



List of Revised Courses

Department : Civil Engineering

Programme Name : B.Tech.

Academic Year : 2021-22

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	CE07TPE02A	PRE-STRESSED CONCRETE
02.	CE07TPE05A	INDUSTRIAL STRUCTURES
03.	CE08TPC18	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
04.	CE08TPE07D	FINITE ELEMENT ANALYSIS



Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2021-22

School : School of Studies of Engineering and Technology

Department : Civil Engineering

Date and Time : July 22, 2021 - 04:30 PM online

Venue : Department of Civil Engineering

Department of Civil Engineering
School of Studies of Engineering & Technology
Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur C.G.

Minutes of Meeting of BoS

A meeting of Board of Studies (BoS) of Civil Engineering was held on 22-07-2021 at 04.30 PM in online in the Department of Civil Engineering (through Google Meet) to discuss, finalize and approve the revised Scheme and syllabus of B.Tech. 4th year (7th and 8th Semesters) Civil Engineering w.e.f 2021-22 academic session. The following members of BoS were attended the meeting.

1. Dr. M. C. Rao, Chairman BoS, Head of the Department Civil Engg.
2. Prof. Umesh K Dewangan, Professor, Civil Engineering Dept., NIT Raipur, Subject Expert and External member of BoS
3. Dr. Shailendra Kumar, Professor, Civil Engg. Dept., GGV, member of BoS
4. Shri.R.K. Choubey, Asso. Professor, Civil Engg. Dept., GGV, member of BoS
5. Mr.A.K. Parashar, Asst.Professor, Civil Engg. Dept., GGV, member of BoS

The following external member of DRC could not attend the meeting due to ill health.

1. Shri. Sunil Kumar Shrivastava, Chief Manager (Civil), SECI, Bilaspur, Industry Expert and member of BoS

At the outset the chairman welcomed all the esteemed members.

The chairman of the DRC has presented the earlier BoS approved B.Tech. Civil Engineering Scheme (approved in the meeting held on 29-06-2019), the revised Scheme and the syllabus of B.Tech. 4th year, prepared as per the revised scheme & as per the AICTE guidelines to all the esteemed members. During meeting the members discussed the previously approved Scheme, the revised scheme and syllabus at length.

After discussion, the members of BoS have approved the B.Tech. scheme (revised) and detailed syllabus of B.Tech. 4th year (7th & 8th Semester) Civil Engineering and recommended to be made effective from session 2021-22. Further the external member has also sent his comments through e-mail (copy enclosed).

The meeting ended with vote of thanks.

Dr. M. C. Rao

Prof. Shailendra Kumar

Prof. Umesh K Dewangan
(Email copy attached)

Dr. R.K. Choubey

Mr. A.K. Parashar



The following revisions were introduced in the B.Tech. 4th year civil engineering:

- ❖ PRE-STRESSED CONCRETE (CE07TPE02A)
- ❖ INDUSTRIAL STRUCTURES (CE07TPE05A)
- ❖ EARTHQUAKE RESISTANT DESIGN OF STRUCTURES (CE08TPC18)
- ❖ FINITE ELEMENT ANALYSIS (CE08TPE07D)

The following new courses were introduced in the B.Tech. 4th year civil engineering:

- ❖ CONSTRUCTION ENGINEERING MATERIALS (CE07TPE02B)
- ❖ DISASTER PREPAREDNESS AND PLANNING (CE07TPE02C)
- ❖ LOW COST HOUSING TECHNIQUE (CE07TPE02E)
- ❖ ENVIRONMENTAL IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS (CE07TPE03E)
- ❖ ENGINEERING HYDROLOGY (CE07TPE04A)
- ❖ FOUNDATION ENGINEERING (CE07TPE04C)
- ❖ AIRPORT PLANNING AND DESIGN (CE07TPE05B)
- ❖ HIGHWAY CONSTRUCTION AND MANAGEMENT (CE07TPE05C)
- ❖ CONTRACTS MANAGEMENT (CE07TPE05D)
- ❖ CONSTRUCTION PROJECTS PLANNING & SYSTEMS (CE07TPE05E)
- ❖ ARTIFICIAL NEURAL NETWORK (CE07TOE02A)
- ❖ ECONOMIC POLICIES IN INDIA (CE07TOE02B)
- ❖ HISTORY OF SCIENCE AND ENGINEERING (CE07TOE02C)
- ❖ OFFSHORE ENGINEERING (CE08TPE06A)
- ❖ SURFACE HYDROLOGY (CE08TPE06B)
- ❖ WATER AND AIR QUALITY MODELLING (CE08TPE06D)
- ❖ CONSTRUCTION EQUIPMENT & AUTOMATION (CE08TPE06E)
- ❖ INFRASTRUCTURE PLANNING AND DESIGN (CE08TPE07A)
- ❖ TRAFFIC ENGINEERING (CE08TPE07B)
- ❖ URBAN HYDROLOGY AND HYDRAULICS (CE08TPE07E)
- ❖ CYBER LAW AND ETHICS (CE08TOE03C)
- ❖ HUMAN RESOURCES DEVELOPMENT AND ORGANISATIONAL BEHAVIOUR (CE08TOE03D)

विभागाध्यक्ष
HOD
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प्रो.स.गु.घा.विश्वविद्यालय, बिलासपुर (छ.ग.)
I.T., G.G.V. Bilaspur (C.G.)

Signature & Seal of HoD



Scheme and Syllabus

CIVIL ENGINEERING DEPARTMENT, SOS, ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR

SCHEME OF B.TECH.VII SEMESTER CIVIL ENGINEERING (New CBCS)
W.E.F. 2021-22 (ODD SEMESTER)

S. No	Subject Code	Subjects	period/Week			Scheme of Evaluation				Grand Total	Credits
			L	T	P	Internal Assessment (IA)			ESE		
						CT-I	CT-II	Total			
		Theory									
1	CE07TPC17	Water Resources Engineering-II	3	0	0	15	15	30	70	100	3
2	CE07TPE02	Professional Elective -02X	3	0	0	15	15	30	70	100	3
3	CE07TPE03	Professional Elective -03X	3	0	0	15	15	30	70	100	3
4	CE07TPE04	Professional Elective -04X	3	0	0	15	15	30	70	100	3
5	CE07TPE05	Professional Elective -05X	3	0	0	15	15	30	70	100	3
6	CE07TOE02	Open Elective -02X	3	0	0	15	15	30	70	100	3
		Practical									
1	CE07PPC08	Seminar*	-	-	3	-	-	50	-	50	1.5
2	CE07PPC09	Minor project	0	0	6	-	-	60	40	100	3
3	CE07PPC10	Estimation and Costing	0	0	3	-	-	30	20	50	1.5
										Total Credits	24

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE -- End Semester Exam; * Seminar on Industrial Training/Internship undergone during summer vacation of 6th Semester



CIVIL ENGINEERING DEPARTMENT, SOS, ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR

SCHEME OF B.TECH.VIII SEMESTER CIVIL ENGINEERING
W.E.F. 2021-22 (EVEN SEMESTER)

S. No	Subject Code	Subjects	period/Week			Scheme of Evaluation				Grand Total	Credits
			L	T	P	Internal Assessment (IA)			ESE		
						CT-I	CT-II	Total			
		Theory									
1	CE08TPC18	Earthquake Resistant Design of structure	3	0	0	15	15	30	70	100	3
2	CE08TPE06	Professional Elective -06X	3	0	0	15	15	30	70	100	3
3	CE08TPE07	Professional Elective -07X	3	0	0	15	15	30	70	100	3
4	CE08TOE03	Open Elective -03X	3	0	0	15	15	30	70	100	3
		Practical									
1	CE08PPC11	Major Project	0	0	14	-	-	120	80	200	7
2	CE08PPC12	Structural Detailing Lab	0	0	3	-	-	30	20	50	1.5
										Total Credits	20.5

L - Lecture Hours, T-Tutorial Hours, P - Practical Hours, CT - Class Test, ESE - End Semester Exam

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22/10/2021



List of Professional (Core) Electives			Credits	Semester
Sl. No.	Subject Code	Name of Subject		
x	CE06TPE01X	Professional Elective-1 (PE Group-1)	4	VI
A	CE06TPE01A	Structural Analysis by Matrix Methods		
B	CE06TPE01B	Advanced Surveying		
C	CE06TPE01C	Advanced Concrete Design		
D	CE06TPE01D	Railway Engineering		
E	CE06TPE01E	Basics of Computational Hydraulics		
Sl. No.	Subject Code	Name of Subject	Credits	Semester
x	CE07TPE02X	Professional Elective-2 (PE Group-2)	3	VII
A	CE07TPE02A	Pre-stressed Concrete		
B	CE07TPE02B	Construction Engineering Materials		
C	CE07TPE02C	Disaster Preparedness and Planning		
D	CE07TPE02D	Advanced Structural Analysis		
E	CE07TPE02E	Low Cost Housing Techniques		
Sl. No.	Subject Code	Name of Subject	Credits	Semester
x	CE07TPE03X	Professional Elective-3 (PE Group-3)	3	VII
A	CE07TPE03A	Environmental Geo-technology		
B	CE07TPE03B	Air Pollution Control Engineering		
C	CE07TPE03C	Solid and Hazardous Waste Management		
D	CE07TPE03D	Design of Hydraulic Structures		
E	CE07TPE03E	Environmental Impact Assessment and Life Cycle Analysis		
Sl. No.	Subject Code	Name of Subject	Credits	Semester
x	CE07TPE04X	Professional Elective-4 (PE Group-4)	3	VII
A	CE07TPE04A	Engineering Hydrology		
B	CE07TPE04B	Structural Dynamics		
C	CE07TPE04C	Foundation Engineering		
D	CE07TPE04D	Rock Mechanics		
E	CE07TPE04E	Water Resources Planning & Management		



Sl. No.	Subject Code	Name of Subject	Credits	Semester
		Professional Elective-5 (PE Group-5)	3	VII
x	CE07TPE05X			
A	CE07TPE05A	Industrial Structures		
B	CE07TPE05B	Airport Planning and Design		
C	CE07TPE05C	Highway Construction and Management		
D	CE07TPE05D	Contracts Management		
E	CE07TPE05E	Construction Projects Planning & Systems		
		Professional Elective-6 (PE Group-6)	3	VIII
x	CE08TPE06X			
A	CE08TPE06A	Offshore Engineering		
B	CE08TPE06B	Surface Hydrology		
C	CE08TPE06C	Bridge Engineering		
D	CE08TPE06D	Water and Air Quality Modelling		
E	CE08TPE06E	Construction Equipment & Automation		
		Professional Elective-7 (PE Group-7)	3	VIII
x	CE08TPE07X			
A	CE08TPE07A	Infrastructure Planning and Design		
B	CE08TPE07B	Traffic Engineering		
C	CE08TPE07C	Repair and Rehabilitation of Structures		
D	CE08TPE07D	Finite Element Analysis		
E	CE08TPE07E	Urban Hydrology and Hydraulics		



SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Cr
		L	T	P	CT-I	CT-II	TOTAL			
Subject Code:	CE07TPE02A							70	100	3
Subject:	Pre-stressed Concrete	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce fundamental of pre-stressing and develop understanding of pre-stressing system.
- To determine loss of pre-stress in pre-tensioned and post-tensioned members as per IS Code provision.
- To analyze simple and composite section in flexure.
- To evaluate deflection in beam and design simply supported beams as per IS Code provision.
- To design the members for shear reinforcement, Ultimate Shear Strength and end block design.

Course Content:

UNIT 1: Introduction: Fundamentals of prestressing - Classification and types of prestressing- Concrete Strength and strain characteristics - Steel mechanical properties - Auxiliary Materials like duct formers.

UNIT 2: Prestressing Systems: Principles of pretensioning and post-tensioning - study of common systems of prestressing for wires strands and bars. Losses of Prestress: Losses of pre-stress in pre-tensioned and post-tensioned members - IS code provisions.

UNIT 3: Analysis of Sections: In flexure, simple sections in flexure, kern distance - cable profile - limiting zones - composite sections cracking moment of rectangular sections.

UNIT 4: Deflection of Beams Long term and Short term deflection and Design of Simply Supported Beams, Allowable stress as per IS. 1343 - elastic design of rectangular and I-sections.

UNIT 5: Shear and Bond: Shear and bond in prestressed concrete beams - conventional design of shear reinforcement - Ultimate shear strength of a section - Prestress transfer in pretensioned beams-Principles of end block design.

Text Books:

1. Krishna Raja. N "Prestressed Concrete", Tata Mc Graw Hill.
2. Lin, T. Y, "Prestressed concrete", Mc Graw Hill Pub. Co.
3. Rajagopalan, "Prestressed concrete", Narosa Publishing House.

Course Outcomes-

- CO1: Describe mechanical properties of pre-stressed concrete, types of pre-stressing and its system.
- CO2: Calculate losses in pre-tensioned and post-tensioned members.
- CO3: Analyze pre-stressed concrete members for flexure, shear and cracking moment.
- CO4: Design pre-stressed concrete beams of rectangular and I section and compute deflection.
- CO5: Explain principle of end block design, pre-stress transfer, shear and bond.



SYLLABUS	(SEMESTER VII)	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Credits
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE07TPE05A							70	100	3
<i>Subject:</i>	Industrial Structures	3	0	0	15	15	30			

Course Learning Objectives:

- Develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard.
- To introduce the students about planning & functional requirement of industries
- To analyse & design the industrial buildings, bunkers & Silos
- To understand the design concept of chimneys
- To understand the principles of cylindrical shells

Course Content:

UNIT-I Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting, ventilation and fire safety- protection against noise and vibrations

UNIT-II Thin Walled / Cold Formed Steel Members: Definitions – Local Buckling of Thin-Elements-Post Buckling of Thin-Elements – Light Gauge Steel Columns and Compression Members – Form-Factor for Columns and Compression Members – Behaviour of Stiffened Elements Under Uniform Compression – Multiple Stiffened Compression Elements –Effective Length of Light Gauge Steel Compression Members – Light Gauge Steel Tension Members.

UNIT-III RC Bunkers & Silos: Introduction – Janssen’s Theory – Airy’s Theory – Design of Square, Rectangular and Circular Bunkers, Design of Silos.

UNIT-IV RC Chimneys: Introduction – Wind Pressure – Stresses in Chimney Shaft Due to Self-Weight and Wind – Stresses in Horizontal Reinforcement Due to Wind Shear – Stresses Due to Temperature Difference – Combined Effect of Self Load, Wind and Temperature – Temperature Stresses in Horizontal Reinforcement Problems.

UNIT-V Design Principles of Cylindrical Shells & Design Problems.

TEXT BOOKS

1. Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers & Distributors) 2005
2. Design of Steel Structures, By Ram Charan and Vinodra Gehlot vol-II, 2007.
3. Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers – 2010
4. Handbook on Machine Foundations by P. Srinivasula and C. V. Vaidyanathan, Structural Engineering Research Center
5. Tall Chimneys- Design and Construction by S. N. Manohar Tata McGrawhill Publishing Company

REFERENCES:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of industrial buildings
3. Design of steel structures by N. Subramanian

Course Outcomes-

At the end of the course, the student will be able to -

- CO1: Plan the functional requirements of structural systems for various industries.
- CO2: Get an idea about the materials used and design of industrial structural elements.
- CO3: Realize the basic concepts and design of power plant structures.
- CO4: Design power transmission structures.
- CO5: Possess the ability to understand the design concepts of Chimneys, bunkers and silos



SEMESTER VIII

SYLLABUS	SEMESTER-VIII	Periods/Week			Internal Assessment (IA)			ESE	Grand Total	Cie
		L	T	P	CT-I	CT-II	TOTAL			
Subject Code:	CE08TPC08							70	100	C
Subject:	Earthquake Resistant Design of Structures	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce Engineering seismology and functional planning and the effects of configurations of buildings for earthquakes.
- To introduce the requirements for conceptual design for earthquake safety and the analysis methods.
- To acquaint with IS code-based design lateral forces for earthquake resistant design of structures.
- To identify the behavior of structural and nonstructural elements for seismic resistance and impart design of shear walls.
- Introduce Capacity Design as per IS 13920: 2016, Capacity Design for Beams, Columns, beam column joints and structure as a whole.

Course Content:

UNIT 1: Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics-Seismic waves- Terms associated with earthquakes-Magnitude/intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India. Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT 2: Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures, Twisting of Buildings - Flexible Building and Rigid Building Systems, Strength and Stiffness - Ductility - Definition - Ductility Relationships - Choice of construction Materials - Unconfined Concrete & Confined Concrete - Masonry, Steel Structures, Design Earthquake Loads - Basic Load Combinations - Permissible Stresses, Seismic Methods of Analysis - Static Method - Equivalent Lateral Force Method, Dynamic Analysis - Response Spectrum Method - Modal Analysis Torsion.

UNIT 3: Introduction to Earthquake Resistant Design - Seismic Design Requirements and Methods, RC Buildings - IS Code based Method - Vertical Irregularities - Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation - Lateral Distribution of Base Shear -

UNIT 4: Structural Walls Strategies and the Location of Structural Walls - Sectional Shapes - Behaviour of Unreinforced and Reinforced Masonry Walls - Behaviour of Walls Box Action and Bands - Behavior of in-fill Walls - Non Structural Elements - Failure Mechanism of Nonstructural Elements - Effects of Nonstructural Elements on Structural System - Analysis - Prevention of Damage to Nonstructural Elements - Isolation of Non-Structures, Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls.

UNIT 5: Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920, Behavior of beams, columns and joints in RC buildings during earthquakes- Vulnerability of open ground storey and short columns during earthquake- Seismic Evaluation and Retrofitting- Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Text Books/References:

- Seismic Design of Reinforced Concrete and Masonry Building - T. Paulay and M.J.N. Priestly, John Wiley & Sons
- Earthquake Resistant Design of structures - Parkaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt Ltd
- Earthquake Resistant Design for Engineers & Architects by Dowrick, D. J., John Wiley & Sons, 2nd Edition, 1987.



4. Earthquake Resistant Design of structures by S. K. Duggal, Oxford University Press.
5. Concrete Structures in Earthquake Regions by Booth, E., Longman Higher Education, 1994.
6. Reinforced Concrete Structures by Park, R. & Paulay, T., John Wiley & Sons, 2nd Edition, 1975.
7. Masonry and Timber structures including earthquake Resistant Design – Arund S.Arya, Nemchand& I
8. Earthquake-Resistant Design of Masonry Building –Mihra Tomazovic, Imperial College Press.
9. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
10. Dynamics of Structures by A.K.C Chopra, Second edition (2001), Prentice Hall India Private Ltd
11. Handbook on Seismic Analysis and Design of Structures by Farhad Naeim, Kluwer Academic Publ 2001.

Reference Codes:

1. IS 1893 (Part-1) : 2016, "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS 4326 : 2013, "Earthquake Resistant Design and Construction of Building", Code of Practice, B.I.S., Delhi.
3. IS 13920 : 2016, "Ductile design and detailing of reinforced concrete structures subjected to seismic fa – Code of practice, B.I.S., New Delhi.

Course Outcomes:

On the completion of this course, the student will be able to:

- CO1: Identify the causes of earthquakes, its propagation, and measurement and can quantify the hazard location of the structure and quantify the forces based on the source.
- CO2: Adopt a suitable structural system to resist earthquake forces considering safe behavior of structural and non-structural elements with different material properties and load combinations.
- CO3: Design seismically safe structures in accordance with the provisions of Indian code IS 1893.
- CO4: Implement design of shear wall elements for earthquake safety of structures.
- CO5: Design or retrofitting of structures by detailing the elements, beams, columns, beam-column joint per capacity-based design adopting ductility provisions as per IS 1893, IS 13920, to mitigate vulnerability of earthquake damages of elements and structures.



SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Cred
		L	T	P	CT-I	CT-II	TOTAL			
<i>Subject Code:</i>	CE08TPE07D									
<i>Subject:</i>	Finite Element Analysis	3	0	0	15	15	30	70	100	03

Course Objectives:

1. To learn basic principles of finite element analysis procedure.
2. To learn the theory and characteristics of finite elements that represent engineering structures.
3. To learn and apply finite element solutions to structural and dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Course Content:

UNIT 1: Matrix Methods of Structural Analysis – Review of concepts – Actions and displacements – compatibility – indeterminacy – Member and joint loads – Flexibility Matrix formulation - Stiffness Matrix formulation.

UNIT 2: Analysis of Beams- Finite Element formulation and Analysis of beams by Finite Element method.

UNIT 3: Analysis of Rigid Jointed Plane Frame - Finite Element formulation and Analysis of rigid jointed plane frame by Finite Element method.

UNIT 4: Analysis of Pin Jointed Plane Frame- Finite Element formulation and Analysis of pin jointed plane frame by Finite Element method.

UNIT 5: Introduction to Plate and Shell Elements- Analysis of plane stress/strain and axis symmetric solids- triangular, quadrilateral and isoparametric elements, Analysis of plate bending, basic equations of thin plate theory, Reissner-Mindlin theory, plate elements and applications. Analysis of shells, degenerated shell elements.

Text Books:

1. Chandrupatla T.R., Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Private Limited, New Delhi.
2. Desai C.S., Abel J.F., Introduction to the Finite Element Method, CBS Publishers & Distributors, Delhi.

Reference Books:

1. Krishnamurthy, C.S., Finite Element Analysis – Theory and Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Finite Element Analysis – Theory and Programming by Cook R.D. et.al., Concepts and Applications of Finite Element Analysis, John Wiley

Course outcomes:

Upon successful completion of this course, you should be able to:

- CO1: Understand the concepts behind formulation methods in FEM.
- CO2: Identify the application and characteristics of FEA elements such as bars, beams, plane.
- CO3: Analyze the rigid and pin jointed plane frame using finite element method.