

CET201	MECHANICS OF SOLIDS	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	3	1	0	4	2019

Preamble:

Mechanics of solids is one of the foundation courses in the study of structural systems. The course provides the fundamental concepts of mechanics of deformable bodies and helps students to develop their analytical and problem solving skills. The course introduces students to the various internal effects induced in structural members as well as their deformations due to different types of loading. After this course students will be able to determine the stress, strain and deformation of loaded structural elements.

Prerequisite: EST 100 Engineering Mechanics

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Recall the fundamental terms and theorems associated with mechanics of linear elastic deformable bodies.	Remembering
CO2	Explain the behavior and response of various structural elements under various loading conditions.	Understanding
CO3	Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants and strain energies in structural elements subjected to axial/transverse loads and bending/twisting moments.	Applying
CO4	Choose appropriate principles or formula to find the elastic constants of materials making use of the information available.	Applying
CO5	Perform stress transformations, identify principal planes/stresses and maximum shear stress at a point in a structural member.	Applying
CO6	Analyse the given structural member to calculate the safe load or proportion the cross section to carry the load safely.	Analysing

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-
CO6	3	3	1	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	15
Understand	10	10	15
Apply	30	20	60
Analyse		10	10
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question carries 14 marks and can have maximum 2 sub-divisions.

CET 203	Fluid Mechanics and Hydraulics	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of fluid mechanics, hydraulics of pipes and open channels and to enhance the problem solving skills. The concepts learned will help in applying them for the design of hydraulic structures and to real world fluid flow problems.

Pre-requisite: Elementary mathematics, concepts in engineering mechanics

Course outcome

After the course, the student will able to:

CO1	Recall the relevant principles of hydrostatics and hydraulics of pipes and open channels
CO2	Identify or describe the type, characteristics or properties of fluid flow
CO3	Estimate the fluid pressure, perform the stability check of bodies under hydrostatic condition
CO4	Compute discharge through pipes or estimate the forces on pipe bends by applying hydraulic principles of continuity, energy and/or momentum
CO5	Analyze or compute the flow through open channels, perform the design of prismatic channels

CET 203 Fluid Mechanics and Hydraulics		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	2	2										
	CO2	2	2										
	CO3	3	3				1						
	CO4	3	3				1						
	CO5	3	3	2									

Assessment pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	5	5	15
Understand	10	10	15
Apply	20	20	40
Analyze	15	15	30

CET205	SURVEYING & GEOMATICS	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	4	0	0	4	2019

Preamble:

Objective of the course is to impart an awareness on the principles of surveying, various methods and instruments of surveying, errors associated with field measurements and advanced surveying techniques.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Apply surveying techniques and principles of leveling for the preparation of contour maps, computation of area-volume and sketching mass diagram
CO 2	Apply the principles of surveying for triangulation
CO 3	Apply different methods of traverse surveying and traverse balancing
CO 4	Identify the possible errors in surveying and apply the corrections in field measurements
CO 5	Apply the basic knowledge of setting out of different types of curves
CO 6	Employ surveying techniques using advanced surveying equipments

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3		2	2							
CO 2	3	3		2								
CO 3	3	3						1	2			
CO 4	3	2										
CO 5	3	2	1	1				1	2			
CO 6	3			2	2			1				2

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (marks)
	Test 1 Marks	Test 2 Marks	
Remember	7.5	7.5	30
Understand	7.5	7.5	30
Apply	10	10	40
Analyse			
Evaluate			
Create			

CEL 201	CIVIL ENGINEERING PLANNING & DRAFTING LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: The course is designed to introduce the fundamentals of Civil Engineering drawing and understand the principles of planning. The students will be able to learn the drafting of buildings manually and using drafting software such as AutoCAD.

Prerequisite: ENGINEERING GRAPHICS

Course Outcomes and their assessment: After the completion of the course, the student will be able to:

Course Outcome (CO)	Course Outcome Description	CO assessment strategy
CO 1	Illustrate ability to organise civil engineering drawings systematically and professionally	Assessment of the overall organisation of the drawing, labels and templates used.
CO 2	Prepare building drawings as per the specified guidelines.	Application of guidelines for functional planning of building unit.
CO 3	Assess a complete building drawing to include all necessary information	Level of incorporation of Guidelines specified by NBC, meeting the requirement of building rules specified by local bodies of administration.
CO 4	Create a digital form of the building plan using any drafting software	Evaluation of the printouts of prepared building plan

Mapping of course outcomes (COs) with program outcomes (POs)

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
CO 1	3	-	-	-	-	-	-	2	3	3	-	-
CO 2	3	-	-	-	-	-	-	2	3	3	-	-
CO 3	3	-	-	-	-	-	-	2	3	3	-	-
CO 4	3	-	-	-	-	-	-	2	2	3	-	-

CEL 203	SURVEY LAB	CATEGORY	L	T	P	CREDIT
		PCC	0	0	3	2

Preamble:

Objective of the course is to impart practical experience to students by exposing them to various techniques of field surveying. The course is designed to make student familiar with conventional and advanced surveying instruments.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Use conventional surveying tools such as chain/tape and compass for plotting and area determination.
CO 2	Apply levelling principles in field
CO 3	Solve triangulation problems using theodolite
CO 4	Employ total station for field surveying
CO 5	Demonstrate the use of distomat and handheld GPS

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3							1	2			
CO 2	3			1				1	2			
CO 3	3			1				1	2			
CO 4	3			1	3			1	2			2
CO 5	3				3			1				2

Course Level Assessment Questions

Course Outcome 1 (CO1): Plot the given area using chain/tape and compass and compute its area.

Course Outcome 2 (CO2): Determine the reduced levels of the given points in the filed with respect to the Bench Mark of RL=100.00

Course Outcome 3 (CO3): Find out the distance between two inaccessible points A and B. Baseline measurement is allowed.

Course Outcome 4 (CO4): Compute the area of a given plot using total station.

Course Outcome 5 (CO5): Explain the parts of a handheld GPS with neat sketch.

CET202	Engineering Geology	Category	L	T	P	Credits	Year of Introduction
		PCC	3	0	1		

Preamble: Goal of this course is to introduce to the students the basics of earth processes, materials, groundwater and the geological characteristics of such processes and materials which are relevant to the Civil Engineering applications.

Prerequisites: Nil

Course Outcomes: After completion of the course the student will be able to:

CO1	Recall the fundamental concepts of surface processes, subsurface process, minerals, rocks, groundwater and geological factors in civil engineering constructions.
CO2	Identify and describe the surface processes, subsurface process, earth materials, groundwater and geological factors in civil engineering constructions.
CO3	Apply the basic concepts of surface and subsurface processes, minerals, rocks, groundwater and geological characteristics in civil engineering constructions.
CO4	Analyze and classify geological processes, earth materials and groundwater.
CO5	Evaluation of geological factors in civil engineering constructions.

Mapping of course outcomes with program outcomes (Minimum requirement)

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

Assessment pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	9 (3 marks for each question in which one question from third module)	6	15
Understand	6	9 (3 marks for each question in which one question from third module)	15
Apply	14 +14 + 7 (Question for 7 marks is from third module)	14 +14 + 7 (Question for 7 marks is from third module)	70
Analyse			
Evaluate			

CET 204	GEOTECHNICAL ENGINEERING - I	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	4	0	0	4	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of soil mechanics and laboratory tests to determine the basic, index and engineering properties of soils. After this course, students will be able to identify and classify the soil and to recognize practical problems in real-world situations and respond accordingly.

Prerequisite : Nil

Course Outcomes: After completion of the course the student will be able to:

CO 1	Explain the fundamental concepts of basic and engineering properties of soil
CO 2	Describe the laboratory testing methods for determining soil parameters
CO 3	Solve the basic properties of soil by applying functional relationships
CO 4	Calculate the engineering properties of soil by applying the laboratory test results and the fundamental concepts of soil mechanics
CO 5	Analyze the soil properties to identify and classify the soil

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	3	-	-	-	-	-	-	-	-	-	-
CO 4	2	3	-	-	-	-	-	-	-	-	-	-
CO 5	2	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	10	15	20
Apply	25	25	50
Analyse	5		10
Evaluate			
Create			

CIVIL ENGINEERING

CET206	TRANSPORTATION ENGINEERING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	4	0	0	4	2019

Preamble

Objective of the course is to introduce the principles and practice of Highway, Railway, Harbour and dock, Tunnel and Airport Engineering.

Prerequisite: Nil

Course Outcomes:

	Description
CO No.	At the end of the course, students will be able to:
CO 1	Apply the basic principles of Highway planning and design highway geometric elements
CO 2	Apply standard code specifications in judging the quality of highway materials; designing of flexible pavements
CO 3	Explain phenomena in road traffic by collection, analysis and interpretation of traffic data through surveys; creative design of traffic control facilities
CO 4	Understand about railway systems, tunnel, harbour and docks
CO 5	Express basics of airport engineering and design airport elements

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	1		1	3	1		2		1
CO 2	3	1	3	1		1	1	1		1		1
CO 3	3	2	2	1					1	2		2
CO 4	2						2	1				2
CO 5	3	3	3			3		2				

CEL 202	MATERIAL TESTING LAB - I	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: The course aims to enrich the understanding of the fundamental concepts of mechanics of deformable bodies through systematic experimental techniques for the estimation of various mechanical properties of engineering materials.

Prerequisite: Engineering Physics, Mechanics of Materials. Knowledge in use of Vernier caliper and micrometer screw gauge expected.

General Instructions to Faculty:

1. Any 12 experiments out of 15 need to be performed mandatorily. Virtual Lab facility [11] cannot be used to substitute the conduct of these mandatory experiments.
2. The laboratory should have possession of modern testing equipment such as strain gauges, LVDTs, load cells and data acquisition systems at least for demonstration purposes
3. Periodic maintenance and calibration of various testing instruments needs to be made.
4. Use of data visualization packages needs to be promoted for making various plots.

Course Outcomes: After the completion of the course, the student will be able to:

Course Outcome	Course Outcome Description
CO 1	The understand the behaviour of engineering materials under various forms and stages of loading.
CO 2	Characterize the elastic properties of various materials.
CO3	Evaluate the strength and stiffness properties of engineering materials under various loading conditions.

Mapping of course outcomes with program outcomes:

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
CO 1	3	2	2	2	1	3	-	-	2	2	-	2
CO 2	3	2	2	2	1	3	-	-	2	2	-	2
CO 3	3	2	2	2	1	3	-	-	2	2	-	2

CEL 204	FLUID MECHANICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: The course is designed to train the students to familiarize and understand the different flow measurement equipment's and their procedures. Students will be introduced to a team working environment where they develop the necessary skills of experimentation techniques for the study of flow phenomena in channels/pipes.

Prerequisite: Fluid Mechanics and Hydraulics

Course Outcomes: After the completion of the course, the student will be able to:

Course Outcome (CO)	Course Outcome Description
CO 1	Apply fundamental knowledge of Fluid Mechanics to corresponding experiments
CO 2	Apply theoretical concepts in Fluid Mechanics to respective experiments
CO 3	Analyse experimental data and interpret the results
CO 4	Document the experimentation in prescribed manner

Mapping of course outcomes (COs) with program outcomes (POs)

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
CO 1	2	2	-	-	-	-	-	2	3	-	-	-
CO 2	2	2	-	-	-	-	-	2	3	-	-	-
CO 3	3	3	-	2	-	-	-	2	3	3	-	-
CO 4	1	-	-	-	-	-	-	2	2	3	-	-

Course Level Assessment Questions

Assessment Pattern

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	End Semester Examination (ESE) Duration
150	75	75	2.5 hours

CET301	STRUCTURAL ANALYSIS - I	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: The course enables the students to analyse various types of simple structures using appropriate methods and tools. It introduces the applications of principles of mechanics of solids to determine stress resultants in statically determinate and indeterminate structures. Specific cases of cables, suspension bridges and arches are also discussed at length. The course trains the students to develop mathematical models and helps to sharpen their analytical skills. After this course students will be able to analyse structures subjected to moving loads as well.

Prerequisite: CET201Mechanics of Solids

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Apply the principles of solid mechanics to analyse trusses.	Applying
CO2	Apply various methods to determine deflections in statically determinate structures.	Applying
CO3	Identify the problems with static indeterminacy and tackling such problems by means of the method of consistent deformations and energy principles.	Understanding, Analysing, Applying
CO4	Apply specific methods such as slope deflection and moment distribution methods of structural analysis for typical structures with different characteristics.	Understanding, Applying
CO5	Apply suitable methods of analysis for various types of structures including cables, suspension bridges and arches.	Understanding, Applying
CO6	Analyse the effects of moving loads on structures using influence lines.	Understanding, Analysing, Applying

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-

CET303	DESIGN OF CONCRETE STRUCTURES	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: Reinforced concrete members are designed according to the existing codes of practice [IS 456 (2000)]. The course provides all the fundamental topics in reinforced concrete design and enable students to design and detail reinforced concrete structural members such as beam, slab, column and footing. The course also provides an introduction to earthquake resistant design and detailing.

Prerequisite: CET201 Mechanics of Solids

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Recall the fundamental concepts of limit state design and code provisions for design of concrete members under bending, shear, compression and torsion.	Remembering/ Understanding
CO2	Analyse reinforced concrete sections to determine the ultimate capacity in bending, shear and compression.	Applying
CO3	Design and detail beams, slab, stairs and footings using IS code provisions.	Applying
CO4	Design and detail columns using IS code and SP 16 design charts.	Applying
CO5	Explain the criteria for earthquake resistant design of structures and ductile detailing of concrete structures subjected to seismic forces.	Understanding

Mapping of course outcomes with program outcomes (Minimum requirement)

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

CET 305	GEOTECHNICAL ENGINEERING - II	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	4	0	0	4	2019

Preamble: Goal of this course is to impart to the students, in-depth knowledge about the basic concepts and theories of foundation engineering. After this course, students will be able to recognize practical problems of foundations in real-world situations and respond accordingly.

Prerequisite : Geotechnical Engineering - I

Course Outcomes: After completion of the course the student will be able to:

CO 1	Understand soil exploration methods
CO 2	Explain the basic concepts, theories and methods of analysis in foundation engineering
CO 3	Calculate bearing capacity, pile capacity, foundation settlement and earth pressure
CO 4	Analyze shallow and deep foundations
CO 5	Solve the field problems related to geotechnical engineering

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	3	-	-	-	-	-	-	-	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	3	-	-	-	-	-	-	-	-	-	-
CO 4	2	2	3	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	5	5	10
Understand	10	10	20
Apply	25	25	50
Analyse	10	10	20
Evaluate			
Create			

CET 307	HYDROLOGY & WATER RESOURCES ENGINEERING	Category	L	T	P	Credit	Year of Introduction
		PCC	4	0	0	4	2019

Preamble: The general objective of this course is to expose the students to the fundamental concepts of surface and groundwater components of hydrology and basics of water resources engineering. The course aim to impart the knowledge on the availability of water on hydrosphere, its distribution and quantification, scientific methods for computing irrigation water requirements, reservoir engineering and river engineering

Pre-requisite: NIL

Course outcome

After the course, the student will be able to:

CO1	Describe and estimate the different components of hydrologic cycle by processing hydro-meteorological data
CO2	Determine the crop water requirements for the design of irrigation canals by recollecting the principles of irrigation engineering
CO3	Perform the estimation of streamflow and/or describe the river behavior and control structures
CO4	Describe and apply the principles of reservoir engineering to estimate the capacity of reservoirs and their useful life
CO5	Demonstrate the principles of groundwater engineering and apply them for computing the yield of aquifers and wells

CO - PO Mapping

CET307 Hydrology and Water Resources		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	3	3		1			1					
	CO2	3	3					1					
	CO3	3	2					1					
	CO4	3	3					1					
	CO5	3	3					1					

CET309	CONSTRUCTION TECHNOLOGY AND MANAGEMENT	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	3	0	0	3	2019

Preamble:

Construction Technology and Management introduces the basic concepts of civil engineering construction and its management. The course provides a detailed insight into the materials used in construction, various building elements and construction technology. Management is essential for successful completion of construction projects and the course introduces the students to the basic concepts of construction project management and planning. After the course, students will be familiar with the fundamental concepts of building construction and management.

Prerequisite: Basics of Civil and Mechanical Engineering

Course Outcomes: After completion of the course, the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Describe the properties of materials used in construction	Understand
CO2	Explain the properties of concrete and its determination	Understand
CO3	Describe the various elements of building construction	Understand
CO4	Explain the technologies for construction	Understand
CO5	Describe the procedure for planning and executing public works	Understand
CO6	Apply scheduling techniques in project planning and control	Application

Mapping of course outcomes with program outcomes(Minimum requirement)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					1	1	1		1		1
CO2	3					1		1		1		1
CO3	3					1				1		1
CO4	3					2	1			1		1
CO5	3	2				1				1	3	1
CO6	3	3	3		1				2	1	3	1

CEL331	MATERIAL TESTING LAB II	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	3	2019

Preamble: The course aims to enrich the students to gain hands-on experience in conducting laboratory tests on various construction materials and thereby evaluate material quality and performance.

Prerequisite: Basics of Construction Engineering Materials.

General Instructions to Faculty:

- Any 12 of the 15 experiments included in the list of experiments need to be performed mandatorily. Virtual Lab facility cannot be used to substitute the conduct of these mandatory experiments.
- The laboratory should have possession of modern testing equipment such as Rebound hammer, ultrasonic pulse velocity, rebar locator, core cutter, concrete penetrometer and crack detection microscope at least for demonstration purposes.
- Periodic maintenance and calibration of various testing instruments needs to be made.
- Use of data visualization packages such as may be required for making various plots.

Course Outcomes: After the completion of the course, the student will be able to:

Course Outcome	Course Outcome Description
CO 1	To describe the basic properties of various construction materials
CO 2	Characterize the physical and mechanical properties of various construction materials.
CO3	Interpret the quality of various construction materials as per IS Codal provisions.

Mapping of course outcomes with program outcomes:

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
CO 1	3	2	2	2	1	3	-	-	2	2	-	2
CO 2	3	2	2	2	1	3	-	-	2	2	-	2
CO 3	3	2	2	2	1	3	-	-	2	2	-	2

Assessment Pattern:

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

CEL 333	GEOTECHNICAL ENGINEERING LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble:

Objective of the course is to familiarize students with the laboratory tests used to determine physical, index and engineering properties of geomaterials.

Prerequisite: CET 204 GEOTECHNICAL ENGINEERING I

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Identify and classify soil based on standard geotechnical experimental methods.
CO2	Perform and analyze permeability tests.
CO3	Interpret engineering behavior of soils based on test results.
CO4	Perform laboratory compaction, CBR and in-place density test for fill quality control in the field.
CO5	Evaluate the strength of soil by performing various tests viz. direct shear test, unconfined compressive strength test and triaxial shear test.
CO6	Evaluate settlement characteristics of soils.

Mapping of course outcomes (COs) with program outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3				1				2	2		
CO2	3				2				2	2		
CO3	3	2							2	2		
CO4	3				1				2	2		
CO5	3				2				2	2		
CO6	3	1			2				2	2		

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	End Semester Examination (ESE) Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks

Continuous Assessment : 30 marks

Internal Test (Immediately before the second series test) : 30 marks

CET302	STRUCTURAL ANALYSIS - II	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: The course enables the students to analyse various types of multistoreyed structures using appropriate methods and tools. It utilises the procedures of force methods and displacement methods for analysing framed structures. Plastic theory and its applications are introduced to students. A very important topic of applications of principles of dynamics to analyse structures while undergoing dynamic deformations is also made familiar with. The course trains the students to develop mathematical models and helps to sharpen their analytical skills, which also helps the student to lay foundation for further advanced topics like finite element method.

Prerequisite: CET301 Structural Analysis I

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Understand the principles of plastic theory and its applications in structural analysis.	Understanding, Applying
CO2	Examine the type of structure and decide on the method of analysis.	Analysing, Applying
CO3	Apply approximate methods of analysis for framed structures to ascertain stress resultants approximately but quickly.	Analysing, Applying
CO4	Apply the force method to analyse framed structures.	Understanding,Analysing, Applying
CO5	Apply the displacement methods to analyse framed structures.	Understanding, Analysing, Applying
CO6	Remember basic dynamics, understand the basic principles of structural dynamics and apply the same to simple structures.	Remembering, Understanding, Applying

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-
CO5	3	3	1	-	-	-	-	-	-	-	-	-
CO6	3	3	1	-	-	-	-	-	-	-	-	-

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	05	05	10
Understand	10	10	20
Apply	20	20	50
Analyse	15	15	20
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
 Continuous Assessment Test (2 numbers) : 25 marks
 Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question carries 14 marks and can have maximum 2 sub-divisions.

CET 304	ENVIRONMENTAL ENGINEERING	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	4	0	0	4	2019

Preamble This course introduces students to various treatment technologies for drinking water and domestic waste water. Students will learn the role of an environmental engineer in ensuring public health. They will understand how engineering approach can enhance the environmental quality by scaling up the physical and biological purification processes that exist in nature.

Prerequisite: CET 203 Fluid Mechanics and Hydraulics, CET 307 Hydrology & Water Resources Engineering

Course Outcomes: After the completion of the course the student will be able

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	To appreciate the role of environmental engineering in improving the quality of environment	Understanding
CO2	To plan for collection and conveyance of water and waste water	Applying
CO3	To enhance natural water purification processes in an engineered environment	Analysing
CO4	To decide on appropriate technology for water and waste water treatment	Evaluating

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	-	-	-	-	2	2	-	-	-	-	-
CO 2	3	-	3	-	-	-	-	-	-	-	-	-
CO 3	3	-	3	-	-	-	-	-	-	-	-	-
CO 4	3	-	3	-	-	-	-	-	-	-	-	-

CET306	DESIGN OF HYDRAULIC STRUCTURES	Category	L	T	P	Credit	Year of Introduction
		PCC	4	0	0	4	2019

Preamble: The general objective of this course is to expose the students to the fundamental concepts of hydraulic design of different hydraulic structures and to develop the drawings of minor irrigation structures. This course equip the students to perform the hydraulic design of minor irrigation structures such as cross drainage works, canal falls and regulators and prepare drawings of the same. To impart the knowledge on causes of failure and design criteria of hydraulic structures like dams and canal structures.

Pre-requisite: Fluid Mechanics and Hydraulics, Hydrology & Water Resources Engineering

Course outcome : After the course, the student will able to:

CO1	Elucidate the causes of failure, principles of design of different components of hydraulic structures
CO2	Describe the features of canal structures and perform the design of alluvial canals
CO3	Perform the hydraulic design of minor irrigation structures such as cross drainage works, canal falls, cross regulator
CO4	Prepare the scaled drawings of different minor irrigation structures
CO5	Describe the design principles and features of dams and perform the stability analysis of gravity dams

CO - PO Mapping

1 – Slight (Low), 2 – Moderate (Medium), 3 – Substantial (High)

DESIGN OF HYDRAULIC STRUCTURES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	3	2					1					
	CO2		2	3									
	CO3	3	3	3									
	CO4										3		
	CO5	3	2					1	1				

CET308	COMPREHENSIVE COURSE WORK	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	1	0	0	1	2019

Preamble: The course is designed to ensure that the student have firmly grasped the foundational knowledge in Civil Engineering familiar enough with the technological concepts. It provides an opportunity for the students to demonstrate their knowledge in various Civil Engineering subjects.

Pre-requisite: Nil

Course outcomes: After the course, the student will able to:

CO1	Learn to prepare for a competitive examination
CO2	Comprehend the questions in Civil Engineering field and answer them with confidence
CO3	Communicate effectively with faculty in scholarly environments
CO4	Analyze the comprehensive knowledge gained in basic courses in the field of Civil Engineering

CET 308 Comprehensive Course Work		P O	P O	P O	P O	P O	P O	P O	P O	P O	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3	1	1			2							1	1	
	CO2	3	1				2				3					
	CO3	3	1			1	2				3				1	
	CO4	3	3			1	2									

Assessment pattern

Bloom's Category	End Semester Examination (Marks)
Remember	25
Understand	15
Apply	5
Analyze	5
Evaluate	
Create	

CEL332	TRANSPORTATION ENGINEERING LAB	CATEGORY	L	T	P	CREDIT	Year of Introduction
		PCC	0	0	3	2	2019

Preamble: The objective of this course is to enable students to assess the quality of various pavement materials and their suitability in highway construction. The course is designed to make student familiar with mix design and do functional evaluation of pavements.

Prerequisite: CET 206 Transportation Engineering I

Course Outcomes:

After the completion of the course the student will be able to

CO 1	Analyse the suitability of soil as a pavement subgrade material
CO 2	Assess the suitability of aggregates as a pavement construction material
CO 3	Characterize bitumen based on its properties so as to recommend it as a pavement construction material.
CO 4	Design bituminous mixes for pavement layers
CO 5	Assess functional adequacy of pavements based on roughness of pavement surface.

Mapping of Course Outcome with Programme Outcome

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

Course level assessment questions

CO1 : Determine CBR value of the given sample of soil. Comment on its suitability as a subgrade material.

CO2 : Find the impact value of the given sample of aggregates. Assess its suitability as a pavement construction material based on specifications given relevant codes/guidelines.

CO3 : Determine softening point of the given sample of bitumen.

CEL 334	CIVIL ENGINEERING SOFTWARE LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		LAB	0	0	3	2	2019

Preamble: The course aims to train the students to use different software tools needed for professional practice in civil engineering. Also, the field expertise needed for undertaking the surveying activity using modern instruments and hence to prepare the necessary engineering documentation are included in this laboratory course.

Prerequisite: Civil Engineering drawing, structural analysis and design courses, surveying lab.

General Instructions to Faculty:

1. A total of 8 experiments are to be completed in the course by ensuring that at least one from each section is done.
2. The laboratory should have possession of required software and survey equipment for effective delivery of laboratory sessions
3. Periodic maintenance and calibration of various testing instruments needs to be made.
4. Use of data visualization packages needs to be promoted for making various plots.

Course Outcomes: After the completion of the course, the student will be able to:

Course Outcome	Course Outcome Description
CO1	To undertake analysis and design of multi-storeyed framed structure, schedule a given set of project activities using a software.
CO2	To prepare design details of different structural components, implementation plan for a project.
CO3	To prepare a technical document on engineering activities like surveying , structural design and project planning.

Mapping of course outcomes with program outcomes:

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
CO 1	3	2	2	2	1	3	-	-	2	2	-	2
CO 2	3	2	2	2	1	3	-	-	2	2	-	2
CO 3	3	2	2	2	1	3	-	-	2	2	-	2

CET401	DESIGN OF STEEL STRUCTURES	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	0	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of DESIGN OF STEEL STRUCTURES. After this course, students will be able to design steel structures and to recognize practical problems in real-world situations and respond accordingly.

Prerequisite: CE302 STRUCTURAL ANALYSIS II

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO 1	Explain the behavior and properties of structural steel members to resist various structural forces and actions and apply the relevant codes of practice	Understanding and analyzing
CO 2	Analyses the behavior of structural steel members and undertake design at both serviceability and ultimate limit states	Analysing and applying
CO 3	Explain the theoretical and practical aspects of Design of composite Steel Structure along with the planning and design aspects	Understanding and applying
CO 4	Apply a diverse knowledge of Design of Steel engineering practices applied to real life problems	Applying
CO5	Demonstrate experience in the implementation of design of structures on engineering concepts which are applied in field Structural Engineering	Applying

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	3	2	-	-	-	-	-	-	-	-	-
CO 3	2	3	2	-	-	-	-	-	-	-	-	-
CO 4	2	3	3	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-

CEL411	ENVIRONMENTAL ENGG LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: This lab provides the knowledge on tests used to analyse the physio-chemical and bacteriological properties of water and explains the various method followed in the test along with its suitability as a drinking water.

Prerequisite: CET 304 Environmental Engineering

Course Outcomes: After the completion of the course, the student will be able to:

Course outcome	Description
CO1	Analyse various physico-chemical and biological parameters of water
CO2	Compare the quality of water with drinking water standards and recommend its suitability for drinking purposes

Mapping of course outcomes with program outcomes:

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12
CO1	3	3	3	1	-	3	3	-	-	-	-	3
CO2	3	3	3	1	-	3	3	-	-	-	-	3

Assessment Pattern:

Mark distribution

Total marks	CIE	ESE	ESE Duration
150	75	75	3 Hrs

CEQ413	SEMINAR	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	2

Preamble: The course ‘Seminar’ is intended to enable a B.Tech graduate to read, understand, present and prepare report about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.

Course Objectives:

- To do literature survey in a selected area of study.
- To understand an academic document from the literature and to give a presentation about it.
- To prepare a technical report.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1	Identify academic documents from the literature which are related to her/his areas of interest (Cognitive knowledge level: Apply).
CO2	Read and apprehend an academic document from the literature which is related to her/ his areas of interest (Cognitive knowledge level: Analyze).
CO3	Prepare a presentation about an academic document (Cognitive knowledge level: Create).
CO4	Give a presentation about an academic document (Cognitive knowledge level: Apply).
CO5	Prepare a technical report (Cognitive knowledge level: Create).

Mapping of course outcomes with program outcomes:

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

CED415	PROJECT PHASE I	CATEGORY	L	T	P	CREDIT
		PWS	0	0	6	2

Preamble: The course ‘Project Work’ is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs] :After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

CET402	QUANTITY SURVEYING AND VALUATION	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	0	0	2	2019

Preamble: The course provides the knowledge about various types of estimation and specification of different civil engineering works. It equips students to analyze the rate of various items of work with reference to the standard data and schedule of rate. This course develops capability of students to prepare the detailed estimate of various items of work related to civil engineering construction and also preparation of the valuation of land and buildings.

Prerequisite: Building drawing

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Define basic terms related to estimation, quantity surveying and contract document	Remembering
CO2	Interpret the item of work from drawings and explain its general specification and unit of measurement.	Understanding
CO3	Make use of given data from CPWD DAR/DSR for calculating the unit rate of different items of work associated with building construction	Applying
CO4	Develop detailed measurement (including BBS) and BoQ of a various work like buildings, earthwork for road, sanitary and water supply work	Applying
CO5	Explain various basic terms related to valuation of land and building	Understanding
CO6	Develop valuation of buildings using different methods of valuation.	Applying

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-

CED416	PROJECT PHASE II	CATEGORY	L	T	P	CREDIT
		PWS	0	0	12	4

Preamble: The course ‘Project Work’ is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs]: After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1