Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

NEP Compliant Structure & Syllabus

of

Department of Civil Engineering

T. Y. B. Tech.

Effective from Academic Year 2026-27

by: - Board of Studies in Civil Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Chairman- BoS **Chairman – Academic Board**

Contents

Program Outcomes

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Academic Information – Please visit www.vit.edu

Program Specific Outcomes (PSO):

PSO1: Engineering graduates will be able to plan and execute the activities of construction projects

PSO2: Engineering graduates will be able to analyze and design components of Civil Engineering Systems.

Vishwakarma Institute of Technology

Issue 1 : Rev No. 00: Dt. 03/07/26

Title : Course Structure

FF No. 653_A

Branch : Civil Engineering Year: T.Y. Academic Year : 2026-27 Semester: I Module: 5 Pattern: 2024

Level 5.5

Course Code	NEP Course Category	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks													Credits			
			Theory	Tutorial	Practical	CVV	CP	LAB/ TUT	GD/ PPT	HA	MSE (W)	MSE (R)	MSE (O)	ESE (R)	ESE (W)	ESE (O)	PRACT+ CVV	ESE-Direct Evaluation	Theory	Tutorial	Practical	Total
Semester V																						
CV3201	PCC	Design of RCC Structures*	3	-	2				-	-	-	-	-	-	40	-	60	-	3	0	1	4
CV3202	PCC	Open Channel Hydraulics	2	-	2	20	30	10	-	-	-	-	-	-	40	-	-	-	2	0	1	3
CV3203	PEC	Program Elective I	3	-	2	20	40	-	20	20	-	-	-	-	-	-	-	-	3	0	1	4
MD316X	PEC	Program Elective II**	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	3	0	0	3
MD320X	OE	Open Elective I**	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	4	0	0	4
MM0201A	MDC	Optimization Techniques	2	1	-	-	30	-	20	10	-	-	-	-	40	-	-	-	2	1	0	3
CV3205	VSEC	Design Thinking - 1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	100	0	1	0	1
CV3204	FP	Engineering Research and Innovation - 1	-	-	4	-	-	-	-	-	-	30		70	-	-	-	-	0	0	2	2
Total			**17**	**2**	**10**	**40**	**100**	**10**	**40**	**30**	**-**	**30**	**-**	**70**	**120**	**-**	**60**	**300**	**17**	**2**	**5**	**24**

* External Pract+CVV ** Coursera

Abbreviations Used	
PPT	Powerpoint Presentation
GD	Group Discussion
CVV	Comprehensive Viva Voce
LAB	Laboratory
TUT	Tutorial
CP	Course Project
PR	Practical
HA	Home Assignment
MSE	Mid Semester Examination
ESE	End Semester Examination
R /W/O	Review /Written/Online

Program Elective I

CV3203A: Foundation Engineering
CV3203B: Environment Impact Assessment
CV3203C: Finite Element Method

Program Elective II

MD3161: Building Information Modeling

Open Elective I

MD3201: Fin Tech
MD3202: Digital Marketing
MD3203: Entrepreneurship
MD3204: Management

B.R.A.C. Trust * Dept. of Civil Engg. * Vishwakarma Institute of Technology

BOS Chairman

Dean Academics

Vishwakarma Institute of Technology Issue 1 : Rev No. 00: Dt. 03/07/26

Title : Course Structure FF No. 653_A

Branch : Civil Engineering **Year: T.Y.** **Academic Year : 2026-27** **Semester: II** **Module: 5** **Pattern: 2024**

Level 5.5

Course Code	NEP Course Category	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks												Credits			
			Theory	Tutorial	Practical	CVV	CP	LAB/ TUT	GD/ PPT	HA	MSE (W)	MSE (R)	MSE (O)	ESE (R)	ESE (W)	ESE (O)	PRACT+ CVV	ESE-Direct Evaluation	Theory	Tutorial	Practical	Total
Semester VI																					
CV3206	PCC	Transportation Engineering*	3	-	2				-	-	-	-	-	-	40	-	60	-	3	0	1	4
CV3207	PCC	Design of Steel Structures	2	-	2	20	30	10	-	-	-	-	-	-	40	-	-	-	2	0	1	3
CV3208	PEC	Program Elective III	3	-	2	20	40	-	20	20	-	-	-	-	-	-	-	-	3	0	1	4
MD326X	PEC	Program Elective IV**	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	3	0	0	3
MD320X	OE	Open Elective II**	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	4	0	0	4
MM0201A	MDC	Data Driven Techniques	2	1	-	-	30	-	20	10	-	-	-	-	40	-	-	-	2	1	0	3
CV3205	VSEC	Design Thinking - 2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	100	0	1	0	1
CV3209	FP	Engineering Research and Innovation - 2	-	-	4	-	-	-	-	-	-	30		70	-	-	-	-	0	0	2	2
Total			**17**	**2**	**10**	**40**	**100**	**10**	**40**	**30**	**-**	**30**	**-**	**70**	**120**	**-**	**60**	**300**	**17**	**2**	**5**	**24**

*** External Pract+CVV** **** Coursera**

Abbreviations Used	
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R /W/O	Review /Written/Online

Program Elective III

CV3208A: Water Resources Engineering
CV3208B: Solid Waste Management
CV3208C: Earthquake Engineering

Program Elective IV

MD3261: Precast Concrete Systems

Open Elective I

MD3201: Fin Tech
MD3202: Digital Marketing
MD3203: Entrepreneurship
MD3204: Management

BOS Chairman **Dean Academics**

FF No.: 654

Course Code: CV3201
Course Name: Design of RC Structures

Teaching Scheme	Examination Scheme
Credits : 4	CP: -- Marks
Lectures : 3 Hrs/week	GD/PPT/HA/LAB: -- Marks
Practical : 2 Hrs/week	MSE (W/~~O~~): -- Marks
Tutorial : -- Hrs/week	ESE (W/~~O~~): 40 Marks
	PRACT + CVV: 60 Marks

Prerequisites:	
•	Mechanics of Solids, Structural Analysis
Course Objectives:	
•	To develop an ability to understand the behavior and basic concepts in design of various reinforced concrete structural components subjected to combination of different loads based on provisions of Indian Standard code.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the composite action of reinforced concrete, concept of singly and doubly reinforced concrete section, design philosophies and analyze singly, doubly and flanged reinforced concrete section subjected to flexure using Limit State Method.
2.	Understand concepts of limit state of serviceability and stability of a structure and design reinforced concrete section subjected to flexure using Limit State Method (LSM).
3.	Design reinforced concrete section subjected to shear, torsion and bond
4.	Design and develop reinforcement details of one-way slabs, two-way slabs, and dog legged staircase using Limit State Method as per guidelines given in Indian Standard Code.
5.	Design reinforced concrete short columns and isolated column footing subjected to gravity loads using Limit State Method as per guidelines given in Indian Standard Code.
6.	Demonstrate the ability to develop structural drawings for R.C.C. framed structure using modern engineering tools individually and / or through teamwork.

Section1:	Topics/Contents

Unit-I : Introduction to reinforced concrete (RC) and limit state method

Introduction to R. C. (composite action). Role of structural designer, Structural properties of concrete and steel. Behavior of concrete under compression (stress-strain curve) and tension, and steel under tension. Design philosophies. Concept of transformed section, singly and doubly R. C. sections. Classification of limit states. Characteristic strengths and loads. Partial safety factors.

Analysis of R. C. section under flexure – assumptions, strain, and stress variation across the section. Behavior of R. C. section under flexure (under reinforced, Balanced, and over reinforced sections). Design parameters for rectangular R.C. section, Moment of resistance of rectangular under reinforced singly, doubly, and flanged R. C. section.

Unit-II: Design for flexure using LSM

Loads and load combinations. Stability of a structure and code provisions (Actions on a structure, failure behavior and safety). Limit state of serviceability: IS code recommendation for limit state of deflection, cracking and fire.

Design for flexure: Design of rectangular under reinforced singly, doubly, and flanged RC section using LSM.

Unit-III: Design for shear, torsion, and bond

Modes of cracking. Shear transfer mechanism. Shear failure modes. Nominal shear stress. Critical sections for shear design. Shear resistance of RC section. Design of RC section subjected to shear as per Indian Standard Code.
Behavior of RC member under torsion. Torsional shear stress. Need for torsional reinforcement. Indian Standard Code provisions for design RC member subjected to torsion.
Concept and types of bond. Bond development mechanism. Bond failure mechanism. Check for adequacy of bond as per Indian Standard Code requirements.

Section2:	**Topics/Contents**

Unit-IV: Design of slabs and staircases
Design and reinforcement detailing of one-way slabs (Simply supported, cantilever and continuous) and dog legged staircase using Indian Standard code.
Design and reinforcement detailing of two-way slabs using Indian Standard code. Distribution of slab load on beams.

Unit-V: Design of short column
Column: Introduction, Indian Standard code requirements for design and reinforcement detailing of short column. Design and reinforcement detailing of short column for axial load, uni-axial and bi-axial bending using interaction curves.

Unit-VI: Design of column footing
Isolated column footing: Soil pressure distribution under isolated footing. General design considerations for isolated footing slab for flexure, shear, bearing and bond. Design and reinforcement detailing of isolated column footing using Indian Standard code.

Text Books: ***(As per IEEE format)***	
1	S. Pillai and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill, New Delhi.
2	Punmia, Jain and Jain, Comprehensive Design of R.C. Structures, Standard Book House, New Delhi.
3	Dr. H. J. Shah, Reinforced Concrete Volume II, Charotar Publishing House Pvt. Limited.
Reference Books: ***(As per IEEE format)***	
1	Dr. V. L. Shah and Dr. S.R. Karve, Illustrated Design of Reinforced Concrete Buildings (G+3), Structures Publications, Pune.
2	Dr. V. L. Shah and Dr. S.R. Karve, Illustrated Reinforced Concrete Design, Structures Publications, Pune.
3	IS: 456-2000: Plain and Reinforced Concrete – Code of Practice, BIS, New Delhi.
4	SP 34 – Handbook on Concrete Reinforcement and detailing
5	SP 16 – Design Aids for Reinforced concrete to IS 456:1980 Code Book.

List of Practical's:

1) Develop working and structural plan of G + 1 (2 bay 2 storied) RC residential building comprising of Slabs, Beams, Columns, Footings and Staircase.
2) Design all plinth and ground floor beams of above developed G+1 RC building.
3) Design all slabs and beams of first floor of above developed G+1 RC building.
4) Design three types columns for, (a) axial load, (b)axial load + uniaxial BM, (c) axial load + biaxial BM), from terrace level to footing of above developed G+1 RC building. Design any one element using spreadsheet / any software.
5) Report on one Site Visit (Building under construction).

Note:

a. Complete the practical work in a group with 3 to 5 number of students per group.
b. Reinforcement details should be developed as per SP - 34.
c. Reinforcement details should be drawn either using any drafting software (e.g. AutoCAD) or hand-drawn.
d. Develop minimum four full imperial size sheets showing details of structural plan at plinth, first floor and terrace level, reinforcement details of slabs, beams, staircases, column and column footing.

List of Project areas:
NA

CO-PO Mapping

CO		Program Outcomes (PO)											PSO		
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	3	-	-	-	-	1	-	-	-	-	-	3	-
CO3	3	1	3	-	-	-	-	1	-	-	-	-	-	3	-
CO4	3	1	3	-	-	-	-	1	-	-	-	-	-	3	-
CO5	3	1	3	-	-	-	-	1	-	-	-	-	-	3	-
CO6	3	-	-	-	1	-	-	1	1	1	-	-	1	-	-
Average	3	1	3	-	1	-	-	1	1	1	-	-	1	3	-

FF No.: 654

Course Code: CV3202
Course Name: Open Channel Hydraulics

Teaching Scheme	Examination Scheme
Credits : 3	CP: 30 Marks
Lectures : 2 Hrs/week	GD/PPT/HA: -- Marks
	LAB: 10 Marks
Practical : 2 Hrs/week	MSE (W/O): -- Marks
Tutorial : NA	ESE (W/O): 40 Marks
	CVV: 20 Marks

Prerequisites:	UG level mathematics, statistics and probability
•	
Course Objectives:	
1	To introduce the fundamental principles of uniform flow in open channel, Manning's and Chezy's equations to analyze uniform flow and concepts of most efficient channel sections.
2	To develop an understanding about the depth energy relationship based on Specific Energy, Specific Force concepts, enabling students to analyze the channel transitions and critical flow computations.
3	To introduce the fundamental principles of non-uniform flow, Gradually Varied Flow, rapidly varied flow for classification various Gradually Varied Flow (GVF) profiles and to solve the dynamic equation of GVF.
4	To impart knowledge on the mechanics of the Hydraulic Jump using momentum equation, its classification based on the Froude Number to evaluate the resulting energy dissipation in rectangular channels.
Course Outcomes:	
	After completion of the course, students will be able to
1.	Apply Manning's and Chezy's equation for uniform flow computations and design hydraulically most efficient channel section for uniform flow.
2.	Determine depth energy relationship using sp. Energy, sp. Force, critical flow concepts and compute the sequent depths.
3.	Classify the water surface profiles and solve dynamic equation of GVF using direct step method.
4.	Classify hydraulic Jump based on Froude's number and determine the energy loss in Hydraulic jump occurred rectangular channel

Section1:	**Uniform flow in open channels: (07 hours)**
Uniform flow in open channels: Introduction to Open channel flow, Classification of channels, and Channel flows. Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, one dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, Characteristics and establishment of uniform flow, uniform flow formulae: Chezy's and Manning's formulae; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections (rectangular, triangular, trapezoidal and circular).	
Section2:	**Depth-Energy Relationships in Open Channel Flow**: **(07 hours)**
Specific energy, Specific force Specific energy diagram, Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent; Critical flow computations; channel transitions.	
Section3:	**Gradually Varied Flow in Open Channels: (07 hours)**
Gradually Varied Flow in Open Channels-Definition and types of non-uniform flow; Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF;	

Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their occurrence; Control section, Methods of GVF computations. Direct Step method.	
Section4:	**Hydraulic Jump: (07 hours)**
Hydraulic Jump-Phenomenon of hydraulic jump; Location and examples of occurrence of hydraulic jump; Assumptions in the theory of hydraulic jump; Application of momentum equation to hydraulic jump in rectangular channel: Conjugate depths and relations between conjugate depths. Energy dissipation in hydraulic jump; Graphical method of determination of energy dissipation, Classification of hydraulic jump; Practical uses of hydraulic jump, venturi flume, standing wave flume	
Text Books: ***(As per IEEE format)***	
1	Subranmanya K., (2019), "Flow in Open Channels", MacGraw Hill Publications
2	Rangaraju K.G., (2001), "Flow through open chnnels",2rd edition, Mc Graw Hill Publications
3	Srivastava R., (2015), "Flow through Open Channels", Oxford University Press
Reference Books: ***(As per IEEE format)***	
1	Open Channel Hydraulics Ven Te Chow, Mc-Graw Hill.
2	Open Channel flow Madan Mohan Das, PHI learning private limited
3	The hydraulic of Open channel flow Hubert Chanson, Arnold Publications UK

List of Practical's:
Following experiments shall be performed in Lab

Experiments (All compulsory)

1. Study of Uniform Flow Formulae of Open channel.
2. Velocity Distribution in Open Channel Flow.
3. Calibration of Standing Wave Flume/Venturi flume
4. Study of Hydraulic Jump as Energy Dissipater.
5. Graphical determination of energy loss in Hydraulic Jump.
6. Assignment on GVF computation using Direct Step and VenTe Chow method.
7. Experimental determination of Sp. Energy diagram using tilting flume
8. Experimental determination of Sp. Force diagram using tilting flume
9. Flow over hump

List of Project areas:
1.Solution of GVF using different techniques
2. Design of hydraulically most efficient channels
3.Use of computer programming for solving open channel hydraulic problems

CO-PO Mapping

CO		**Program Outcomes (PO)**											**PSO**		
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO12**	**PS O1**	**PS O2**	**PSO3**
CO1	3	1	2	--	--	2	1	1	1	1	--	1	--	2	NA
CO2	3	1	2	--	--	2	1	1	1	1	--	1	--	2	NA
CO3	3	1	2	--	--	2	1	1	1	1	--	1	--	2	NA
CO4	3	1	2	--	--	2	1	1	1	1	--	1	--	2	NA
Average	3	1	2	--	--	2	1	1	1	1	--	1	--	2	NA

FF No.: 654

Course Code: CV3203A
Course Name: Foundation Engineering

Teaching Scheme	Examination Scheme
Credits : 4	CP: 40 Marks
Lectures : 3 Hrs/week	GD/PPT: 20 Marks
	HA: 20 Marks
Practical : 2 Hrs/week	MSE (W/O): -- Marks
Tutorial : 0 Hrs/week	ESE (W/O): -- Marks
	CVV: 20 Marks

Prerequisites:	Geotechnical Engineering, Fluid Mechanics, Engineering Mathematics
Course Objectives:	
•	To inculcate necessary geotechnical engineering skills to analyze and design of shallow and deep foundation systems under different loading and soil conditions.
Course Outcomes:	
	After completion of the course, student will be able to
1.	**Explain** field investigation and understand field tests to investigate properties of soil
2.	**Determine** bearing capacity of the soil and explain effect of water table on bearing capacity
3.	**Understand** consolidation process and **calculate** settlement of soil due to external pressure
4.	**Understand** the deep foundation and **calculate** load carrying capacity of single and group of pile by using soil properties
5.	**Explain** construction process of foundation over soft clayey soil and problems associated with problematic soil during design of the foundation
6.	**Explain** the mechanism of soil reinforcement and **understand** effect of earthquake on foundation design

Section1:	**Subsurface investigations for foundation**
Purpose, Objectives, and planning of subsurface exploration. Methods of Investigation: Trial pits, borings, depth & number of exploration holes, core recovery, RQD, Core Log. Geophysical methods. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field tests - SPT, DCPT, SCPT and Pressure meter test.	
Section2:	**Bearing capacity of Shallow Foundation**
Basic definitions, Modes of shear failure, Bearing capacity analysis- Terzaghi's, Hanson's, Meyerhof's, Skempton's and Vesics equations. IS code method - Rectangular and Circular Footings. Bearing Capacity evaluation- Plate Load Test and SPT, Housel's perimeter shear concept. Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Presumptive bearing capacity.	
Section3:	**Settlement and Consolidation**
Introduction to concept of settlement Causes of settlement. Contact pressure. Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, consolidation settlement. Use of Plate load test and SPT in settlement analysis. Introduction to concept of consolidation, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- Square root of time fitting method and logarithm of time fitting method. Time factor. Introduction of Normal consolidation, Over consolidation and Pre-consolidation pressure.	
Section4:	**Deep Foundations**
Introduction, Pile classification, Pile installation techniques. Load carrying capacity of pile by static method, Dynamic Methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action-Field rule, Rigid block method. Negative skin friction. Settlement of pile group incohesive soil by approximate method. Piers and Caissons-Definition, Types and uses. Well foundation: components, sand island method.	

Section5:	**Special Foundations and Excavation Support Systems**
Strutting for excavation, pressure distribution, design of cantilever sheet pile. Cofferdam uses and features. Characteristics of black cotton soil, swelling potential and its evaluation methods, engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed piles- Design principles. Stone columns, prefabricated vertical drains, preloading technique, and vibroflotation technique.	
Section6:	**Soil Reinforcement and Earthquake Geotechnics.**
Basic components and Mechanism of reinforced soil. Geosynthetics: type's, functional properties, and requirements. Geosynthetics applications in Civil Engineering. Earthquake Terminology, Sources of earthquakes. Seismic waves, Location of earthquakes, Size of earthquake, Characteristics of Strong ground motion, Seismic hazards- liquefaction, Effect of liquefaction, Evaluation of liquefaction susceptibility, liquefaction hazard mitigation.	
Text Books: ***(As per IEEE format)***	
1	V. N. S. Murthy, *Principles of Soil Mechanics and Foundation Engineering*. New Delhi, India: UBS Publishers.
2	B. C. Punmia, *Soil Mechanics and Foundation Engineering*. New Delhi, India: Laxmi Publications.
3	B. J. Kasmalkar, *Foundation Engineering*. Pune, India: Pune Vidyarthi Griha Prakashan.
4	N. V. Nayak, Foundation Design Manual. New Delhi, India: Dhanpat Rai Publications.
Reference Books: ***(As per IEEE format)***	
1	J. E. Bowles, *Foundation Analysis and Design*. New York, NY, USA: McGraw-Hill.
2	P. C. Varghese, *Foundation Engineering*. New Delhi, India: PHI Learning Pvt. Ltd.
3	S. L. Kramer, *Geotechnical Earthquake Engineering*. Upper Saddle River, NJ, USA: Prentice Hall.

Term Work:

The term work shall consist of Laboratory Experiments, AI-Assisted Design Assignments, Site Exposure, and Case Study Analysis aimed at developing practical understanding, analytical skills, and industry-oriented problem-solving ability in Geotechnical and Foundation Engineering.

A) Laboratory Experiments (Any Two)

Students shall perform experiments, analyze observations manually and using AI-assisted interpretation tools/software, and prepare technical reports including engineering significance, graphical interpretation, and design implications.

List of Practical's

1. **Hydrometer Analysis of Fine-Grained Soil**
   - Determination of particle size distribution of silt and clay fraction.
   - AI-assisted plotting and interpretation of grain-size distribution curve.
2. **One-Dimensional Consolidation Test**
   - Determination of compression index, coefficient of consolidation, and settlement characteristics.
   - Use of spreadsheets/AI tools for settlement prediction and curve fitting.
3. **Swelling Pressure Test on Expansive Soil**
   - Evaluation of swelling characteristics of black cotton soil.
   - AI-assisted comparison with published empirical correlations.
4. **Triaxial Shear Test with Pore Pressure Measurement**
   - Determination of shear strength parameters under drained/undrained conditions.
   - Interpretation of stress path and Mohr-Coulomb parameters using digital tools.

B) Assignments

Students shall use standard design procedures along with AI-enabled tools/software/spreadsheets for analysis, verification, optimization, and report preparation.

Assignment 1

Bearing Capacity and Settlement Analysis of Shallow Foundation

Students shall develop the ability to interpret geotechnical data and perform foundation design using conventional and modern computational approaches

- Use data from a sample Geotechnical Investigation Report.
- Compute:
  - Ultimate and safe bearing capacity
  - Immediate and consolidation settlement
- Compare manual calculations with AI/software-assisted results.
- Suggest suitable foundation type and improvements.

Assignment 2

Design of Pile Foundation under Compression and Uplift Loads

- Use borehole and soil data from a sample Geotechnical Investigation Report.
- Determine:
  - Axial load carrying capacity
  - Uplift/tension capacity
  - Group efficiency and settlement considerations
- Use AI-assisted tools/spreadsheets for optimization of pile diameter, spacing, and length.

Students shall understand design methodology and optimization of deep foundations under various loading conditions.

C) Site Visit and Case Study

1. Industrial/Site Visit

Visit to an Important Deep Foundation or Ground Improvement Project

Suggested Sites

- Pile foundation project
- Metro/bridge foundation
- Diaphragm wall/secant pile work
- Ground improvement project

Detailed Report should submit after site visit in proper format

2. Case Study of Foundation Failure - Students shall study any one published case related to:

- Bearing failure
- Excessive settlement
- Liquefaction
- Slope/foundation instability
- Failure due to expansive soil

Students may use AI tools for:

- Literature review
- Comparative analysis
- Failure mechanism visualization
- Preparation of technical summaries

Following tools may use responsibly for learning and analysis:

- Spreadsheet tools (Excel/Google Sheets)
- GeoStudio / PLAXIS (demonstration level)
- MATLAB/Python for data plotting
- AI-assisted technical writing tools
- CAD and foundation design software

Note - Students must validate all AI-generated outputs using engineering principles and codal provisions.

CO-PO Mapping

CO			Program Outcomes (PO)										PSO	
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO 11	PO12	PSO1	PSO2
CO1	3											2		3
CO2	3			1										3
CO3	3				1							2		3
CO4	3													3
CO5	3													3
CO6	3											2		3
Average	**3**				**1**							**2**		**3**

FF No.: 654

Course Code: CV3203B
Course Name: Environmental Impact Assessment

Teaching Scheme	Examination Scheme
Credits : 04	CP: 40 Marks
Lectures : 03 Hrs/week	GD/PPT: 20 Marks
	HA: 20 Marks
Practical : 02 Hrs/week	MSE (W/O): -- Marks
Tutorial : 00 Hrs/week	ESE (W/O): -- Marks
	CVV: 20 Marks

Prerequisites:	
•	Environmental Science, Water supply Engineering and Waste water Engineering
Course Objectives:	
•	To create awareness among the students for environmental impact assessment technique.
•	To prepare the students for EIA norm and provisions
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the concept of Environmental impact assessment
2.	Understand the methodologies involved in EIA
3.	Use of Water and air Quality Impact Assessment
4.	Well conversant with procedure for environmental clearance & structure of EIA document
5.	Apply Norms &Standards for EIA of any small scale industry project
6.	Understand and become well conversant with EIA notification Procedure for obtaining Environmental clearance for construction projects.

Section1:	**Unit 1 : Environmental impact assessment(6 Hrs)** Environmental impact assessment: Introduction, Concepts and aims, Impact statement, Methods and Processes, Mitigation processes. Prediction and assessment of impact on air, water and noise. Public participation in environment decision making: Environment education and awareness, Environmental economics, Economics of Pollution control, Cost benefit analysis.
Section1	**Unit 2: Methods of EIA (6 Hrs)** Methods for impact assessment: Background information, interaction matrix methodologies, network methodologies, environmental setting, environmental impact assessment methodology, documentation and selection process, environmental indices and indicators for describing affected environment, Life cycle assessment
Section1	**Unit 3 : Water, air quality Impact Assessment (6 Hrs)** Water, air quality Impact Assessment – attributes, Water Quality Impact Assessment of Water Resources Projects, Data requirements of water quality impact assessment for dams, Impacts of dams on environmental, Case studies. Prediction and assessment of impact for air environment: Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation
Section2	**Unit 4: EIA for industry as per the category(CPBC/MPCB). (6 Hrs)** Categorization of Industries for seeking environmental clearance from concerned authorities(MoEF), procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring

Section2	**Unit 5: Norms and Standards (6 Hrs)** Norms & Standards: OHSHAS 18001 & its significance, ISO 14000 & its significance, other acts in ESE and case studies, Feasibility Studies and Management issues. Related Issues: Principles of sustainable development and implications of finite biosphere and complexities for engineering design and decision-making, Design of controlled environments to enhance health and protection of natural resources for sustainable development, Resource problems and design with ecology and economics.
Section2	**Unit VI: Provisions of EIA (6 Hrs)** Latest EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Procedure for public hearing, post environmental monitoring, Procedure for obtaining Environmental clearance for construction projects.
Text Books:	
1	Canter R.L., Environmental Impact Assessment, International edition, 1997. McGraw Hill publisher
2	Peter Watten (Eds.) - `Environmental Impact Assessment Theory and Practice', 1988 edition ,Unwin Hyman, London
3	Environmental Impact Assessment By R.RBarthwal ,New Age International Publishers
Reference Books:	
1	John G. Rau and David C. Woolen (Eds.) `Environmental Impact Analysis Hand Book', 1980 edition ,McGraw Hill publisher.
2	Meyers A. Robert (Eds.) Encyclopaedia of Environmental Analysis and Remediation Vol. 1-8, 1998 edition John Wiley & Sons publications
3	Encyclopaedia of Industrial Safety and Health, 1999

List of Practical's:

One Assignment on each from Unit 1 to Unit 6

List of Project areas:

1.
2.
3.

CO-PO Mapping

CO		**Program Outcomes (PO)**											**PSO**		
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3					2	3					1	1	1	
CO2	3					2	3					1	1	1	
CO3	3					2	3					1	1	1	
CO4	3					2	3					1	1	1	
CO5	3					3	3					1	1	2	
CO6	3					2	3					1	2	1	
Average	3					2	3					1	1	1	

FF No.: 654

Course Code: CV3203C
Course Name: Finite Element Method

Teaching Scheme	Examination Scheme
Credits : 04	CP: 40 Marks
Lectures : 03 Hrs/week	GD/PPT: 20 Marks
	HA: 20 Marks
Practical : 02 Hrs/week	MSE (W/O): -- Marks
Tutorial : 00 Hrs/week	ESE (W/O): -- Marks
	CVV: 20 Marks

Prerequisites:	
•	Mechanics of Solids, Structural Analysis
Course Objectives:	
•	• To analyse some real problem and to formulate the conditions of FEA application • To execute a reasonable choice of parameters and variables of the FEA model (geometry, material properties, boundary conditions)
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand the basic concepts of Theory of Elasticity and Finite Element Method.
2.	Develop the generalized stiffness matrix for the analysis of bar and beam element
3.	Develop the generalized stiffness matrix for the analysis of plane truss
4.	Understand the displacement function and its use in two- and three-dimensional elements
5.	Explain the use of CST and LST elements in the analysis of the two-dimensional solids and explain the concept of Tetra-hadron element for three dimensional solids
6.	Comprehend the use of FEM software

Section I	**Unit I: Introduction**
Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress and plane strain problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems. General steps of the finite element method, Applications and advantages of FEM, concept of finite element for continuum problems, discretization of continuum, use of polynomial displacement function, Pascal's triangle, convergence criteria.	
Section I	**Unit II:** Stiffness Matrix and Boundary Conditions for bar and beam
Bar element: stiffness matrix, load vector, assembly of element matrices implementing boundary conditions, stress calculations, support reactions. Beam element: Introduction, Derivation of Element Stiffness Matrix, Generalized Stiffness Matrix of a Beam Member, stress calculations, support reactions	
Section I	**Unit III**: Stiffness Matrix and Boundary Conditions for Truss
Introduction, Element Stiffness of a Truss Member, Member Stiffness with Varying Cross Section, Generalized Stiffness Matrix of a Plane Truss Member, Analysis of Truss.	
Section II	**Unit IV**: Finite Element Formulation Techniques
Choice of Displacement Function: Convergence criteria, Compatibility, Geometric invariance, Shape Function, Degree of Continuity, Introductory concept of Iso-parametric Elements	
Section II	**Unit V**: Two and Three Dimensional Elements
Two dimensional element : Constant Strain Triangle (CST) : Element Stiffness Matrix for CST, Nodal Load Vector for CST, Linear Strain Triangle: Element Stiffness Matrix for LST, Nodal Load, Vector for LST, Numerical Example using CST, Three-dimensional element (only introduction) : Tetrahedron element	

Section II	**Unit VI**: FEM software
Working of FEM, Steps, algorithm flow charts, sequence of procedure followed in software, description of FEM software, common mistakes, validation study.	
Text Books: ***(As per IEEE format)***	
1	S.S. Bhavikatti -Finite Element Analysis –New Age International Publishers, Delhi
2	C. S. Desai and John Abel- Introduction to Finite Element Method, C.B.S. Publishers and Distributors, New Delhi
3	P.N.Godbole-Introduction to Finite Element Methods, I.K. International Publishing
4	G.R. Buchanan –Finite Element Analysis Schaum's outlines -Tata McGraw Hill Publishing Co. Ltd
Reference Books: ***(As per IEEE format)***	
1	Zienkiewicz and Taylor -The Finite Element Method 4th Edition –Vol –I & II – McGraw Hill International Edition
2	C.S. Krishnamoorthy –Finite Element Analysis –Theory & Programming –Tata McGraw Hill Publishing Co. Ltd

List of Practical's:

1. Minimum two (2) assignments on each unit

List of Project areas:

1. Analysis of vibration of Water Tank resting on ground using FEM
2. Analysis of Stepped bar under axial load using FEM
3. Analysis of 2D truss structure using FEM

CO-PO Mapping

CO		Program Outcomes (PO)										PSO		
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PS O2	PSO 3
CO1	3	2		1	-	-	-	-	3	2	-	-	-	2	-
CO2	3	2	-	1	-	-	-	-	3	2	-	-	-	2	-
CO3	3	2	-	1	-	-	-	-	3	2	-	-	-	2	-
CO4	3	2	-	1	-	-	-	-	3	2	-	-	-	2	-
CO5	3	2	-	1	-	-	-	-	3	2	-	-	-	2	-
CO6	3	2	-	1	-	-	-	-	3	2	-	-	-	2	-
Average	3	2	-	1	-	-	-	-	3	2	-	-	-	2	-

FF No.: 654

Course Code: MD3161
Course Name: Building Information Modeling

Teaching Scheme	Examination Scheme
Credits: 3	CP: -- Marks
Lectures: 3 Hrs/week	GD/PPT/HA: -- Marks
Practical: -- Hrs/week	MSE (W/O): -- Marks
Tutorial: -- Hrs/week	ESE (Direct Evaluation): 100 Marks

Prerequisites:	
•	Geomatics Engineering, Structural Analysis, Building Planning and Drawing, Computer-Aided Drafting (AutoCAD)

Course Objectives:	
•	Understand the principles of Building Information Modeling (BIM), industry standards (ISO 19650), and Autodesk Revit for creating integrated architectural, structural, and MEP models.
•	Develop multidisciplinary BIM models using Autodesk Revit and apply BIM coordination, visualization, and Level of Development (LOD) concepts for effective project collaboration.
•	Apply advanced BIM technologies, including Common Data Environment (CDE), 4D/5D BIM, digital twins, and other emerging digital tools to improve construction planning, project management, and asset lifecycle management.
•	Utilize BIM-enabled simulation and analysis tools to support engineering decision-making, cost estimation, scheduling, clash detection, and construction management.
•	Evaluate sustainability and urban performance using BIM-based assessment methods to promote resource efficiency and sustainable infrastructure development.

Course Outcomes:	
	After completion of the course, student will be able to
1.	Apply BIM fundamentals and Revit tools to create, manage, and coordinate architectural, structural, and MEP models in accordance with ISO 19650 standards.
2.	Apply BIM coordination, analysis, LOD management, and visualization techniques to improve building performance and project communication.
3.	Apply BIM technologies, including CDE, 4D/5D BIM, and emerging digital tools, to enhance construction planning, coordination, and asset management.
4.	Apply BIM and Autodesk Revit to develop 3D building models and integrate design information for engineering applications
5.	Utilize BIM tools for simulation, construction planning, cost estimation, and project management to support informed engineering decisions.
6.	Apply sustainability assessment methods to evaluate neighbourhood performance, optimize resource use, and support sustainable urban planning.

Section1:	**Fundamentals for Engineers**
Fundamentals of BIM, including creating 3D models and using isometric views to enhance project efficiency and collaboration; basics of Autodesk Revit, Revit Architecture for building design, starting with file setup and modeling architectural elements; Use specific modelling techniques for architecture, structure, and MEP, adhering to ISO 19650 standards for managing Work In Progress (WIP); Use Revit MEP for mechanical, electrical, and plumbing design, including HVAC, plumbing, piping, fire protection systems, and electrical lighting	

Section2:	**BIM Coordination**
Concept and implementation of federated models, clash detection processes, and Levels of Detail (LOD) or Development (LOD) in BIM coordination; perform structural, energy, and lighting analyses using BIM to optimize building performance and efficiency; various visualization types in BIM, including creating different views, walkthroughs, VR, MR, and AR demos to enhance project communication; understand linking and managing Revit files, performing clash checks, generating reports, and using LOD matrices	

Section3:	**Field BIM**
BIM applications in construction, CDE importance in BIM, 4D BIM, preparation, implementation, and applications; Emerging trends beyond BIM including IoT, Digital Twins, Scan to BIM, Big Data, and AI/ML, highlighting future directions in construction technology; explore 4D BIM applications like site planning, construction analysis, 3D coordination, and safety, 5D BIM and Asset Information Model; modules including CDE, 4D/Field BIM intro, practical 4D applications in construction, advanced 4D/BIM uses, 5D BIM, AIM, and emerging BIM trends.	
Section4:	**BIM Applications for Engineers**
Skills to learn: Simulation and Simulation Software; Computer-Aided Design; Data Integration; Simulations 3D Modeling; Building Information Modeling; Construction Management; Construction Estimating; Cost Estimation. Tools to learn - Autodesk Revit; Autodesk	
Section5:	**Introduction to Interdisciplinary Sustainable Architecture**
Build theoretical neighbourhood sustainability models and assess performance metrics using foundational sustainability evaluation components; Integrate energy considerations and quantify climate change impacts through CO2 emissions analysis for global sustainability assessment; Optimize building material performance and select urban infrastructure elements for green, blue, and gray infrastructure systems; Conduct unified sustainability assessments and directly link findings to relevant policy frameworks for practical implementation.	
Text Books: ***(As per IEEE format)***	
1	C. M. Eastman, P. Teicholz, R. Sacks, and K. Liston, BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd ed. Hoboken, NJ, USA: John Wiley & Sons, 2018.
2	B. Hardin and D. McCool, BIM and Construction Management: Proven Tools, Methods, and Workflows, 2nd ed. Indianapolis, IN, USA: John Wiley & Sons, 2015.
3	P. Barnes and C. Davies, BIM in Principle and in Practice, 2nd ed. London, U.K.: ICE Publishing, 2021.
4	E. Krygiel and B. Nies, Green BIM: Successful Sustainable Design with Building Information Modeling. Indianapolis, IN, USA: Wiley Publishing, 2008.
Reference Books: ***(As per IEEE format)***	
1	A. Pimplikar and S. Pimplikar, Building Information Modeling (BIM): Concepts and Applications. Pune, India: Nirali Prakashan, 2022.
2	V. J. Hegde, Building Information Modeling Using Autodesk Revit. New Delhi, India: CBS Publishers & Distributors, 2021.
3	A. Gupta and S. Kumar, Building Information Modeling for Civil Engineers. New Delhi, India: S. Chand Publishing, 2023.
4	P. Smith, BIM Implementation: Global Strategies. Cham, Switzerland: Springer, 2024.

List of Practical's:

1. N/A
2.
3.

List of Project areas:

1. N/A
2.
3.

CO-PO Mapping

CO	Program Outcomes (PO)												PSO		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PS O 3
CO1	3	2	2	1	3	-	1	-	2	2	1	2	2	3	
CO2	2	3	3	3	3	-	2	-	2	3	1	2	2	3	
CO3	2	3	2	2	3	1	2	-	3	3	3	2	3	2	
CO4	3	2	3	2	3	-	1	-	2	2	1	2	2	3	
CO5	2	3	3	3	3	1	2	-	3	3	3	2	3	2	
CO6.	2	3	2	3	2	2	3	1	2	2	2	3	2	2	
Average	2.33	2.67	2.50	2.33	2.83	0.67	1.83	0.17	2.33	2.50	1.83	2.17	2.33	2.50	

FF No.: 654

Course Code: MD3201
Course Name: Fin Tech

Teaching Scheme	**Examination Scheme**
Credits: 4	CP: -- Marks
Lectures: 4 Hrs/week	GD/PPT/HA: -- Marks
Practical: Hrs/week	MSE (W/O): -- Marks
Tutorial: Hrs/week	ESE (Direct Evaluation): 100 Marks

Prerequisites:	
•	Coursera Course
Course Objectives:	
•	
Course Outcomes:	
	After completion of the course, student will be able to
1.	
Section1:	**FinTech: Finance Industry Transformation and Regulation Specialization**
https://www.coursera.org/programs/faculty-development-program-b-2025-26-sem-i-m0ein/specializations/fintech?source=search	
Section2:	**Digital Transformation in Financial Services Specialization**
https://www.coursera.org/programs/faculty-development-program-b-2025-26-sem-i-m0ein/specializations/digital-transformation-financial-services?source=search	
Section3:	**Financial Markets Specialization**
https://www.coursera.org/programs/faculty-development-program-b-2025-26-sem-i-m0ein/specializations/financial-markets?source=search	
Section4:	**FinTech Law and Policy**
https://www.coursera.org/programs/faculty-development-program-b-2025-26-sem-i-m0ein/learn/fintechlawandpolicy?source=search	
Section5:	**Decentralized Finance (DeFi): The Future of Finance Specialization**
https://www.coursera.org/programs/faculty-development-program-b-2025-26-sem-i-m0ein/specializations/decentralized-finance-duke?source=search	
Text Books: ***(As per IEEE format)***	
1	
Reference Books: ***(As per IEEE format)***	
1	

List of Practical's:
1. N/A

List of Project areas:
1. N/A

FF No.: 654

Course Code: MD3202
Course Name: Digital Marketing

Teaching Scheme	**Examination Scheme**
Credits: 4	CP: -- Marks
Lectures: 4 Hrs/week	GD/PPT/HA: -- Marks
Practical: Hrs/week	MSE (W/O): -- Marks
Tutorial: Hrs/week	ESE (Direct Evaluation): 100 Marks

Prerequisites:	
•	Coursera Course
Course Objectives:	
•	
Course Outcomes:	
	After completion of the course, student will be able to
1.	
Section1:	**Foundations of Digital Marketing and E-commerce**
https://www.coursera.org/learn/foundations-of-digital-marketing-and-e-commerce	
Section2:	**Adobe Digital Marketing**
https://www.coursera.org/learn/adobe-digital-marketing	
Section3:	**Digital Marketing Operations & Analytics Specialization**
https://www.coursera.org/specializations/digital-marketing-operations-analytics	
Section4:	**Social media and Digital Marketing Fundamentals**
https://www.coursera.org/learn/social-media-digital-marketing-fundamentals	
Section5:	**Introduction to Digital Marketing**
https://www.coursera.org/learn/introduction-digital-marketing	
Section6:	**Digital Marketing Trends**
https://www.coursera.org/learn/digital-marketing-trends	
Section7:	**Assess for Success: Marketing Analytics and Measurement**
https://www.coursera.org/learn/assess-for-success	
Section8:	**Concepts, Strategies, and Analytics in Performance Marketing and Digital Advertising Specialization**
https://www.coursera.org/specializations/digital-advertising-strategy	
Section9:	**Integrated Marketing Communications: Advertising, Public Relations, Digital Marketing and more**
https://www.coursera.org/learn/integrated-marketing-communications	
Section10:	**Marketing in a Digital World**
https://www.coursera.org/learn/marketing-digital	
Section11:	**Marketing Analytics Foundation**
https://www.coursera.org/learn/marketing-analytics-foundation	
Text Books: ***(As per IEEE format)***	
1	
Reference Books: ***(As per IEEE format)***	
1	

List of Practical's:
1. N/A

List of Project areas:
1. N/A

FF No.: 654

Course Code: MD3203
Course Name: Entrepreneurship

Teaching Scheme	**Examination Scheme**
Credits: 4	CP: Marks
Lectures: 4 Hrs/week	GD/PPT/HA: Marks
Practical: Hrs/week	MSE (W/O): Marks
Tutorial: Hrs/week	ESE (Direct Evaluation): 100 Marks

Prerequisites:	
•	Coursera Course
Course Objectives:	
•	
Course Outcomes:	
	After completion of the course, student will be able to
1.	
Section1:	**Essentials of Entrepreneurship: Thinking & Action**
https://www.coursera.org/learn/entrepreneurial-thinking	
Section2:	**Technology & Entrepreneurship Specialization**
https://www.coursera.org/specializations/technology-and-entrepreneurship	
Section3:	**Entrepreneurship: Growing Your Business Specialization**
https://www.coursera.org/specializations/entrepreneurship-growing-your-business	
Section4:	**Skills for a Modern Entrepreneur or Business Owner Specialization**
https://www.coursera.org/specializations/packt-skills-for-a-modern-entrepreneur-or-business-owner	
Section5:	**Innovation & Entrepreneurship - From Design Thinking to Funding**
https://www.coursera.org/learn/design-thinking-entrepreneurship	
Section6:	**Innovation and entrepreneurship Specialization**
https://www.coursera.org/specializations/innovation-entrepreneurship	
Section7:	**The Entrepreneurial Toolkit Specialization**
https://www.coursera.org/specializations/the-entrepreneurial-toolkit	
Text Books: ***(As per IEEE format)***	
1	
Reference Books: ***(As per IEEE format)***	
1	

List of Practical's:
1. N/A

List of Project areas:
1. N/A

FF No.: 654

Course Code: MD3204
Course Name: Management

Teaching Scheme	**Examination Scheme**
Credits: 4	CP: Marks
Lectures: 4 Hrs/week	GD/PPT/HA: Marks
Practical: Hrs/week	MSE (W/O): Marks
Tutorial: Hrs/week	ESE (Direct Evaluation): 100 Marks

Prerequisites:	
•	Coursera Course
Course Objectives:	
•	
Course Outcomes:	
	After completion of the course, student will be able to
1.	
Section1:	**Digital Product Management Specialization**
https://www.coursera.org/programs/fy-toppers-vit-b-2025-26-sem-i-q0138/specializations/uva-darden-digital-product-management?source=search	
Section2:	**Project Management: Tools, Approaches, Behavioural Skills Specialization**
https://www.coursera.org/programs/fy-toppers-vit-b-2025-26-sem-i-q0138/specializations/project-management-tools-approaches-skills?source=search	
Section3:	**Foundations of Management Specialization**
https://www.coursera.org/programs/fy-toppers-vit-b-2025-26-sem-i-q0138/specializations/foundations-management?source=search	
Section4:	**Supply Chain Management Specialization**
https://www.coursera.org/programs/fy-toppers-vit-b-2025-26-sem-i-q0138/specializations/supply-chain-management?source=search	
Text Books: ***(As per IEEE format)***	
1	
Reference Books: ***(As per IEEE format)***	
1	

List of Practical's:

1. N/A

List of Project areas:

1. N/A

FF No.: 654

Course Code: MM0201A
Course Name: Optimization Techniques

Teaching Scheme	**Examination Scheme**
Credits : 3	CP: 30 Marks
Lectures : 2 Hrs/week	GD/PPT/HA: 20 Marks
	HA: 10 Marks
Practical : NA	MSE (W/O): -- Marks
Tutorial : 1 Hr/week	ESE (W/O): 40 Marks

Prerequisites:	UG level mathematics, statistics and probability
•	
Course Objectives:	
1	To introduce the students of Civil Engineering the concept of optimization Techniques.
2	To make students familiar with linear and nonlinear optimization Problems
3	To introduce students to sequencing problems and stochastics programming
Course Outcomes:	
	After completion of the course, student will be able to
1.	Understand different approaches of optimization techniques and use local & global optima, unimodal function, convex and concave function to solve optimization problems.
2.	Implement Gradient descent, Newton's method, Lagrange to solve Nonlinear programming problems
3.	Apply stochastic programming techniques for queuing of jobs, sequencing of operations
4.	Apply linear programming techniques to maximize the profit or minimizing the cost problems using simplex method, Big M method.
5	Solve transportation model and assignment model.

Section1:	**Non-Linear programming: (07 hours)**
Introduction to System approach, Operations Research and Optimization Techniques, Introduction to Linear and Nonlinear programming methods, Local & Global optima, unimodal function, convex and concave function, The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method. Multivariable optimization with equality constraints - Lagrange Multiplier Technique	
Section2:	**Sequencing and Stochastic Programming**: **(07 hours)**
Sequencing– n jobs through 2, 3 and M machines. Queuing Theory: elements of Queuing system and its operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single channel Queuing theory: Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1): (FCFS//)	
Section3:	**Linear Programming (A): (07 hours)**
Formulation of Linear optimization models for Civil engineering applications. The simplex method, Method of Big M	
Section4:	**Linear Programming (B): (07 hours)**
The Transportation Model and its variants, Assignment Model, and its variants.	

Text Books: *(As per IEEE format)*	
1	Engineering Optimization by S.S.Rao
2	Quantitative Techniques in Management by N.D. Vohra (McGraw Hill)
3	Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).
Reference Books: *(As per IEEE format)*	
1	Topics in Management Science by Robert E. Markland (Wiley Publication)
2	An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen

3	Operations Research by Hamdy A. Taha
	e-Resources:
	Mathematical Model for Optimization (MMO Software)
	nptel.iitm.ac.

List of Practical's/Term Work:

Student should complete following assignments in laboratory. All assignments are compulsory.

Assignments on –

1. Local & Global optima, unimodal function, convex and concave function
2. Gradient techniques: steepest ascent/decent technique
3. Newton's Method, Lagrange Multiplier Technique
4. Sequencing– n jobs through 2, 3 and M machines
5. Queuing Theory: Kendall's notation, Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1): (FCFS/)
6. Linear optimization: simplex method
7. Linear optimization: Method of Big M
8. Transportation Model and its variants
9. Assignment Model and Its variants

List of Project areas:

1. Use of freeware softwares for optimization problems
2. Formulate optimization problems in various civil Eng. domains

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CO-PO Mapping

CO		Program Outcomes (PO)											PSO		
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PS O1	PS O2	PSO3
CO1	3	1	2	2	---	2	---	1	1	1	2	2	2	1	NA
CO2	3	1	2	2	---	2	---	1	1	1	2	2	2	1	NA
CO3	3	1	2	2	---	2	---	1	1	1	2	2	2	1	NA
CO4	3	1	2	2	---	2	---	1	1	1	2	2	2	1	NA
Average	3	1	2	2	---	2	---	1	1	1	2	2	2	1	NA

FF No.: 654

Course Code: ML2001
Course Name: Design Thinking - 1

Teaching Scheme	Examination Scheme
Credits : 1	CP: Marks
Lectures : Hrs/week	GD/PPT/HA: Marks
Practical : Hrs/week	MSE (W/O):30 Marks
Tutorial : 1 Hrs/week	ESE (W/O):70 Marks

Prerequisites:	
●	Course Prerequisites: Problem Based Learning, Project Centric Learning Course Relevance:
Course Objectives:	
●	To provide ecosystem for students and faculty for paper publication and patent filing
Course Outcomes:	**[Publication of paper or patent]**
	After completion of the course, student will be able to
1.	Understand the importance of doing Research
2.	Interpret and distinguish different fundamental terms related to Research
3.	Apply the methodology of doing research and mode of its publication
4.	Write a Research Paper based on project work
5.	Understand Intellectual property rights
6.	Use the concepts of Ethics in Research , Understand Entrepreneurship and Business Planning
7.	

Section1:	**Topics/Contents**
What is research? Importance of Paper Publication and Patents Importance of Paper Publication and Patents Structure of Paper Journal Publication Publication in conference Literature Review Research Paper Writing Journal Ratings and Evaluation How to rate a Journal? Intellectual property (IP) Research Ethics Entrepreneurship	
Section2:	**Topics/Contents**
Structure of The paper Journal List (Top 50 Journals) Selection of the journal Use of various online journal selection tools Plagiarism checking Improving contents of the paper Patent drafting Patent search Filing of patent Writing answers to reviewer questions Modification in manuscript Checking of publication draft	

CO – PO / PSO Articulation Matrix

Correlation: 1 = Low (Slight), 2 = Medium (Moderate), 3 = High (Substantial), '-' = no correlation.

CO	Program Outcome (PO)												PSO		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1							1	1	2	2
CO2	1	1	1	1	1							1	1	2	2
CO3	2	2	3	3	2	2	1	2	2	3		1	1	3	3
CO4	3	3	3	3	3	2	1	2	2	3	1	1	1	3	3
CO5	1	1	1	1	1							1	1	2	2
CO6	2	2	2	2	2	2	1	3	2	3		1	1	3	3
Avg	1.7	1.7	1.8	1.8	1.7	2.0	1.0	2.3	2.0	3.0	1.0	1.0	1.0	2.5	2.5

FF No.: 654

Course Code: ML2306
Course Name: Engineering Research and Innovation-1

Teaching Scheme	**Examination Scheme**
Credits : 2	CP: Marks
Lectures : Hrs/week	GD/PPT/HA: Marks
Practical : 2 Hrs/week	MSE (W/O):30 Marks
Tutorial : Hrs/week	ESE (W/O):70 Marks

Prerequisites:	
●	Course Prerequisites: Research Based Learning Course Relevance: Research Centric Learning (RCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course based research projects, curriculum can be enriched with semester long Engineering Research and Innovation courses, in which students can investigate socially relevant problems using various technologies and research methods from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such research problems, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the research domain, thereby achieving research centric learning. Modern world sustained and advanced through the successful completion of research and innovation. In short, if students are prepared for success in life, we need to prepare them for a research-based world. It is a style of active learning and inquiry-based learning. Research centric learning will also redefine the role of teacher as mentor in the learning process. The RCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.
Course Objectives:	
●	To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problems.
●	To Evaluate alternative approaches, and justify the use of selected tools and methods,
●	To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
●	To engage students in rich and authentic learning experiences.
●	To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
●	To develop an ecosystem to promote entrepreneurship and research culture among the students
Course Outcomes:	
	After completion of the course, student will be able to
1.	Identify a real-life research problem or gap from societal and technological need point of view
2.	Choose and compare alternative research methodologies to select the most feasible one
3.	Analyze and synthesize the identified research problem from a technological and scientific perspective.
4.	Design a reliable and scalable research methodology/experimental approach to meet the challenges.
5.	Evaluate the research outcomes based on the criteria specified
6.	Inculcate a long life learning and research attitude towards the societal problems

Section1:	Topics/Contents

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ERI, laboratory course contents of "Engineering Research" are designed as a ladder to extend connectivity of research methodologies and emerging technologies to solve real world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Research Databases and Literature Repositories (IEEE Xplore, Scopus, Google Scholar), Patent Search and IPR Tools, Statistical and Data Analysis Tools, Computational Biology (Biomedical and Bioinformatics), Robotics and Automation, Industry 4.0 (Artificial Intelligence, Machine Learning, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Group Structure:

There should be a team/group of 4-5 students. A supervisor/mentor teacher assigned to individual groups. It is useful to group students of different abilities and nationalities together.

Selection of Research Problem/Topic:

● Students must focus on initiating the task/idea. The idea of inception and consideration shall be from following areas as a real world problem:

-Health Care, Agriculture, Defense, Education, Smart City, Smart Energy, Swaccha Bharat Abhiyan, Environment, Women Safety.

● This is the sample list to start with. Faculty and students are free to include other ar eas which meet society's requirements at large.

● The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated disciplinary subject frame/domain.

● A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

● By exemplarity, a problem needs to refer to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

Teacher's Role in RCL:

● Teacher is not the source of solutions rather he will act as the facilitator and mentor.

● To utilize the principles of problem solving, critical thinking and metacognitive skills of the students.

● To make the group aware about time management.

● Commitment to devote the time to solving student's technical problems and interested in helping students to empower them better.

Student's Role in RCL:

● Students must have ability to initiate the task/idea, they should not be mere imitators.

● They must learn to think.

● Students working in RCL must be responsible for their own learning.

● Students must quickly learn how to manage their own learning, instead of passively receiving instruction.

● Students in RCL are actively constructing their knowledge and understanding of the situation in groups.

● Students in RCL are expected to work in groups.

● They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Developing Inquiry Skills:

● Students in PCL are expected to develop critical thinking abilities by constantly relating: What they read to do? What do they want to do with that information?

● They need to analyze information presented within the context of finding answers.

● Modeling is required so that the students can observe and build a conceptual model of the required processes.

● Use the following mechanism to maintain the track of moving towards the solution.
How effective is …….?
How strong is the evidence for ……?
How clear is ……?
● What are the justifications for thinking? Why is the method chosen?
● What is the evidence given to justify the solution?

Literature Survey – To avoid reinvention of wheel:

● It is an integral part of self- directed learning
● Identify the information needed to solve a given problem or issue
● Be able to locate the needed information
● Use the information to solve the given problem effectively.
● Skills required by students in information literacy include:
● · How to prepare for the search? How to carry out research
● Sorting and assessing of information in general

Use of Research Methodology: - investigation, collaboration, comprehension, application, analysis, synthesize and evaluation

Focus on the following skills while working in a team to reach to solution:

● Collaborative learning
● Interpersonal Skills
● Resources Evaluation
● Metacognitive Skills
● Reflection Skills

Section2:	**Topics/Contents**

ERI Sample Research Case Studies: -

With the adaptation of industry communication standards and modern research tools and platforms, the following research problems can be taken up:

1) Research on soil moisture prediction and detection using sensor data and machine learning
2) Research on temperature monitoring and prediction using IoT sensors and analytics
3) Research on pressure sensing and anomaly detection techniques for industrial applications
4) Research on early smoke and fire detection using sensor fusion and AI
5) Research on human motion detection and activity recognition using sensors
6) Research on collision detection and avoidance systems using sensor fusion
7) Research on acoustic and sound-based anomaly detection using machine learning

...**not limited to.....Faculty and students are free to include other areas which meet society's requirements at large.**

Text Books: ***(As per IEEE format)***

1	*Research Methodology: Methods and Techniques. By C.R. Kothari. New Age International Publishers. ISBN:978-8122415223; 2004*
2	*Research Methodology: A Step-by-Step Guide for Beginners. By Ranjit Kumar, SAGE Publications. 2019.*
3	*Practical Research: Planning and Design. By Paul D. Leedy, Jeanne Ellis Ormrod, Pearson. 2019*
4	*The Craft of Research. By Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams.*

	University of Chicago Press. 2016
Reference Books: ***(As per IEEE format)***	
1	Creswell J.W.: Research Design: Qualitative, Quantitative and Mixed Methods Approaches. Sage Publications. 2014.
2	Research project management core textbook, second edition, Indian Edition, by Gopalan.
3	The Craft of Research. By Wayne C. Booth, Gregory G. Colomb & Joseph M. Williams

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CO2	2	2	3	2	2		2		3		2	2	3	3	2
CO3	2	2	3	2	3		2		3	1	2	2	3	3	2
CO4	2	2	3	2	3	3		2	3		2	2	3	3	2
CO5	2	2	3	2	3	2			3		2	2	3	3	2
CO6	2	2	3	3	2				3		3	2	3	3	2
Avg	2.0	2.0	2.83	2.83	2.6	2.5	2.0	2.0	3.0	1.0	2.16	2.0	3.0	3.0	2.0