Course Title	ENTREPRENEURSHIP AND ENGINEERING MANAGEMENT	Semester	V
Course Code	MVJ19EEM51	CIE	50
Total No. of Contact Hours	40 L: T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3Hrs

Course objective is to: This course will enable the students to

- Introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
- Explain need of coordination between the manager and staff, the social responsibility of business and leadership.
- Explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship.
- Discuss the importance of Small-Scale Industries and the related terms and problems involved.
- Explain project feasibility study and project appraisal and discuss project financing.

Module-1	L1 ,L2	8Hrs.

Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art &Profession.

Planning: Nature, Importance and Purpose of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.

Laboratory Sessions/ Experimental learning

- Case study on decision making process in a corporate.

Applications

- Planning in engineering field.

Web Link and Video Lectures

- https://nptel.ac.in/courses/110/105/110105146/
- https://nptel.ac.in/courses/122/108/122108038/

Module-2	L1, L2	8Hrs.

Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Vs Decentralization of Authority and Responsibility, Span of Control, Nature and

Importance of Staffing, Process of Selection and Recruitment.

Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories, Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling.

Laboratory Sessions/ Experimental learning

- Case study of steel plant departmentalization.

Applications

- Effective communication in a corporate.

Web Link and Video Lectures

- https://nptel.ac.in/content/storage2/courses/122106031/slides/3_2s.pdf
- https://www.slideshare.net/100005130728571/27-nature-of-directing

Module 3	L1,L2	8Hrs.

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance.

Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.

Laboratory Sessions/ Experimental learning

- Case study of a startup.

Application

- Social auditing in a software company

Web Link and Video Lectures

- https://nptel.ac.in/courses/110/106/110106141/
- https://nptel.ac.in/courses/127/105/127105007/

Module 4	L1,L2	8Hrs.

Modern Small Business Enterprises: Role of Small-Scale Industries, Concepts, and definitions of SSI

Enterprises, Government policy and development of the Small-Scale sector in India, Growth and Performance of Small-Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).

Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central– Level Institutions, State-Level Institutions.

Laboratory Sessions/ Experimental learning

- Case study on the growth of small-scale industries.

Application

- Small Scale Industries

Web Link and Video Lectures

- https://www.slideshare.net/syedmubarak15/institutional-support-for-business-enterprises
- https://www.wto.org/english/docs_e/legal_e/gatt47_01_e.htm

Module-5	L1,L2	8Hrs.

Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification-

Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation. New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM.

Laboratory Sessions/ Experimental learning

- Investigation on the market in correspondence to project.

Application

- Preparations of project report.

Web Link and Video Lectures

- https://www.projectmanager.com/project-scheduling
- https://kissflow.com/project/basics-of-project-scheduling/

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Course outcomes: At the end of the course, the student will be able to

CO1	Describe the concept of Management
CO2	Assess staffing process
CO3	Identify the social responsibilities of business towards Different Groups
CO4	Explain the Role of Small Scale Industries

CO5	Interpret the Project Objectives
Textbooks:	
1.	Tripathy PC & Reddy PN, "Principles of Management" , Tata McGraw Hill, 1999
2.	Management and Entrepreneurship by NVR Naidu and T. Krishna Rao, I.K. International Publishing House Pvt, Ltd. New Delhi
Reference Books:	
1.	Stephen P. Robbins & Mary Coulter, Management‖, Prentice Hall (India) Pvt. Ltd., 10thEdition, 2009
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert , Management‖, Pearson Education,6th Edition, 2004.
3.	Stephen A. Robbins & David A. Decenzo& Mary Coulter, Fundamentals of Management‖ Pearson Education, 7th Edition, 2011.
4.	Robert Kreitner& Mamata Mohapatra, Management‖, Biztantra, 2008.
5.	Harold Koontz & Heinz Weihrich , "Essentials of management",‖ Tata McGraw Hill,1998.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	-	-	-	1	2	3	3	3	3
CO2	1	2	1	-	2	-	1	2	3	3	3	3
CO3	1	2	1	-	2	-	1	2	3	3	3	3
CO4	1	2	1	-	-	-	1	2	3	3	3	3
CO5	1	3	1	-	2	-	1	2	3	3	3	3

High-3, Medium-2, Low-1

Course Title	HIGHWAY ENGINEERING	Semester	V
Course Code	MVJ19CV52	CIE	50
Total No. of Contact Hours	50 L : T : P :: 3 : 2 : 0	SEE	50
No. of Contact Hours/week	5	Total	100
Credits	4	Exam. Duration	3 Hrs

Course objective is to: This course will enable the students to

- Brief on different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
- Explain on Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
- Detail on different aspects of geometric elements and train them to design geometric elements of a highway network.
- Analyze pavement and its components, pavement construction activities and its requirements.
- Evaluate the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts.

Module-1	L1, L2	10 Hrs.

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute

Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4ththwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021.

Laboratory Sessions/ Experimental learning

- Traffic volume count, Extensive Survey

Camp. Applications

- Selection of centerline for road project

Module-2	L1, L2	10 Hrs.

Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed

survey, Reports and drawings for new and re-aligned projects.

Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.

Laboratory Sessions/ Experimental learning

- Traffic volume count, Extensive Survey

Camp Applications

- DPR preparation, Designing of Highway elements

Module-3	L1, L2	10 Hrs.

Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates-Desirable properties and tests, Bituminous materials Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material

Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples

Laboratory Sessions/ Experimental learning

- Highway Material lab. Geo-Technical

Lab Applications

- Understanding the properties of Highway materials

Module-4	L1, L2	10 Hrs.

Pavement Construction: Design of soil aggregate mixes by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction.

Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of (i) Granular Sub base, (ii) WBM Base, (iii) WMM base, (iv) Bituminous Macadam, (v) Dense Bituminous Macadam,(vi) Bituminous Concrete, (vii) Dry Lean Concrete sub base and PQC,(viii) concrete roads.

Laboratory Sessions/ Experimental learning

- Understanding the properties of Highway

materials Applications

- To understand the pavement construction procedure

Module-5	L1, L2	10 Hrs.

Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic

analysis - annual cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing- BOT-BOOT concepts

Laboratory Sessions/ Experimental learning:

- Identification of best suitable subsurface drainage system

Applications:

- Designing the Highway drainage

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Course outcomes: At the end of the course, the student will be able to

CO1	Restate the different modes of transportation, history, organizations. Also understanding of planning, types of roads and highway projects.
CO2	Get insight in to alignment, essential surveys and geometrical elements with specifications as per IRC and design of highway geometric elements
CO3	Understand the pavement and its components and design of the pavement
CO4	Understand pavement and its components, pavement construction activities and its requirements
CO5	Understand pavement and its components, pavement construction activities and its requirements Evaluating the highway economics by B/C, NPV, IRR, methods and also to introduce highway financing concepts.

Text Books:

1.	S K Khanna and C E G Justo, " Highway Engineering", Nem Chand Bros, Roorkee, 1991
2.	L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi. 2017

Reference Books:

1.	R Srinivasa Kumar, "Highway Engineering", University Press. 2001

2.	K.P.subramanium, "Transportation Engineering", SciTech Publications, Chennai. 2000
3.	Relevant IRC Codes
4.	Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi. 2002
5.	C. JotinKhisty, B. Kent lal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi. 1998.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	-	1	-	-	-	1	-	1	1
CO2	2	1	2	-	1	-	-	-	1	-	1	1
CO3	2	1	2	-	1	-	-	-	1	-	1	1
CO4	2	1	2	-	1	-	-	-	1	-	1	1
CO5	2	1	2	-	1	-	-	-	1	-	1	1

High-3, Medium-2, Low-1

Course Title	ADVANCED GEOTECHNICAL ENGINEERING	Semester	V
Course Code	MVJ19CV53	CIE	50
Total No. of Contact Hours	50 L : T : P :: 3 : 2 : 0	SEE	50
No. of Contact Hours/week	5	Total	100
Credits	4	Exam. Duration	3 Hrs

Course objective is to: This course will enable the students to

- Understand the importance of Subsurface investigation in various Civil Engineering Projects.
- Compute the stresses in soil due to various types of loading.
- Conceptually use various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
- Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow foundation fulfilling settlement criteria.
- Design of Pile foundation as per the specifications

Module -1	L3	10 Hrs.

Prerequisites: *Index and Engineering properties of soil*

Soil Exploration: Objectives of soil exploration, Methods of exploration-Boring, Geophysical method- Seismic refraction method -Problems, Types of samples- Undisturbed, disturbed and representative samples , bore hole log, Depth, Number and disposition of bore holes

Drainage and Dewatering: .Objectives of Dewatering- Methods of Dewatering- Ditches and sumps, well point system, Vacuum Method, Electro- Osmosis method.

Demonstration of auger boring

Laboratory Sessions/ Experimental learning: (Self Learning)

- Demonstration of auger boring

Applications: (Self Learning)

- Understanding the scope of the subject.
- Identifying different types of soil.
- Knowledge about dewatering, soil exploration and its practical use.

Video link / Additional online information: (Self Learning)

- https://www.digimat.in/nptel/courses/video/105105185/L55.html
- https://nptel.ac.in/courses/105/105/105105168/

Module-2	L3	10 Hrs.

Prerequisites: Effective stress, Total stress, and Pore water pressure

Stress in Soils: Boussinesq's and Westergaard's Analysis for concentrated load Boussinesq's analysis -circular loading, equivalent method, Rectangular loading, pressure distribution diagrams-On horizontal and vertical planes due to Boussinesq's point load Newmark's chart – Construction and Use

Settlement: Computation of immediate and consolidation settlement

Graphical method: Newmark's chart

Applications: (Self Learning)

- Design of foundation for various civil structures:
- As foundation resting on soil carries load of any particular structure, geotechnical engineering is applicable to design such stable foundations for various loads.

Video link / Additional online information: (Self Learning)

- https://www.digimat.in/nptel/courses/video/105105185/L55.html
- https://nptel.ac.in/courses/105/105/105105168/

Module-3	L3	10 Hrs.

Prerequisites: Effective stress, Total stress, and Pore water pressure

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesion-less and cohesive soils, Coulomb's theory-Rebhann's and Culmann's graphical construction.-Only for coarse grained soils.

Stability of Slopes: Assumptions, infinite and finite slopes, Swedish slip circle method for C and C-Φ (Method of slices) soils, Friction Circle method.

Graphical method: Method of slices, Rebhann's and Culmann's method .

Applications: (Self Learning)

- Design of earth retaining structures: Geotechnical engineering is also applicable to design and construct earth retaining structures like retaining wall and sheet pile useful for hill roads, landslides.

Video link / Additional online information: (Self Learning)

- https://www.digimat.in/nptel/courses/video/105105185/L55.html
- https://nptel.ac.in/courses/105/105/105105168/

Module-4	L3	10 Hrs.

Prerequisites: Types of shallow and deep foundation

Bearing Capacity of Shallow Foundation: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), General, Local and Punching

shear failure. Effect of water table and eccentricity on Bearing capacity, Plate load test.
Proportioning of shallow foundations: Isolated and combined footings (only two columns)

Model making : Different types of shallow foundation
Applications: (Self Learning)

- To determine the bearing capacity of the soil of the selected foundation

Video link / Additional online information: (Self Learning)

- https://www.digimat.in/nptel/courses/video/105105185/L55.html
- https://nptel.ac.in/courses/105/105/105105168/

Module-5	L3	10 Hrs.

Prerequisites: Types of shallow and deep foundation
Pile Foundations: Types and classification of piles, Pile load capacity in cohesion-less and cohesive soils by static formula, efficiency of file group, group capacity of piles in cohesion-less and cohesive soils , negative skin friction, Settlement of piles, under reamed piles (only introductory concepts – no derivation)
Model making: Under-reamed pile foundation

Applications: (Self Learning)

- Design of foundation for various structures: Foundation is required to transfer the load of super structure to foundation soil and to give stability to the super structure.
- The size and type of foundation is affected by the bearing capacity of soil.
- The GTE helps in design of foundation by investigating bearing capacity of soil.

Video link / Additional online information: (Self Learning)

- https://www.digimat.in/nptel/courses/video/105105185/L55.html
- https://nptel.ac.in/courses/105/105/105105168/

Course outcomes: On completion of the course, students would be able to	
CO1	Plan and execute geotechnical site investigation program for different civil engineering projects
CO2	Explain stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
CO3	Estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
CO4	Determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
CO5	Capable of estimating load carrying capacity of single and group of piles

Textbooks:	
1.	GopalRanjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2.	Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
Reference Books:	
1.	Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
2.	Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India
3.	T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	1	1	-	1
CO2	3	3	-	1	-	-	-	-	1	1	-	1
CO3	3	3	-	1	-	-	-	-	1	1	-	1
CO4	3	3	1	2	1	-	-	-	1	1	-	1
CO5	3	3	1	2	1	-	-	-	1	1	-	1

High-3, Medium-2, Low-1

Course Title	WATER SUPPLY AND TREATMENT ENGINEERING	Semester	V
Course Code	MVJ19CV54	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs.

Course objective is to: This course will enable the students to

- Analyze the variation of water demand and to estimate water requirement for a community.
- Evaluate the sources and conveyance systems for raw and treated water.
- Relate drinking water quality standards and to illustrate qualitative analysis of water.
- Design physical, chemical and biological treatment methods to ensure safe and potable water Supply.
- To have adequate knowledge on operation and maintenance of water supply and treatment process.

Prerequisites: *Environmental Studies, Introduction to Environmental engineering.*

Module-1	L1, L2	8 Hrs

Introduction: Need for protected water supply. Demand of Water: Types of water demands - domestic demand, industrial, institutional, and commercial, public use, fire demand estimation factors affecting per capita demand, Variations in demand of water, Peak factor.

Design period and factors governing design period. Methods of population forecasting and numerical problems.

Laboratory Sessions/ Experimental learning:

- Population Forecasting and Urban Planning Practice: A Case Study

Applications:

- Water treatment

Video link:

- https://nptel.ac.in/courses/105105201/

Module-2	L1,L2,L3	8 Hrs

Sources, Collection and Conveyance of Water: Surface and subsurface sources and Suitability with regard to quality and quantity.
Intake structures – types. Factors to be considered in selection of site for intake structures.
Collection and Conveyance of water: Types of pumps with working principles and numerical problems. Design of the economical diameter for the rising main.
Pipe appurtenances, Valves, Fire hydrants and different pipe materials with their advantages and disadvantages. Factors affecting selection of pipe material.

Laboratory Sessions/ Experimental learning: Based on population and per capita demand selection of water source, and design a intake structure to withdraw water from source: A Case Study
Applications:

- Water treatment

Video link:

- https://nptel.ac.in/courses/105105201/

Module-3	L1	8 Hrs

Quality of Water: Objectives of water quality management. Concept of safe water, wholesome & palatability, water borne diseases. Sampling: Objectives, methods, and preservation techniques Examination of water: Objectives-physical, chemical, and microbiological Examinations (BIS 3025 and BIS 1622) using analytical and instrumental techniques. Drinking water standards BIS and WHO guidelines.
Water Treatment: Objectives, Unit flow diagrams – significance of each unit: Aeration process, and Types.

Laboratory Sessions/ Experimental learning:

- Determine the physical and chemical characteristics of the given ground water sample.

Applications:

- Water treatment

Video link:

- https://nptel.ac.in/courses/105105201/

Module-4	L1,L3	8 Hrs

Sedimentation: Theory, settling tanks, types, and design. Coagulation and flocculation, Clari-flocculators (circular and rectangular). Theory, types of coagulants, coagulant feeding devices. Jar test apparatus
Filtration: mechanism, theory of filtration, types of filters: slow sand, rapid sand, and pressure filters. Operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.

Laboratory Sessions/ Experimental learning:

Design and fabricate low-cost potable filtration unit for the treatment of surface water source.

Applications:

- Water treatment

Video link:

- https://nptel.ac.in/courses/105105201/

Module-5	L1,L2	8 Hrs

Miscellaneous treatment Process: Softening: Lime soda and Zeolite process. Estimation of Hardness. Fluoridation and De-fluoridation, Nalgonda Technique.

Disinfection: Theory of disinfection. Methods of disinfection with merits and demerits. Chlorination: Types, Forms of application of Chlorination, Chlorine Demand, Break – point Chlorination.

Distribution system: Methods: Gravity, Pumping and Combined gravity and pumping system Types of Distribution system. Service reservoirs and their capacity determination.

Laboratory Sessions/ Experimental learning:

- Determination of fluoride in the given ground water sample

Applications:

- Water treatment

Video link:

- https://nptel.ac.in/courses/105105201/ https://nptel.ac.in/courses/105105201/

Course outcomes: On completion of the course, students would be able to

CO1	Estimate average and peak water demand for a community
CO2	Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community
CO3	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
CO4	Design a comprehensive water treatment process to purify water to the required quality standards.
CO5	Design a network of water distribution system and operation and maintenance of water supply

Scheme of Evaluation		
Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Textbooks:	
1.	S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2015
2.	B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2016.

Reference Books:	
1.	Howard S. Peavy, Donald R. Rowe, George T, Environmental Engineering - McGraw Hill International Edition, New York 2000
2.	CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
3.	Mark.J Hammer, Water & Wastewater Technology, John Wiley & Sons Inc., New York,2008.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	2	2	1	1	-	2	1
CO2	3	3	2	1	-	1	2	-	1	1	2	1
CO3	3	3	2	1	-	2	2	-	1	1	2	1
CO4	3	3	2	2	-	2	2	-	1	1	2	1
CO5	3	3	2	2	-	2	2	-	1	1	1	1

High-3, Medium-2, Low-1

Course Title	NUMERICAL METHODS AND APPLICATIONS	Semester	V
Course Code	MVJ19CV551	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs

Course objective is to: This course will enable the students to

- Provide the necessary basic and advanced concepts in Transportation Problems
- Illustrate on assignments problems, game theory, decision analysis and numerical methods
- State the procedures for solving different kinds of problems occurring in engineering and technology

Module-1	L1, L2, L3	8 Hrs.

Transportation Problems

The initial Basic feasible solution to transportation problem: North-West Corner Rule, The Row Minima Method, The Column Minima Method, Matrix Minima method, Vogel's Approximation Method.

Module-2	L1, L2, L3	8 Hrs.

Assignment Problems

Mathematical formulation of Assignment Problem, Solution of assignment problem: Complete Enumeration Method, Transportation Method, Simplex Method, Hungarian Assignment Method

Module-3	L1, L2, L3	8 Hrs.

Game Theory

Introduction, two-person zero-sum game, some basic terms, the maxmin and minmax principle, Pure Strategy problems, games without saddle points-mixed strategies problems, graphical solutions of 2*n and m*2 games, dominance property.

CPM & PERT- project scheduling, critical path calculations, Crashing

Module-4	L1, L2, L3	8 Hrs.

Decision Analysis

Types of Decisions, Components of Decision-Making, Decision-making problems, Laplace Criterion

(Baye's Criterion Rationality), Maximin, Minmax, Maximax, Minimax, Savage, Hurwicz criterion, The expected Monetary Value, Expected value of perfect information, the expected opportunity loss, marketing problem production problem, Inventory problem, reliability and

newspaper problem and steel production problem.		
Module-5	**L1, L2, L3**	**8 Hrs.**
Numerical Methods: Boundary Value Problems in Ordinary and Partial Differential Equations: Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two-dimensional Laplace's. Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.		

Course outcomes: On completion of the course, students would be able to

CO1	Build and solve Transportations models by Approximation method
CO2	Build and solve Assignment models by Simplex method
CO3	Solve with two players game and end of the module, students can able to find the value of the game & gain the knowledge to solve the real life problems
CO4	Identify the alternative course of action is a direct effect to decision theory.
CO5	Solve the numerical problems in engineering and technology.

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Textbooks:

1.	S.D. Sharma, "OPERATIONS RESEARCH Theory, Methods & Applications, ISBN: 978-93- 80803-38-8, KNRN Publications, 17TH Edition, New Delhi.2009
2.	SankaraRao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi, 2007.

Reference Books:

1.	Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2010.

2.	Ravindran A, Philips D.T & Solbery. J.J, Operations Research: Principles and practise, John Wiley & Sons, New Yark, 1987.
3.	Hillier. F. S & Liberman. G. J, Operations Research, Second Edition, Holden Day inc, 1974

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	2	-	1	-	-	2	-	-	1
CO2	1	2	1	2	-	1	-	-	2	-	-	1
CO3	1	2	1	2	-	1	-	-	2	-	-	1
CO4	1	2	1	2	-	1	-	-	2	-	-	1
CO5	1	2	1	2	-	1	-	-	2	-	-	1

High-3, Medium-2, Low-1

Course Title	MATRIX METHODS OF STRUCTURAL ANALYSIS	Semester	V
Course Code	MVJ19CV552	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs

Course objective is to: This course will enable the students to

- Use principles of structural analysis.
- Solve for forces and moments of indeterminate structures using principle of matrix method.
- Investigate the internal forces of various types of beams, frames & trusses.
- Examine the force and displacement parameters of the structures.

Module-1	L2,L3	8 Hrs.

Prerequisites: *Concepts of Analysis of Structures, SFD & BMD, Strain Energy & Energy Concepts*

Fundamental concepts: Static and Kinematic indeterminacy, Concepts of stiffness and flexibility. Energy concepts. Principle of minimum potential energy and minimum complementary energy. Development of element flexibility and element stiffness matrices for truss, beam and grid elements.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Computation of Forces & Displacements using structural software
- Computation of Forces & Displacements using EXCEL Sheet

Applications: (Self Learning)

- Calculations of Forces & Moments due to external and unit load application
- To check the behavior of Beams, Trusses & Frames

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/content/storage2/courses/112108092/module4/lec27.pdf
- https://nptel.ac.in/courses/105/105/105105180/

Module-2	L3	8 Hrs.

Prerequisites: *Concepts of Analysis of Structures, SFD & BMD, Strain Energy & Energy Concepts*

Analysis using Flexibility method: Force transformation matrix using Flexibility method, Development of global flexibility matrix for continuous beams, plane trusses and rigid plane frames (having not more than six co-ordinates – 6x6flexibility matrix) Analysis of continuous

beams, plane trusses and rigid plane frames by flexibility method (having not more than 3 coordinates – 3x3 flexibility matrix.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Computation of Forces & Displacements using structural software
- Computation of Forces & Displacements using EXCEL Sheet

Applications: (Self Learning)

- Development of global flexibility matrix for different structural elements
- Analyzing the behavior of Beams, Trusses & Frames using flexibility method

Video link / Additional online information: (Self Learning)

- https://web.iitd.ac.in/~sbhalla/flexibility.pdf
- https://nptel.ac.in/content/storage2/courses/105105109/pdf/m2l7.pdf

Module-3	L2,L3	8 Hrs.

Prerequisites: Concepts of Analysis of Structures, SFD & BMD, Strain Energy & Energy Concepts

Analysis using Stiffness Method: Displacement transformation matrix using Stiffness Method, Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames (having not more than six co-ordinates – 6x6 stiffness matrix) Analysis of continuous beams, plane trusses and rigid plane frames by stiffness method (having not more than 3 coordinates – 3x3 stiffness matrix)

Laboratory Sessions/ Experimental learning: (Self Learning)

- Computation of Forces & Displacements using structural software
- Computation of Forces & Displacements using EXCEL Sheet

Applications: (Self Learning)

- Development of global stiffness matrix for different structural elements
- Analyzing the behavior of Beams, Trusses & Frames using stiffness method

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/content/storage2/courses/105105109/pdf/m4l30.pdf

Module-4	L3	8 Hrs.

Prerequisites: Concepts of Analysis of Structures, SFD & BMD, Temperature Stresses

Effects of temperature change and lack of fit: Related numerical problems by flexibility and stiffness method as in Module 2 and 3.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Computation of Forces & Displacements using structural software
- Computation of Forces & Displacements using EXCEL Sheet

Applications: (Self Learning)

- Analyzing the behavior of structural elements subjected to temperature stresses
- Analyzing the behavior of Trusses due to Lack of fit

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105/105/105105180/

Module-5	L3	8 Hrs.

Prerequisites: Matrix methods, Redundant Forces, Static & Kinematic Indeterminacies

Solution techniques: Solution techniques including numerical problems for simultaneous equations, Gauss elimination and Cholesky method. Bandwidth consideration.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Computation of Forces & Displacements using structural software
- Computation of Forces & Displacements using EXCEL Sheet

Applications: (Self Learning)

- Calculation of Forces & Displacements using matrix methods

Video link / Additional online information: (Self Learning)

- https://www.stat.cmu.edu/~ryantibs/convexopt-S15/scribes/09-num-lin-alg-scribed.pdf
- https://atozmath.com/example/CONM/GaussEli.aspx?he=e&q=CD2

Course outcomes: On completion of the course, students would be able to

CO1	Illustrate problem solving skills
CO2	Examine the principles of Structural Analysis
CO3	Use analytical skills
CO4	Write the Solution techniques
CO5	Investigate the behavior of structure.

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Textbooks:	
1.	Rajasekaran S, Computational Structural Mechanics, Prentice Hall of India, New Delhi, 2001
2.	Manickaselvam V.K., Elements of Matrix and Stability Analysis of Structures, Khanna Publishers, New Delhi, 1998.

Reference Books:	
1.	Moshe, F., Rubenstein, Matrix Computer Analysis of Structures, Prentice Hall, New York, 1986.
2.	W.Weaver and J.H.Gere, "Matrix Analysis of Framed Structures", Van Nastran, 1980.
3.	A.K.Jain "Advanced Structural Analysis with Computer Application" Nemchand and Brothers, Roorkee, India.
4.	M.F.Rubinstein "Matrix Computer Methods of Structural Analysis "Prentice – Hall.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	-	-	-	-	-	-	1
CO2	1	1	1	1	-	-	-	-	-	-	-	1
CO3	2	2	2	1	-	-	-	-	-	-	-	1
CO4	1	1	2	1	-	-	-	-	-	-	-	1
CO5	2	1	2	2	-	-	-	-	-	-	-	2

High-3, Medium-2, Low-1

Course Title	ALTERNATE BUILDING MATERIALS AND TECHNOLOGY	Semester	V
Course Code	MVJ19CV553	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0: 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs

Course objective is to: This course will enable the students to

- Relate environmental issues due to building materials and the energy consumption in manufacturing building materials
- Demonstrate the various masonry blocks, masonry mortar and structural behavior of masonry under compression.
- Relate the alternative building materials in the present context.
- Explain the alternative building technologies which are followed in present construction field.

Module-1	L1 L2	8 Hrs.

Prerequisites: Basic Knowledge of different building materials.

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global Warming, and construction industry. Green concepts in buildings, green building ratings – IGBC and LEED manuals – mandatory requirements.

Rainwater harvesting & solar passive architecture. Environmentally friendly and cost-effective building technologies.

Laboratory Sessions/ Experimental learning (Self Learning):

- Developing models for Rainwater harvesting.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105102195/

Module-2	L1 L2	8 Hrs.

Elements of Structural Masonry : Elements of Structural Masonry, Masonry materials, requirements of masonry units : characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud blocks. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementitious materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and

requirements of mortar, selection of mortar.

Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials

and masonry, Design of masonry compression elements subjected to axial load (Only Theory)

Laboratory Sessions/ Experimental learning: (Self Learning)

- Presentation regarding different types of mortars

Applications: (Self Learning)

- Knowledge about the behaviour and strength of basic mortars.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105106197/

Module-3	L1 L2	8 Hrs.

Alternate Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from a ground industrial waste, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

Laboratory Sessions/ Experimental learning (Self Learning):

- Comparing different Alternate Building Materials

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105102195/

Module-4	L1 L2	8 Hrs.

Alternate Building Technologies: Alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferrocement and ferro concrete building components, Materials and specifications, Properties, Construction methods, Applications Top-down construction, Mivan Construction Technique.

Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Presentation on advantages of the above alternate building technologies

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105102195/

Module-5	L1 L2	8 Hrs.

Equipment for Production of Alternate Materials: Machines for manufacture of concrete, Equipment's for production of stabilized blocks, Moulds and methods of production of precast elements.

Cost concepts in buildings: Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Presentation on precast concrete elements.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105/102/105102012/

Course outcomes: On completion of the course, students would be able to

CO1	Identify the problems of Environmental issues concerned to building materials and cost effective building technologies.
CO2	Identify appropriate type of masonry unit and mortar for civil engineering constructions
CO3	Design Structural Masonry Elements under Axial Compression.
CO4	Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
CO5	Identify various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Textbooks:

1.	KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International publications.

2.	Arnold W Hendry, “Structural Masonry”, Macmillan Publishers.
Reference Books:	
1.	RJS Spence and DJ Cook, “Building Materials in Developing Countries”, Wiley publications.
2.	LEED India, Green Building Rating System, IGBC publications.
3.	IGBC Green Homes Rating System, CII publications.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	1	-	-	-	-	2	1
CO2	2	1	1	1	-	1	-	-	-	-	-	1
CO3	2	1	2	1	1	1	-	-	-	-	1	1
CO4	1	2	1	1	1	1	1	-	-	-	-	1
CO5	1	2	2	1	1	2	1	-	1	1	-	1

High-3, Medium-2, Low-1

Course Title	FINITE ELEMENT METHOD	Semester	V
Course Code	MVJ19CV554	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs

Course objective: Students will be able to,

- Outline Energy concepts in FEM problems
- Outline the concept of discretization in FEM and Various Co-ordinate system in FEM
- Predict shape function for higher order elements
- Examine the need of ISO, Sub and super parametric elements in FEM.
- Use some of the software in FEM

Module-1	L1, L2, L3	08 Hr.

Pre-requisites: *Basic Concepts of Strength of Materials, Mechanics of Deformable bodies, Equilibrium Concepts, Analysis of trusses.*

Introduction to Finite Element method: Various Numerical methods, Difference between Finite element and Finite difference method. Advantages and Disadvantages of FEM. Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Steps in finite element analysis, displacement approach, stiffness matrix for a Bar, Beam and Truss element. Problems on Bar element only.

Laboratory Sessions/ Experimental learning:

- Application of Energy principles to different structural elements.

Applications(Self learning)

- Solution to problems from Numerical methods.

Video link / Additional online information:

- https://nptel.ac.in/courses/105105108/
- https://nptel.ac.in/courses/105/102/105102090/

Module-2	L1, L2, L3	08 Hr.

Discretization and Coordinate System: Finite representation of infinite bodies and discretization of very large bodies, Different types of Coordinate system in FEM, Shape functions, Polynomial, LaGrange and Serendipity , one dimensional formulation; Analysis of Beams and Trusses with numerical examples.

Laboratory Sessions/ Experimental learning:

- Development of Shape function for Serendipity elements by Inspection.

Application:(Self learning)

- Verification of Suitability of Shape function using Serendipity concepts.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105105108/
- https://nptel.ac.in/courses/105/102/105102090/

Module-3	L1,L2L3	08 Hrs.

Shape functions: Convergence of Shape functions, Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, Axi symmetric Elements

Laboratory Sessions/ Experimental learning:

- Experimental study on Static Condensation of Nodes.

Application:(Self learning)

- Solution to Axi-symmetric problems using FEM Techniques.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105105108/
- https://nptel.ac.in/courses/105/102/105102090/

Module-4	L1,L2L3	08 Hrs.

Isoparametric Elements: Iso parametric, Sub parametric and Super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Iso parametric Elements, Numerical integration by Gaussian quadrature rule for one-, two- and three-dimensional problems

Laboratory Sessions/ Experimental learning:

- Practical application of Quadrature rule for one-, two- and three-dimensional problems

Application: (Self Learning)

- Numerical integration techniques in FEM.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105105108/
- https://nptel.ac.in/courses/105/102/105102090/

Module-5	L1, L2L3	08 Hrs.

Application of FEM in Civil Engineering: Analysis of Trusses, Frames, Beams & Bars, Determination of stresses in Soil, dams, Stresses in different layers of a flexible pavement due to loading. Exposure to FEM software's.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Hands on exposure to Use of Ansys Software.

Application :

- Solution to various structural engineering problems using FEM.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105105108/
- https://nptel.ac.in/courses/105/102/105102090/

Scheme of Evaluation:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	30
Quizzes		2x2 = 4
Activities / Experimentations related to courses/Assignment		8
Mini Projects / Case Studies		8
Semester End Examination	SEE (50)	50
	Total	100

Course outcomes: On completion of the course, students would be able to

CO1	Use the basic Knowledge of Energy concepts in FEM method.
CO2	Compose Shape functions for Different types of Elements
CO3	Solve the Basic Structural Engineering problems using FEM analysis
CO4	Design the concept of developing Shape functions for Higher order elements.
CO5	Use the various FEM Software's.

Textbooks:

1.	Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill,1900
2.	Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,1972

Reference Books:	
1.	Cook R D et.al., "Concepts and applications of Finite Element analysis ", John Wiley,1995
2.	S.S.Bhavikatti,"Finite Element Analysis, New age International Publishers, 2005.
3.	Bathe K J - " Finite Element Procedures in Engineering analysis "- Prentice Hall,2003
4.	A First Course in the Finite Element Method D L Logan (Indian Edition) CL Engineering

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	-	-	-	1	.	-	1
CO2	3	3	3	1	-	-	-	-	1	-	-	1
CO3	3	3	3	1	-	-	-	-	1	-	-	1
CO4	3	3	3	2	3	-	-	-	1	-	-	1
CO5	3	3	3	2	3	-	-	-	1	-	-	1

High-3, Medium-2, Low-1

Course Title	COMPUTER AIDED BUILDING PLANNING & DRAWING	Semester	V
Course Code	MVJ19CVL56	CIE	50
Total No. of Contact Hours	L : T : P :: 0 : 2 : 2	SEE	50
No. of Contact Hours/Week	4	Total	100
Credits	2	Exam Duration	3Hrs

Course objective is to: This course will enable the students to

- Identify, formulate, and solve engineering problems of RC elements subjected to different kinds of loading.
- Follow a procedural knowledge in designing various structural RC elements.
- Impart the culture of following the codes for strength, serviceability, and durability as an ethics.
- Provide knowledge in analysis and design of RC elements for the success in competitive examinations.

Module-1	L3,l4

Engineering design principles, interactive design using workstations, and software tools:

Usage of all draw tools. Usage of all modify tools.
Using Text: Single line text, Multiline text.
Special Features: View tools, Layers concept, Dimension tools, Hatching, creating blocks. Customizing toolbars, Working with multiple drawings
Introduction to Autocad 3D, basic tools, and commands

Module-2	L3, L4

Drawing of structural Detailing Elements:

Size Stone Masonry
Beam Detailing: Simply supported, Cantilever
Beam
Footing detailing: Isolated, Stepped.
Simple Steel Roof Truss with bolted connection.
Modeling of staircase and two room residential building using 3D modelling tools.

Module-3	L3, L4

Building Drawings and generation of design basis Report:

Educational Institution
Commercial building
Residential building
Multistorey structure

All drawings should be submitted with elevation and cross section with Plan showing sanitary and electrical layout.

Video link:

- http://www.nptelvideos.in/2012/12/computer-aided-engineering-design.html

Scheme of Evaluation:

Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

Course outcomes: On completion of the course, students would be able to	
CO1	Create drawings through editing and plotting techniques
CO2	Practice the AutoCAD commands for drawing 2D & 3D building drawings required for different Civil Engineering applications
CO3	Plan and draw Civil Engineering Buildings as per aspect and orientation

Reference Books:	
1.	SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards.
2.	Beginning AutoCAD 2015, by Cheryl R. Shroc.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	1	3	-	-	-	2	-	2	1
CO2	1	-	-	1	3	-	-	-	2	-	2	1
CO3	1	-	-	1	3	-	-	-	2	-	2	1

High-3, Medium-2, Low-

Course Title	HIGHWAY ENGINEERING LABORATORY	Semester	V
Course Code	MVJ19CVL57	CIE	50
Total No. of Contact Hours	L : T : P :: 0 : 2 : 2	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	2	Exam. Duration	3 Hrs

Course objective is to: This course will enable the students to

- Explain the properties of Aggregates and different test pertaining to Aggregates
- Explain procedures of conducting tests on bitumen.
- Demonstrate on properties of bitumen for field condition

Prerequisites: Basic geotechnical engineering, theory of stress & strain

S.NO	Experiments	L3,L4
1	Determination of Crushing strength of aggregates by Compression test.	
2	Determination of Toughness of an aggregate by Impact test.	
3	Determination of Hardness of an aggregate by Abrasion test.	
4	Shape tests on aggregates.	
5	Test on Stripping value of aggregates.	
6	Determination of penetration value of bitumen.	
7	Determination of softening point of bitumen using ring ball apparatus.	
8	Test on viscosity of bitumen.	
9	Test on ductility value of bitumen.	
10	Determination of flash and fire point of bitumen.	
11	Specific gravity test on bitumen.	
12	CBR Test	

Video link / Additional online information: (Self Learning)

- http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Transportation_Engineering_Lab/labs/index.html
- https://www.digimat.in/nptel/courses/video/105106203/L01.html

Course outcomes: On completion of the course, students would be able to

CO1	Test the aggregates for Crushing, Hardness and Toughness properties
CO2	Test neat bitumen for field applications
CO3	Restate the testing procedure on Aggregate and neat Bitumen

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	**50 marks**

Reference Books:	
1.	Highway Material Testing – S K Khanna- C.E.G. Justo , and Veera Raghavan A Nemchand Bros- Roorkee, 2010
2.	IS 456-2016, IS:383-1970, IS:2386-1 (1963) and IRC Publications
3.	ASTM Standards for Aggregate and Bitumen Testing

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	-	3	1	-	-	-	2	-	1	2
CO2	1	2	-	3	1	-	-	-	2	-	1	2
CO3	1	2	-	3	1	-	-	-	2	-	1	2

High-3, Medium-2, Low-1

Course Title	GEOTECHNICAL ENGINEERING LABORATORY	Semester	V
Course Code	MVJ19CVL58	CIE	50
Total No. of Contact Hours	L : T : P :: 0 : 2 : 2	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	2	Exam. Duration	**3 Hrs**

Course objective: Students should be able to,

- Examine laboratory tests and to classify the soil as per IS codal procedures
- Identify laboratory tests to determine index properties of soil
- Investigate shear strength and consolidation characteristics of soils

Prerequisites: Basic geotechnical engineering, theory of stress & strain

S.NO	Experiments	L3,L4
1	Determination of Specific Gravity of Soil Solids by Density Bottle Method	
2	Determination of Specific Gravity of Soil Solids by Pycnometer Method	
3	Determination of Water Content of Soil by Oven Drying Method	
4	Determination of Water Content of Soil by infrared moisture method-Demonstration	
5	Determination of Particle size Distribution by Sieve Analysis	
6	Determination of Particle size Distribution by Hydrometer analysis	
7	Determination of Field Density of Soil by Core-cutter Method	
8	Determination of Field Density by Sand Replacement Method	
9	Determination of the Liquid Limit by Casagrande Method	
10	Determination of the Liquid Limit by Cone Penetration Method	
11	Determination of Plastic Limit of the Soil	
12	Determination of Shrinkage Limit	
13	Moisture Content–Dry Density Relationship by Standard Proctor Compaction Test	
14	Moisture Content–Dry Density Relationship by Modified Proctor Compaction Test	
15	Determination of Permeability of a Soil sample by Constant-head Method	

16	Falling Head Permeability test for fine Grained Soils
17	Unconfined Compression Test.
18	Determination of Shear Parameters by Direct Shear Test
19	Determination of Shear Parameters of a given Soil sample of Soil by Triaxial Shear Test
20	One-Dimensional Consolidation Test -Demonstration
21	Vane Shear Test – Demonstration
22	Demonstration of Miscellaneous Equipment's such as Augers, Proctor's needle.
23	Demonstration of Determination of Relative Density of Sands.

Video link / Additional online information: (Self Learning)

- https://nptel.ac.in/courses/105/101/105101201/
- https://nptel.ac.in/courses/105/101/105101160/

Course outcomes: On completion of the course, students would be able to

CO1	Examine physical and index properties of the soil
CO2	Classify based on index properties and field identification
CO3	Identify OMC and MDD, plan and assess field compaction program
CO4	Analyze shear strength and consolidation parameters to assess strength and deformation characteristics.
CO5	Investigate in-situ shear strength characteristics (SPT- Demonstration)

Scheme of Evaluation	
Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Tota l	50 marks

Reference Books:	
1.	Punmia B C, Soil Mechanics and Foundation Engineering- (2017), 16th Edition, Laxmi Publications co., New Delhi.

2.	Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3.	Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4.	Bowles J.E., "Engineering Properties of Soil and Their Measurements",- McGraw Hill Book Co. New York
5.	Relevant Code Books

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	1	1	1	1	-	1	1	-	-
CO2	2	1	1	-	1	1	1	-	-	1	-	-
CO3	1	2	2	2	-	-	1	-	1	1	-	-
CO4	1	-	1	2	1	2	1	-	1	1	-	-
CO5	2	1	-	1	-	1	1	-	1	1	-	-

High-3, Medium-2, Low-1

Course Title	ENVIRONMENTAL STUDIES	Semester	V
Course Code	MVJ19ENV59	CIE	50
Total No. of Contact Hours	15 L: T: P :1 :0 :0	SEE	50
No. of Contact Hours/week	1	Total	100
Credits	1	Exam. Duration	3 Hrs.

Course objective is to: This course will enable the students to

- Relate to interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes; Study drinking water quality standards and to illustrate qualitative analysis of water.
- Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation and societal stability.

Prerequisites: *Basic Science*

Module-1	L1, L2	3 Hrs

Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.
Ecosystems (Structure and Function): Forest, Desert, Rivers, Ocean
Biodiversity: Types, Hot spots; Threats and Conservation of biodiversity, Deforestation.

Video link:

- https://nptel.ac.in/courses/127/106/127106004/

Module-2	L1,L2	3 Hrs.

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-study): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Video link:

- https://nptel.ac.in/courses/121/106/121106014/

Module-3	L1	3 Hrs.
Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects:** Bio-medical Waste; Solid waste; Hazardous waste; E-waste. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/105/105105160/		
Module-4	**L1,**	**3 Hrs.**
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming Climate Change; Acid Rain; Ozone Depletion; Fluoride problem in drinking water. Video link: • https://nptel.ac.in/courses/122/106/122106030/ • https://nptel.ac.in/courses/120108004/ • https://onlinecourses.nptel.ac.in/noc19_ge23/preview		
Module-5	**L1,L2**	**3 Hrs.**
Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO 14001. Video link: • https://nptel.ac.in/courses/105/102/105102015/ • https://nptel.ac.in/courses/120/108/120108004/		
Course outcomes: On completion of the course, students would be able to		

CO1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.

CO3	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.
CO4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Scheme of Evaluation		
Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE(50)	40
Quizzes / Assignment		10
Semester End Examination	SEE (50)	50
	Total	100

Textbooks:	
1.	Environmental Studies Benny Joseph Tata Mc Graw – Hill. 2nd Edition, 2012
2.	Environmental Studies S M Prakash Pristine Publishing House, Mangalore 3rd Edition, 2018.

Reference Books:	
1.	Principals of Environmental Science and Engineering, Raman Siva kumar, Cengage learning, Singapur, 2nd Edition, 2005
2.	Environmental Science – working with the Earth G.Tyler Miller Jr. Thomson Brooks /Cole, 11th Edition, 2006
3.	Textbook of Environmental and Ecology, Pratiba Singh, Anoop Singh & Piyush Malaviya ,ACME Learning Pvt. Ltd. New Delhi, 1st Edition.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	–	2	2	1	1	–	2	1
CO2	3	3	2	1	–	1	2	–	1	1	2	1
CO3	3	3	2	1	–	2	2	–	1	1	2	1
CO4	3	3	2	2	–	2	2	–	1	1	2	1

High-3, Medium-2, Low-1