVIEMPCT 202				3			
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Understand the fundamentals of wave propagation in soil media.
CO2	Apply theory of vibrations to solve dynamic soil problems & to calculate the dynamic properties of
CO3	Analyze the behaviour of a machine foundation resting on the surface and embedded foundation.
CO4	Analyze the block foundation under different modes of vibrations.
CO5	Understand the principles of design of foundations for reciprocating and impact machines as per IS code.

Course Contents

Module 1	Construction Industry	Hrs. 6
Nature, characteristics, size and structure, Role of infrastructure development in employment generation and improving of the National economy.		
Module 2	**Infrastructure Policies and Agencies**	**Hrs. 6**
Indian government policy, Five year plan of government, Various Agencies associated with infrastructure development in India as regards various sectors.		
Module 3	**Status of Infrastructure Development in India**	**Hrs. 6**
Roads and buildings, communication, water supply, irrigation, power energy sectors, ports and aviation, health		

and educational services, rural development. Issues related with infrastructure development, Government sector management, public sector management, private sector management.		
Module 4	**Funding and Consultant**	**Hrs.6**
Funding and managing infrastructure projects, role, and responsibility of project management consultants.		
Module 5	**Project Development**	**Hrs.10**
BOT projects, PPP projects, related to role of government, concern Construction Company, benefits and limitations		

Guidelines for Assignments:	
	The candidate shall perform minimum six assignments consisting theoretical as well as numerical aspects of the Course.

Text Books:	
1	Rakesh Mohan, India Infrastructure Report.
2	Infrastructure Today – Magazine.
3	Document of five year plans, published by Govt. of India.
4	CE & CR Magazine.

SUBJECT CODE	(Program Elective-III)	CREDITS
MCVIEMPET 203A	Environment & Energy Management	3

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Learn the concept of environmental impact and identify key impact factors in infrastructure projects.
CO2	Understand environmental, social, and economic impacts using concepts like significance effect and resource commitment.
CO3	Understand and apply laws and regulations related to energy conservation and pollution control.
CO4	Evaluate energy efficiency of projects, including the role of ESCOs and performance contracts.
CO5	Learn the methodology, procedures, and benefits of Clean Development Mechanism (CDM) under the UNFCCC framework.

Course Contents

Module 1	**Environment & Environmental Impact**	**Hrs. 6**

Concept of Environment & Environmental Impact, Environmental Impact Factors & Area of Considerations for Infrastructure project such as Airport, Highway, Power Projects, Water Related Projects		
Module 2	**Measurement of Environmental & Socio Economic Impact**	**Hrs. 6**
Natural/Physical Environmental Impacts, Social Impacts, Economic Impacts, concept of Significance Effect, Considerations of Alternatives, Short term versus Long term effects, Irreversible and Irretrievable Commitments of Resources. Physical, Social, Aesthetic and Economic Environment, Type of socio economic Impacts, Outline of basic steps in performing the socio economic assessment, Fiscal Impact Analysis.		
Module 3	**Environmental and Pollution Control Laws**	**Hrs. 6**
Rules, Regulations & Laws governing Energy Conservation in India & Developed Nations - Energy Conservation Act 2001, Revisions and Present State of Implementation Standardization & Labelling, Electricity Act 2003, Revisions and Present Status of Implementation. United Nations Framework Convention on Climate Change (UNFCC), Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon Funds(PCF), Carbon Credits and it's trading, Benefits to developing countries		
Module 4	**Energy Efficiency Projects & Financing of Energy Efficiency Projects**	**Hrs.6**
Energy Efficiency Projects, Evaluation of Energy Efficient Projects, Various ways of Financing Energy Efficiency Projects, Role of Financial Institutions and Corporate Banks, Deferred Payment Financing, Types of Energy Performance Contracts, Energy Service Companies (ESCOs) and their Role, Emphasis on ESCOs		
Module 5	**Clean Development Mechanism Benefits - Methodology & Procedure**	**Hrs.10**
Methodology and Procedures for CDM, Eligibility Criteria, UNFCCC, Role of UNFCCC and Government of India		

Text Books:	
1	Management of Energy Environment Systems -W.K.Hall, John Wiley and Sons.
2	Energy Management and Control Systems -M.C.Macedo Jr., John Wiley and Sons.
3	Environmental Impact Analysis Handbook -J.G.Rau, D.C.Wood, McGraw Hill.
4	Energy & Environment – J.M. Fowler, McGrawHill.
5	Energy Management W R Murphy; G Mckay, B.S. Publications

Reference Books:	
1	Renewable Energy and Energy Management S C Patra; B C Kurse; R Kataki Int. Book Co.
2	Operations and Maintenance Manual for Energy Management, J Piper, Standard Publishers.
3	Environmental Pollution Compliance H.C. Sharma CBS Publishers.

SUBJECT CODE	(Program Elective-III)	CREDITS
MCVIEMPET 203B	Value Engineering and Valuation	3

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Understand concepts in structural health monitoring and acquire knowledge of smart materials.
CO2	Understand vibration control methods in structural health monitoring.
CO3	Understand electrical impedance methods in structural health monitoring.
CO4	Understand wave propagation methods in structural health monitoring.
CO5	Understand advanced signal processing techniques in structural health monitoring.

Course Contents

Module 1	**Value engineering**	**Hrs. 6**
Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, economic etc., Difference between value engineering, value analysis & value management, Habits, roadblocks, attitudes & their relevance in value engineering. Introduction, Life cycle of a Product, Definition, objectives and methodology of value Engineering, Comparison with other cost reduction techniques, unnecessary cost.		
Module 2	**Valuation**	**Hrs. 6**
Types of value, purposes of valuation factors affecting value, Different methods of valuation for different types of assets such as land and building, horticulture, historical places, Valuation Report: Valuation Report, contents, standard formats, Case study of any one Report.		
Module 3	**Job Plan**	**Hrs. 6**
Definition & Terms related to Value Engineering Job Plan, Various versions of job plan, Phases involved in job plan- General, information, function, creation/speculation, evaluation, investigation, recommendation and implementation. FAST diagramming: Critical path of function, How, why and when logic, supporting and all time functions, Ground rule for FAST diagram		
Module 4	**Function Analysis**	**Hrs.6**
Function- Definition, Role of function in achieving value, Types of function, relationship between different functions in design of a Product, functional cost, functional worth, test for poor value, aim of value engineering. Function Analysis System Techniques (FAST), Graphical Function Analysis, Systematic approach, Phases of value engineering.		

Module 5	Value Analysis & Life cycle costing	Hrs.10
Principles of value analysis, Benefits & applications of value analysis, Methods for improving the effectiveness of value analysis, Decision /evaluation Matrix: Quantitative comparison of alternatives, estimation of weight factors and efficiency. Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, sensitivity analysis, Different methods of performing value engineering		

Guidelines for Assignments:	
	The candidate shall perform minimum six assignments consisting theoretical as well as numerical aspects of the Course.

Text Books:	
1	Value Engineering: Analysis and Methodology By Del Younke
2	Industrial Engg. & Mgt., O.P.Khanna, DhanpatRai Publ.
3	Industrial Organization &Engg. Economics, T.R.Banga, S.C.Sharma, Khanna Publ.
4	Estimating and Costing in Civil Engineering: Theory and Practice B.N Dutta Published Dutta & Company, Lucknow.
5	Estimating, Costing Specifications & valuation in Civil Engineering By: M.Chakraborty Published By: Author.

Reference Books:	
1	Estimating and Costing By: G.S.Birdie
2	Estimating and Costing By: Rangwala Published By: Charotar Publishing House,
3	Practical Information for Quantity Surveyors, Property valuers, Architects Engineers and
4	Builders, P.T.Joglekar, Pune VidyarthiGrihaPrakashan, 2008 reprint.

SUBJECT CODE	(Program Elective-IV)	CREDITS
MCVIEMPET 204A	Resource Management	3

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Explain the importance and functions of materials management.
CO2	Apply ABC analysis and vendor analysis.
CO3	Learn to use inventory control techniques.
CO4	Learn stores operations management effectively.

CO5	Develop skills in human resource management and value engineering.

Course Contents

Module 1	**Materials Management**	**Hrs. 6**
Importance of materials management and its role in construction industry-scope, objectives and functions, integrated approach to materials management, Role of materials manager, Classification and Codification of materials of construction.		
Module 2	**ABC analysis**	**Hrs. 6**
Procedure and its use, Standardization in materials and their management, Procurement, identification of sources of procurement, vendor analysis, Vendor analysis concept of (MRKP), Material requirement planning, planning, purchase procedure, legal aspects.		
Module 3	**Inventory Management**	**Hrs. 6**
Inventory Control techniques. EOQ, Advantages and limitation of use of EOQ, Periodic ordering, order point control, safety stock, stock outs, application of AC analysis in inventory control, concept of (JIT)- Just in time management, Indices used for assessment of effectiveness of inventory management		
Module 4	**Stores Management**	**Hrs.6**
Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing, site layout and site organization, scheduling of men, materials and equipment. **Use of MMS** Materials Management Systems in materials planning, procurement, inventory, control, cost control etc.		
Module 5	**Need for Development of Human Resource**	**Hrs.10**
Flow diagram of human resource development and human resource management, Training, competency development, capacity building of resources required at grass root level and at the managerial level in construction. Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, sensitivity analysis, Different methods of performing value engineering		

Guidelines for Assignments:	
	The candidate shall perform minimum six assignments consisting theoretical as well as numerical aspects of the Course.

Text Books:	
1	K. S. Menon, “Purchasing and Inventory Control”, Wheeler Publication
2	Dr. Mahesh Verma, “Construction equipment planning and applications”
3	Robert Peurifoy, “Construction planning, equipment and methods”, Tata McGraw Hill.

4	Biswajeet Pattanayak, "Introduction to Human Resource Management".
5	Bohlander & Snell, "Managing Human Resources".

SUBJECT CODE	(Program Elective-IV)						CREDITS
MCVIEMPET 204B	Urban Hydrology and Storm Water Management						3
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Understand the urban hydrologic process and analyze the impacts of urbanization.
CO2	Apply storm water modeling techniques to assess urban water quantity and quality
CO3	Implement storm water management practices for mitigating the impacts of urban storm runoff
CO4	Design and maintain urban drainage systems, considering sewer capacity.
CO5	Evaluate design considerations for sewer system components.

Course Contents

Module 1	**Urban hydrologic process**	**Hrs. 6**
Process of urbanization, Water in Urban ecosystem, Urban water subsystems, Urban hydrologic cycle, Impact of urbanization on urban runoff and stream flow quantity, Impact of urbanization on quality of runoff and stream flow, Erosion due to urban runoff.		
Module 2	**Storm water modelling**	**Hrs. 6**
Analysis of hydrologic changes due to urbanization, Approaches to study, Data collection and analysis, Probabilistic and statistical approaches, Modelling of urban water quantity, Types of models, Rainfall, Runoff modelling, urban watershed modelling (quantity), Rational Method (or coefficient method), Runoff hydrograph, unit hydrographs, synthetic unit hydrograph, Urban watershed modelling for water quality of runoff and stream water quality.		
Module 3	**Storm water management**	**Hrs. 6**
Urban storm runoff quantity and quality management, Mitigation of damaging effects of urban storm runoff Structural and non- structural, control measures, Storm water management models.		
Module 4	**Urban drainage systems & maintenance**	**Hrs.6**
Sanitary and combined sewer systems, components, Design considerations for fixing sewer capacity, Infiltration into and exfiltration from sewers, causes, Infiltration inflow analysis, Field investigations, Control measures. Maintenance management of UDS and its subsystems, Drainage system, Storm drain conveyance system,		

Pump stations, Open channel, illicit connections and discharges, Spill response, Other considerations (limitations and regulations).		
Module 5	**Design consideration of the components of the sewer systems**	**Hrs.10**
Performance of the sewer system both under dry weather flow condition and under storm water impact, Sewer sediment.		

Guidelines for Assignments:	
	The candidate shall perform minimum six assignments consisting theoretical as well as numerical aspects of the Course.

Text Books:	
1	Stormwater Hydrology and Drainage " by D.Stephenson, Elsevier Publications.
2	"Urban Hydrology" by J.M.Hall, Elsevier Applied Science Publishing Company.
3	"Storm water Modeling" by Overtens D.E., and Meadows M.E., Academic Press, NY.
4	"Urban Water Infrastructure Planning, Management, and Operations" by Neil S.Grigg, John Wiley & Sons
5	"Introduction to Hydrology" by Viessman W.I., Knapp J.W., Lewis G.L., and Henbrough, T.E., Harper and Row Publishing Company.

Reference Books:	
1	Manual of Sewerage and Sewage Treatment" Ministry of works and Housing, Government of India.
2	"Applied Hydrology", by K.N. Mutreja, Tata McGraw- Hill publishing company Ltd., New Delhi.
3	"Engineering Hydrology", by K. Subramanya, Tata McGraw- Hill publishing company Ltd., New Delhi.
4	Understand Various Retrofitting methods for RC framed structure and masonry structures.

SUBJECT CODE	(Open Elective-IV)	CREDITS
MCVIEMOET 205A	Safety Management in Construction	3

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to	
CO1	Understand roles and responsibilities of various parties in construction safety management.
CO2	Identify safety practices for different construction sites and stages to prevent accidents.
CO3	Apply safety measures in the use of construction equipment.

CO4	Recognize the importance of safety gear and legal requirements on-site.
CO5	Analyze safety policies and practices in ISO-approved construction companies.

Course Contents

Module 1	**Construction Safety Management**	**Hrs. 6**
Role of various parties, duties and responsibilities of top management, site managers, supervisor's etc., role of safety officers, responsibilities of general employees, safety committee. Safety training, incentives and monitoring, writing safety manuals, preparing safety checklists and inspection reports		
Module 2	**Safety in construction operations**	**Hrs. 6**
Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction, Approach to improve safety in construction for different work, Measuring safety, Prevention of accidents, Safety measures.		
Module 3	**Safety in use of construction equipment**	**Hrs. 6**
Vehicles, cranes, hoist and lift etc. Safety of scaffolding and working platforms, Safety while using electrical appliances, Explosives, Prevention of fires at construction site.		
Module 4	**Various safety equipment and gear used on site**	**Hrs.6**
First aid on site, Labour laws, legal requirement and cost aspects of accidents on site, Safety Audit.		
Module 5	**Study of safety policies**	**Hrs.10**
Methods, equipment, training provided on any ISO approved construction company.		

Text Books:	
1	Construction Safety Manual - Published by National Safety Commission of India.
2	Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai
3	Construction Safety Handbook – Davies V.S.Thomasin K, Thomas (Telford, London.)
4	ISI for safety in Construction – Bureau of Indian Standards.
5	Safety management – Grimaldi and Simonds (AITBS, New Delhi)

SUBJECT CODE	(Open Elective-V)						CREDITS
MCVIEMOET 205B	Research Methodology						3
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Outcomes: Students will be able to

CO1	Understand concept of research, its types, methods, detailed procedure to identify and solve a
CO2	Understand various mathematical techniques useful in research work.
CO3	Understand various sampling techniques useful in research work.
CO4	Understand various techniques for correlating and predicting different parameters with each other
CO5	Design the experiments for research work.

Course Contents

Module 1		**Hrs. 6**
Introduction, meaning of research, objectives, types and role of scientific and engineering related research in advancing the knowledge, defining a research problem, formulation of a hypothesis, research design and features of good design, methods of data collection, approaches and techniques for data acquisition, processing, analyses and synthesis, Designing a questionnaire, Interpretation of results, Report Writing, Aspects of literature review, Different ways of communication and dissemination of research results.		
Module 2		**Hrs. 6**
Descriptive Statistics, Probability and Distribution: Basic statistical concepts, Measures of central tendency and dispersion, Elements of Probability, Addition and multiplication theorems of probability, Examples, probability distributions, Binomial, Poisson and normal distributions.		
Module 3		**Hrs. 6**
Sampling Techniques: Random sampling, simple random sampling and stratified random sampling, Non-sampling errors.		
Module 4		**Hrs.6**
Correlation and Regression: Product moment correlation coefficient and its properties. Simple linear regression and multiple linear regressions, Statistical Inference: Statistical hypotheses, Error Types, level of significance, Chi-square Test and F distributions. Central limit theorem, Tests for the mean, equality of two means, variance, large sample tests for proportions, Confidence interval.		
Module 5	**Approach to conduct Structural Audits**	**Hrs.10**
Design of Experiments: Analysis of variance. Data Classification, Completely randomized, randomized block, Factorial experiments, Yates technique Multivariate Data Analysis: Multivariate normal distributions. Mean vector, variance, covariance matrix and correlation matrix, Step wise regression, Selection of best subject of variables, Classification and discrimination problems, Factor analysis, Principal component analysis. Data analysis using software's		

Guidelines for Term Work:	
	Student shall critically read recent three to four journal articles within the broader field of their prospective specializations to identify research and knowledge gaps and accordingly formulate specific research questions. On the basis of these research questions student will retrieve

	additional relevant information and prepare well-articulated and content rich introductory problem description as well as proposed research methodology notes. The subject teacher and research guide of the student shall assess this jointly.

Text Books:	
1	Gupta S. C. and Kapoor V. K, "Fundamentals of Mathematical Statistics", Sultan Chand & Company New Delhi.
2	Gupta S. C. and Kapoor V. K, "Fundamentals of Applied Statistics", Sultan Chand & Com. N.Delhi.
3	Montogomery D. C., "Probability and Applied Statistics for Engineers", Wiley Int.Student Edition
4	Walpole Ronald E, Myers Raymond H and Myers Sharon L, "Probability & Statistics for Engineers and Scientists", 6thEdition, Prentice Hall.
5	Ross S. M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edi, Elsevier

Reference Books:	
1	Johnson R. and Wichern, "Applied Multivariate Statistical Analysis", 3rd Edi, Prentice Hall India
2	Douben K. J., "Research Methodologies – Principles and Guidelines of Applied Scientific Research", UNESCO-IHE Lecture Notes LN0317/06/01, Delft, the Netherlands.
3	Holtom D. and E. Fisher, "Enjoy Writing Your Science Thesis - a Step by Step Guide to Planning and Writing Dissertations and Theses for Undergraduate and Graduate Science Students", Imperial College Press. ISBN 1-86094-207-5, London, UK.
4	Kumar R., "Research Methodology- a Step-by-step Guide for Beginners", Sage Publi.. ISBN 0-7619-6213-1. London, UK.
5	Johnson R. and Wichern, "Applied Multivariate Statistical Analysis", 3rd Edi, Prentice Hall India

SUBJECT CODE	PG Laboratory –II	CREDITS
MCVIEMELP 206		2

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	4	2	25	--	25	50

Course Contents

Laboratory Work: The students are expected to submit total 10 assignments or Project report
It shall consist of 2 assignments/assigned work based on each of the 5 subjects of First year Term –II. Assignments may consists of theory questions, work study, site reports or software based work Journal shall consist of these assignments. Oral will be taken based on term work.

SUBJECT CODE	Mini -Project	CREDITS
MCVIEMELP 207		4

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	8	4	25	--	25	50

Course Contents

Laboratory Scheme:

Mini project shall be based on one of the topic chosen in consultation with the supervisor. Mini project may be interdisciplinary nature. Areas of recent techno-management development shall be explored. Research innovations may be considered as prospective areas. Mini project may be related with main project to explore possibilities of continuation further and to study the pre-requisites.

SUBJECT CODE		CREDITS

MCVIEMHMP 208	History of Construction Technology in India						3
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	-	-	3	20	20	60	100

Course Objectives	
CO1	To understand the evolution of ancient Indian construction techniques and materials across different historical periods.
CO2	To explore traditional construction materials and their sourcing, processing, and environmental adaptability.
CO3	To analyze the engineering principles, structural systems, and architectural innovations in ancient Indian monuments.
CO4	To examine methods for documenting, preserving, and adapting ancient construction knowledge for modern applications.

Course Outcomes: Students will be able to	
CO1	Learn historical advancements in construction technology in India.
CO2	Iidentify and evaluate the properties and uses of traditional Indian construction materials.
CO3	Ddevelop skills in analysing structural and architectural principles used in ancient Indian buildings.
CO4	Uunderstand preservation techniques and apply conservation principles to historical structures.

Course Contents

Module 1	**Introduction**	**Hrs. 8**
Evolution of construction techniques through time - Early Indus Valley Civilization, Vedic and Post-Vedic Era, British Raj, Late 20th Century Developments (Materials, Notable Structures, Technology and Techniques). Traditional Construction Materials - Local materials, Techniques for sourcing and processing materials, Material durability and environmental adaptability. Engineering Principles in Ancient Construction.		
Module 2	**Construction Techniques of Ancient Structures**	**Hrs. 8**
Building Types in Ancient India, Temple Architecture: Techniques and Symbolism, Construction of Forts, Palaces, and Stepwells, Earthquake-Resistant and Sustainable Practices - Damping systems and flexibility for seismic resilience, Sustainability of materials and energy-efficient practices, Examples of earthquake-resistant ancient buildings.		
Module 3	**Structural Analysis of Monumental Structures**	**Hrs. 6**
Case Studies in Ancient Structural Engineering, Load-Bearing Structures and Their Stability, Foundation Systems and Their Evolution, Column and Beam Constructions.		
Module 4	**Preservation of Ancient Indian Construction**	**Hrs. 6**
Documentation of Ancient Construction Knowledge, Restoration and Conservation Techniques, Impact and Influence of Ancient Techniques on Modern Construction, Practical Applications.		

Reference Books:	
1	Building Construction and Materials" by Dr. S.K. Duggal
2	Indian Architecture: Hindu, Buddhist, and Jain" by Percy Brown
3	Structural Analysis of Historical Constructions" by Paulo B. Lourenço and Francisco Milani
4	Principles of Structural Stability Theory" by Alexander Chajes
5	Conservation of Architectural Heritage" by C.A. Brebbia and R. Laing

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Semester-III										
1	MCVIEMMDP 301	MOOC/SWAYAM/ NPTEL PLATFORM COURSES/Self Study. (It is desirable to choose one course from each of PE,OE &AE)	3	--	--	20	20	60	100	3
2	MCVIEMMDP 302		3	--	--	20	20	60	100	3
3	MCVIEMHMP 303		3	--	--	20	20	60	100	3
4	MCVIEMELP 304	Seminar-I	--	--	4	25	--	25	50	2
5	MCVIEMELP 305	Dissertation Stage -I	--	--	24	50	--	50	100	12
		TOTAL	**9**	**--**	**24**	**135**	**60**	**255**	**450**	**21**

SUBJECT CODE	Multidisciplinary Minor Courses	CREDITS
MCVIEMMDP 301 MCVIEMMDP 302 MCVIEMHMP 303		3

Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Contents

Course Contents

Multidisciplinary Minor Courses
MOOC/SWAYAM/ NPTEL -Project Management and Intellectual Property Rights (Self Study)
Student may select this course either from MOOC/SWAYAM/ from NPTEL pool or any other approved reputed sourc
The submission of course completion certificate is mandatory.
MCVIEMMDP 301/302, MCVIEMHMP 303 - Institute has to take care of registration of subjects with detailed syllabu
in first two weeks of beginning of the semester with exam department of DABATU.

SUBJECT CODE	Seminar I			CREDITS			
MCVIEMELP 304				2			
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	4	2	25	--	25	50

Guidelines for Seminar

Seminar I shall be presented on one of the advanced topics chosen in consultation with the supervisor. Students must study latest literature. The concepts must be clearly understood and presented by the student. The student should use all modern methods of presentation. The student expects minimum 03 presentations within period of semester. A hard copy of the report should be submitted before delivering the seminar. A copy of the report in soft form must be submitted to the Supervisor along with other details, if any.

SUBJECT CODE	Dissertation Stage-I			CREDITS			
MCVIEMELP 401				12			
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	24	24	50	--	50	100

Course Contents

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for M. Tech. in Civil Engineering with Specialization in Infrastructure Engineering and Management

Dissertation Stage-I

Students can take Industry Internship along with Dissertation Stage –I. Students must maintain regular reporting with Dissertation supervisor regarding status of Dissertation. Dissertation -I is an integral part of the final project work. In this, the student shall complete the partial work of the Dissertation which will consist of problem statement, literature review, project overview, scheme of implementation that may include mathematical model/block diagram/ PERT chart, and layout and design of the proposed system/work.

As a part of the progress report of project-I work; the candidate shall deliver a presentation on progress of the work on the selected dissertation topic. It is desired to publish the paper on the state of the art on the chosen topic in international conference/ journal. The student shall submit the duly certified progress report of Dissertation Stage -I in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.

Sr. No.	Course Code	Course Title	Teaching Scheme	Evaluation Scheme	

			L	T	P	ISE	MSE	ESE	Total	
Semester-IV										
1	MCVIEMELP 401	Dissertation Stage-II	--	--	40	100	--	100	200	20
		TOTAL	**--**	**--**	**40**	**100**	**--**	**100**	**200**	**20**

SUBJECT CODE	Dissertation Stage-II			CREDITS			
MCVIEMELP 401				20			
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
0	0	40	40	100	--	100	200

Course Contents

Dissertation Stage-II
In Dissertation Stage-II , the student shall complete the remaining part of the project, which will consist of the simulation/ analysis/ synthesis/ implementation / fabrication of the proposed project work, work station, conducting experiments and taking results, analysis and validation of results and drawing conclusions. It is mandatory to publish the paper on the state of the art on the chosen topic in international conference/ journal. The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.