

**INTEGRAL UNIVERSITY**  
**DEPARTMENT OF CIVIL ENGINEERING**

**PROGRAMME: B.TECH**

**PROGRAM SPECIFIC OUTCOMES (PSO):**

**PSO-1:** Developing employability skills among students so that they are capable of qualifying State and National level competitive examinations in government/ semi-government/private sectors.

**PSO-2:** Developing Analytical and Design Skills among students in order to make them capable to peruse higher studies as well as have a career as an entrepreneur.

**PROGRAM EDUCATIONAL OBJECTIVES (PEO):**

**PEO-1:** Enabling the application of basic and engineering science principles in analysis, design and execution of civil engineering works.

**PEO-2:** Planning suitable infrastructure as per environmental and societal needs for sustainable development.

**PEO-3:** Promoting lifelong learning to meet the dynamic professional demands by developing ethical, IT, inter personal and team skills.

**PROGRAM OUTCOMES (PO):**

**PO1- Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2- 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.

**PO3- 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.

**PO4- 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.

**PO5- Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6- 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.

**PO7- 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.

**PO8- Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9- Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10- 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.

**PO11- 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.

**PO12- 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.

**COURSE: FLUID MECHANICS****COURSE CODE: CE201****COURSE OBJECTIVES:**

- To understand basic concept of properties of fluid and its properties and application
- To understand basic concept of the Kinematics and Dynamics of Fluid and its application in civil engineering
- To understand basic concept of fluid measurement, flow types, dimensional analysis and its application.
- To understand about the losses in flow through pipes, boundary layer flow and its separation.
- To understand basic concept of turbulent flow in pipe, velocity distribution and its application.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able to understand basic concept of properties of fluid and its properties.
CO2	Students are able to understand the Kinematics and Dynamics of Fluid and its application.
CO3	To understand the concept of fluid measurement, types of flows and dimensional analysis.
CO4	To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.
CO5	Students are able to understand the concept of turbulent flow in in pipe and its nature.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able to understand basic concept of properties of fluid and its properties.	2	2	2	3	2	2	3	2	2	3	2	2
CO2	Students are able to understand the Kinematics and Dynamics of Fluid and its application.	3	3	3	2	3	3	3	2	2	2	1	1
CO3	To understand the concept of fluid measurement, types of flows and dimensional analysis.	2	2	3	3	2	2	3	2	3	3	2	2
CO4	To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.	2	3	2	2	3	2	3	2	3	2	1	2
CO5	Students are able to understand the concept of turbulent flow in pipe and its nature.	3	2	2	2	2	2	2	2	1	2	1	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: BASIC SURVEYING****COURSE CODE: CE202****COURSE OBJECTIVES:**

- To understand the importance of surveying and the basics of linear methods like chain surveying, Tape surveying and Modern Instruments.
- Student will understand about compass coordinates and different methods of calculating the horizontal and vertical angles.
- Student will be able to understand the fundamentals of tachometry and to adjust the traverse.
- Student will know the fundamentals of leveling work and to calculate the levels of different points above or below the earth surface.
- Students have an ability to understand the basics of contour and sheet numbering system.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	The students have the ability to understand the measurement techniques and equipment used in land surveying.
CO2	The students have the ability to take angular measurement from compass and correct them from different errors.
CO3	The students have an ability to calculate the linear measurement and area of the land.
CO4	The students will Gain the ability to measure differences in elevation
CO5	The students will be able to represent the topography of the land graphically.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	The students have the ability to understand the measurement techniques and equipment used in land surveying.	2	2	1	1	1	0	0	0	2	1	0	1
CO2	The students have the ability to take angular measurement from compass and correct them from different errors.	2	1	1	0	1	1	0	0	1	0	1	1
CO3	The students have an ability to calculate the linear measurement and area of the land.	1	1	1	0	1	0	0	0	1	0	0	0
CO4	The students will Gain the ability to measure differences in elevation	2	2	1	1	1	0	1	0	2	1	0	1
CO5	The students will be able to represent the topography of the land graphically.	2	1	1	1	0	0	0	0	1	1	0	1

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: BUILDING MATERIAL AND CONSTRUCTION**  
**COURSE CODE: CE203**

**COURSE OBJECTIVES:**

- To learn about the various building materials used.
- To learn about various construction techniques.
- To learn about a major problem with building i.e. Dampness (its causes, prevention) and Anti-Termite treatment.
- To learn about the types of foundation used for building depending upon the ground situation.
- To learn about various types of building components such as Stairs, windows, floors etc.
- To learn about finishing works in building construction such as painting, pointing etc.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To develop sound knowledge, understanding and awareness of various materials used in construction industry.
CO2	To learn and understand various construction techniques and get aware about different problems faced and their remedial measures.
CO3	To understand the types of amenities that are to be provided in a building during construction and their respective measures and applications.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To develop sound knowledge, understanding and awareness of various materials used in construction industry.	1	2	1	0	2	1	1	0	0	0	0	0
CO2	To learn and understand various construction techniques and get aware about different problems faced and their remedial measures.	1	2	1	0	1	1	1	0	0	0	0	0
CO3	To understand the types of amenities that are to be provided in a building during construction and their respective measures and applications.	1	0	1	1	0	1	1	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: STRENGTH OF MATERIALS****COURSE CODE: CE204****COURSE OBJECTIVES:**

- To understand the stress-strain developed in structural members including their materials properties.
- To form bending moment equations, shear force equations and bending stress diagram for a determinant beams.
- To familiarize with strain energy and the theories of failure.
- To introduce methods in order to calculate the deflections and rotations of a determinant beams and buckling load of long columns.
- To impart knowledge in order to access the stress and strain developed in cylindrical and spherical vessels.

**COURSE OUTCOMES (CO):***After the successful course completion, a learner will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
<b>CO1</b>	In-depth understanding of stress strain relationship and of various properties for different materials with ability to calculate stress- strain for different structural members subjected to given loading conditions.
<b>CO2</b>	Interpretation of bending moments, shear forces and bending stresses for determinant beams under different loading and support conditions. Be able to analyze the effects of torsion on shafts.
<b>CO3</b>	Insight of strain energy in a structural element subjected to various types of forces and understanding of different failure theories.
<b>CO4</b>	Ability to calculate the deflections and rotations of a beam under given loading and support conditions and be able to comprehend the buckling loads of a long column according to its support conditions.
<b>CO5</b>	Ability to analyze the stresses and strains associated with thin- thick wall cylindrical and spherical pressure vessels.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	In-depth understanding of stress strain relationship and of various properties for different materials with ability to calculate stress- strain for different structural members subjected to given loading conditions.	3	3	0	3	0	0	0	0	0	0	0	0
<b>CO2</b>	Interpretation of bending moments, shear forces and bending stresses for determinant beams under different loading and support conditions. Be able to analyze the effects of torsion on shafts.	3	3	0	3	0	0	0	0	0	0	0	0
<b>CO3</b>	Insight of strain energy in a structural element subjected to various types of forces and understanding of different failure theories.	3	3	0	3	0	0	0	0	0	0	0	0
<b>CO4</b>	Ability to calculate the deflections and rotations of a beam under given loading and support conditions and be able to comprehend the buckling loads of a long column according to its support conditions.	3	3	0	3	0	0	0	0	0	0	0	0
<b>CO5</b>	Ability to analyze the stresses and strains associated with thin- thick wall cylindrical and spherical pressure vessels.	3	3	0	3	0	0	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Students are able to learn the concept of Buoyancy and Metacenter Height in a ship model
<b>CO2</b>	Students are able to learn the concept of Bernoulli's Theorem and its application.
<b>CO3</b>	Students are able to learn to find the discharge using Venturimeter and Orifice meter.
<b>CO4</b>	Students are able to learn to find the discharge using Orifice meter.
<b>CO5</b>	Students are able to learn to find the Coefficient of Discharge in rectangular and triangular notch.
<b>CO6</b>	Students are able to verify the Impulse Momentum equation experimentally
<b>CO7</b>	Students are able to plot flow pattern net using the Hele-shaw apparatus.
<b>CO8</b>	Students are able to study the variation of friction factor 'f', for turbulent flow in commercial pipes.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Students are able to learn the concept of Buoyancy and Metacenter Height in a ship model	3	0	0	3	0	0	0	0	0	0	0	0
<b>CO2</b>	Students are able to learn the concept of Bernoulli's Theorem and its application.	2	0	0	2	0	0	0	0	0	0	0	0
<b>CO3</b>	Students are able to learn to find the discharge using Venturimeter and Orifice meter.	2	0	0	2	0	0	0	0	0	0	0	0
<b>CO4</b>	Students are able to learn to find the discharge using Orifice meter.	2	0	0	3	0	0	0	0	0	0	0	0
<b>CO5</b>	Students are able to learn to find the Coefficient of Discharge in rectangular and triangular notch.	2	0	0	3	0	0	0	0	0	0	0	0
<b>CO6</b>	Students are able to verify the Impulse Momentum equation experimentally	2	0	0	1	0	0	0	0	0	0	0	0
<b>CO7</b>	Students are able to plot flow pattern net using the Hele-shaw apparatus.	2	0	0	2	0	0	0	0	0	0	0	0
<b>CO8</b>	Students are able to study the variation of friction factor 'f', for turbulent flow in commercial pipes.	3	0	0	3	0	0	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: BASIC SURVEY FIELD WORK****COURSE CODE: CE 206****COURSE OBJECTIVES:**

1. To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.
2. To use techniques, skills, and modern engineering tools necessary for engineering practice
3. To function as a member of a team.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able to perform ranging and taking offset along a survey line.
CO2	Students are able to find out the reduced level of given points using Dumpy level by height of collimation method.
CO3	Students are familiar about Auto level and find out the reduced levels of given points by rise and fall method.
CO4	Students are able to perform fly leveling with a level.
CO5	Students are able to draw the longitudinal and cross sectional profiles along a given route.
CO6	Students are familiar about use of transit theodolite and total station.
CO7	Students are able to measure horizontal angle by Repetition method using transit theodolite.
CO8	Students are able to measure horizontal angle by reiteration method using transit theodolite
CO9	Students are able to determine the Tacheometric constants of a given Theodolite.
CO10	Students are able to to determine the bearing of a given traverse using prismatic compass and plotting of the traverse.
CO11	Students are able to determine the elevations of a given point.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able to perform ranging and taking offset along a survey line.	2	0	0	0	2	0	0	0	1	2	0	2
CO2	Students are able to find out the reduced level of given points using Dumpy level by height of collimation method.	2	0	0	1	2	0	0	0	2	2	0	3
CO3	Students are familiar about Auto level and find out the reduced levels of given points by rise and fall method.	2	0	0	1	2	0	0	0	1	2	0	2
CO4	Students are able to perform fly leveling with a level.	2	0	0	1	2	0	0	0	2	2	0	3
CO5	Students are able to draw the longitudinal and cross sectional profiles along a given route.	2	0	0	2	2	0	0	0	2	2	0	2
CO6	Students are familiar about use of transit theodolite and total station.	2	0	0	2	2	0	0	0	2	2	0	2
CO7	Students are able to measure horizontal angle by Repetition method using transit theodolite.	2	0	0	2	2	0	0	0	2	2	0	3
CO8	Students are able to measure horizontal angle by reiteration method using transit theodolite	2	0	0	2	2	0	0	0	3	2	0	2

<b>CO9</b>	Students are able to determine the Tacheometric constants of a given Theodolite.	2	0	0	2	2	0	0	0	2	2	0	2
<b>CO10</b>	Students are able to determine the bearing of a given traverse using prismatic compass and plotting of the traverse.	2	0	0	2	2	0	0	0	2	2	0	1
<b>CO11</b>	Students are able to determine the elevations of a given point.	2	0	0	2	2	0	0	0	3	2	0	1
3: Strong contribution, 2: average contribution, 1: Low contribution													



**COURSE: HYDRAULICS & HYDRAULICS MACHINES****COURSE CODE: CE209****COURSE OBJECTIVES:**

- To introduce the importance of study of open channel flow, to give brief description on different types of flows and channels and hydraulic design principles of channels. To understand the different equation and their application related to non-uniform flow
- To learn the fundamentals of Uniform and Non-Uniform flow in open channels. To introduce the concepts of momentum principles.
- To learn the fundamentals of Uniform and Non-Uniform flow in open channels.
- To give an idea about the gradually varied flow and rapidly varied flow and their equations and computations.
- To impart the knowledge on pumps and turbines.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Students will learn basic concept of open channel flow and its types
<b>CO2</b>	Students will learn about different equation and their application related to non-uniform flow
<b>CO3</b>	Students will learn about basic principle of Gradually Varied flow GVF and its applications
<b>CO4</b>	Students will learn about the condition and criteria of flow through hydraulic jump
<b>CO5</b>	Students will learn about the Hydraulic machines and there function, application

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Students will learn basic concept of open channel flow and its types	2	3	2	3	2	1	3	2	3	1	2	0
<b>CO2</b>	Students will learn about different equation and their application related to non-uniform flow	2	2	3	3	3	2	3	2	2	1	1	1
<b>CO3</b>	Students will learn about basic principle of Gradually Varied flow GVF and its applications	2	3	3	2	3	2	3	2	2	2	2	1
<b>CO4</b>	Students will learn about the condition and criteria of flow through hydraulic jump	2	2	2	3	1	2	3	2	3	2	1	0
<b>CO5</b>	Students will learn about the Hydraulic machines and there function, application	3	2	2	2	2	2	2	2	1	2	1	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: ADVANCE SURVEYING****COURSE CODE: CE210****COURSE OBJECTIVES:**

- Student will understand the importance of plane table surveying in civil engineering and method of preparing small scale maps.
- Student will understand about the basic principle of triangulation survey.
- Student will be able to understand the methods to adjust errors.
- Student will know the fundamental elements of different types of curves.  
Students have an ability to understand the general requirements of various types of civil engineering projects and fundamentals of astronomical survey.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	The students have the ability to prepare a small scale maps.
<b>CO2</b>	The students have the ability to make control points of long observation and to measure them accurately.
<b>CO3</b>	The students have an ability to calculate the errors and correct them by applying different numerical methods.
<b>CO4</b>	The students will be able to make different types of curves used on highways and railway project.
<b>CO5</b>	The students will be able to tell about the general requirements and specifications of various civil engineering projects.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	The students have the ability to prepare a small scale maps.	3	1	1	2	1	1	0	0	3	1	2	2
<b>CO2</b>	The students have the ability to make control points of long observation and to measure them accurately.	2	2	1	2	1	1	0	0	3	2	1	1
<b>CO3</b>	The students have an ability to calculate the errors and correct them by applying different numerical methods.	2	2	1	1	0	0	0	0	1	1	1	1
<b>CO4</b>	The students will be able to make different types of curves used on highways and railway project.	3	2	1	1	1	1	0	0	3	2	1	2
<b>CO5</b>	The students will be able to tell about the general requirements and specifications of various civil engineering projects.	2	1	0	0	1	1	0	0	1	1	2	1

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: CONCRETE TECHNOLOGY**  
**COURSE CODE: CE211**

**COURSE OBJECTIVES:**

- To learn about Cement as a material used in construction and its manufacturing process.
- To learn about various tests to be done cement and aggregates.
- To learn about various properties of concrete (such as workability, durability etc.) that play an important role in quality and also the problems faced while concreting.
- To learn about Mix designing of concrete as per Indian Standard.
- To learn about the special concretes used in extreme weather conditions.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To understand the manufacturing process of cement and its various properties.
CO2	To learn about various types of cement and test on coarse aggregates.
CO3	To learn about various problems arising while concreting and tests performed on fresh and hardened concrete.
CO4	To learn the procedure of the mix design of concrete as per Indian standard.
CO5	To understand about special concretes

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To understand the manufacturing process of cement and its various properties.	2	0	1	1	3	2	2	0	0	0	0	0
CO2	To learn about various types of cement and test on coarse aggregates.	3	1	1	0	2	1	0	0	0	0	0	0
CO3	To learn about various problems arising while concreting and tests performed on fresh and hardened concrete	2	2	0	2	1	1	1	0	0	0	0	0
CO4	To learn the procedure of the mix design of concrete as per Indian standard.	3	2	3	1	1	1	1	0	0	0	0	0
CO5	To understand about special concrete	3	1	0	0	2	2	2	0	0	0	0	0

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE OBJECTIVES:**

- To impart knowledge about classification of structures, then they should be able classify structure as well as able to calculate degree of determinacy by knowing its form and end condition.
- To impart concept of truss, then they should be able classify truss as well as able to analyse simple and compound truss for given loads.
- To impart concept of rolling load, then they able to formulate and analyse beams/girder and arches as well as able to draw shear force, bending moment and influence lines diagram for determinate structure.
- To impart concept of arches, so that they should able to classify, analyse and compute bending moment and shear forces for three hinged arches.
- To impart principle of Strain energy, then they should able to know the significances and applications of different strain energy methods. After completing they should able to calculate deflection in determinate structures for given load conditions.
- To impart concept of unsymmetrical bending.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learners should be able to classify structure in terms of stability and determinacy. Also able to analyze determinate truss for given load & support conditions.
CO2	Learners should be able to analyze beams/girders subjected to moving load as well as draw the influence lines for reactions, shears, and bending moments by knowing loading conditions.
CO3	Learner should able to analyze and draw the influence lines for reactions, radial shears, normal thrust and bending moments for three hinged arches by knowing its shapes and loading conditions.
CO4	Learner should know the principle and significance of strain energy methods as well as able to calculate deflections in statically determinate structures by applying strain energy methods for given loading conditions.
CO5	Learner should able to analysis unsymmetrical beams by knowing load pattern.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learners should be able to classify structure in terms of stability and determinacy. Also able to analyse determinate truss for given load & support conditions.	3	3	0	3	0	0	0	0	0	0	0	0
CO2	Learners should be able to analyse beams/girders subjected to moving load as well as draw the influence lines for reactions, shears, and bending moments by knowing loading conditions.	3	3	0	3	0	0	0	0	0	0	0	0
CO3	Learner should able to analyse and draw the influence lines for reactions, radial shears, normal thrust and bending moments for three hinged arches by knowing its shapes and loading conditions.	3	3	0	3	0	0	0	0	0	0	0	0
CO4	Learner should know the principle and significance of strain energy methods as well as able to calculate deflections in statically determinate structures by applying strain energy methods for given loading conditions.	3	3	0	3	0	0	0	0	0	0	0	0
CO5	Learner should able to analysis unsymmetrical beams by knowing load pattern.	3	3	0	3	0	0	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: HYDRAULICS AND HYDRAULIC MACHINE LAB**  
**COURSE CODE: CE213**

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able to learn to find the Manning's coefficient of roughness 'n' for the bed of a given flume.
CO2	Students are able to learn to study the velocity distribution in an open channel and to determine the energy and momentum correction factors
CO3	Students are able to learn the rotodynamic pumps and their characteristics
CO4	Students are able to calibrate a sharp-crested rectangular and triangular weirs
CO5	Students are able to learn the characteristics of free hydraulic jump.
CO6	Students are able to learn the flow characteristics over a hump placed in an open channel
CO7	Students are able to learn the flow through a horizontal contraction in a rectangular channel.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able to learn to find the Manning's coefficient of roughness 'n' for the bed of a given flume.	2	0	0	2	0	0	0	0	0	0	0	0
CO2	Students are able to learn to study the velocity distribution in an open channel and to determine the energy and momentum correction factors	3	0	0	2	0	0	0	0	0	0	0	0
CO3	Students are able to learn the rotodynamic pumps and their characteristics	2	0	0	3	0	0	0	0	0	0	0	0
CO4	Students are able to calibrate a sharp-crested rectangular and triangular weirs	2	0	0	2	0	0	0	0	0	0	0	0
CO5	Students are able to learn the characteristics of free hydraulic jump.	3	0	0	3	0	0	0	0	0	0	0	0
CO6	Students are able to learn the flow characteristics over a hump placed in an open channel	2	0	0	1	0	0	0	0	0	0	0	0
CO7	Students are able to learn the flow through a horizontal contraction in a rectangular channel.	1	0	0	2	0	0	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE:** ADVANCE SURVEY FIELD WORK

**COURSE CODE:** CE214

**COURSE OBJECTIVES:**

- To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.
- to make student competent enough to, carry out triangulation, topographic mapping, layout of building plans & curves on ground
- To use techniques, skills, and modern engineering tools necessary for engineering practice.
- To function as a member of a team.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able setting up the plane table and plotting the given area by radiation method.
CO2	Students are able setting up the plane table and plotting the given area by intersection method.
CO3	Students are able to do traversing of the given area by plane table.
CO4	Students are able to solve three point problem by mechanical method.
CO5	Students are able to solve three point problem by graphical method.
CO6	Students are able to solve two point problem.
CO7	Students are able to carry out Triangulation and Trilateration of a given area
CO8	Students are able to layout a simple circular curve on the ground using tape by perpendicular offset method.
CO9	Students are able to layout a simple circular curve on the ground using tape by radial offset method
CO10	Students are able to layout a simple circular curve on the ground using two theodolite method.
CO11	Students are able to layout a building on the ground.
CO12	Students are able to plot the details as well as contours (topographic mapping) of area.
CO13	Students are able work on Electronic Total Survey Station.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able setting up the plane table and plotting the given area by radiation method.	2	0	0	1	2	0	0	0	1	2	0	3
CO2	Students are able setting up the plane table and plotting the given area by intersection method.	2	0	0	1	2	0	0	0	2	2	0	2
CO3	Students are able to do traversing of the given area by plane table.	2	0	0	1	2	0	0	0	1	2	0	3
CO4	Students are able to solve three point problem by mechanical method.	2	0	0	1	2	0	0	0	2	2	0	2
CO5	Students are able to solve three point problem by graphical method.	2	0	0	2	2	0	0	0	2	2	0	1
CO6	Students are able to solve two point problem.	2	0	0	1	2	0	0	0	2	2	0	3

<b>CO7</b>	Students are able to carry out Triangulation and Trilateration of a given area	2	0	0	2	2	0	0	0	2	2	0	2
<b>CO8</b>	Students are able to layout a simple circular curve on the ground using tape by perpendicular offset method.	2	0	0	1	2	0	0	0	3	2	0	3
<b>CO9</b>	Students are able to layout a simple circular curve on the ground using tape by radial offset method	2	0	0	1	2	0	0	0	2	2	0	1
<b>CO10</b>	Students are able to layout a simple circular curve on the ground using two theodolite method.	2	0	0	1	2	0	0	0	2	2	0	2
<b>CO11</b>	Students are able to layout a building on the ground.	2	0	0	2	2	0	0	0	3	2	0	2
<b>CO12</b>	Students are able to plot the details as well as contours (topographic mapping) of area.	2	0	0	2	2	0	0	0	2	2	0	2
<b>CO13</b>	Students are able work on Electronic Total Survey Station.	2	0	0	2	3	0	0	0	2	2	0	3

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE STRUCTURAL ANALYSIS - II****COURSE CODE:** CE301**COURSE OBJECTIVES:**

- To analyze the indeterminate structures using different methods.
- To apply the Muller Breslau principle for drawing the ILD of Indeterminate structures.
- To analyze the suspension bridges.
- To apply the methods of analyzing of indeterminate structures by matrix method.
- To give a basic idea of Plastic Theory.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	To impart various methods of analyzing the indeterminate structures.
<b>CO2</b>	To enable the student how to draw the influence line diagrams of indeterminate structures and their applications.
<b>CO3</b>	To enable him to analyze the cables and suspension bridges.
<b>CO4</b>	This unit enables to understand the method of analyzing the indeterminate structures using matrix method.
<b>CO5</b>	To enable the student to have the basic knowledge of plastic theory.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	To impart various methods of analyzing the indeterminate structures.	1	2	3	2	2	2	1	0	1	1	1	0
<b>CO2</b>	To enable the student how to draw the influence line diagrams of indeterminate structures and their applications	1	1	0	2	0	1	2	2	2	1	1	1
<b>CO3</b>	To enable him to analyze the cables and suspension bridges	2	2	1	2	2	2	1	2	1	1	1	0
<b>CO4</b>	This unit enable to understand the method of analyzing the indeterminate structures using matrix method	2	2	3	3	1	2	2	1	2	1	1	0
<b>CO5</b>	To enable the student to have the basic knowledge of plastic theory	1	2	3	0	1	2	2	1	2	1	1	0
3: Strong contribution, 2: average contribution, 1: Low contribution													



**COURSE: DESIGN OF REINFORCED CONCRETE STRUCTURE-I**  
**COURSE CODE: CE302**

**COURSE OBJECTIVES:**

- To develop the knowledge of design of RCC beam using different methods of design.
- To develop the knowledge of designing of doubly reinforced beam and codal recommendation.
- To develop the design of beam for shear reinforcement & concept of anchorage length.
- To develop the knowledge of designing of 'one way' and 'two way' slab and calculation of crack width & definitions.
- To develop the knowledge of concept of column design.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Student will be able to design singly reinforced beam of different spans and loading.
CO2	Student will be able to design doubly reinforced beam of different spans and loading.
CO3	Student will be able to design beams for shear reinforcement and can determine development length.
CO4	Student will be able to design slab and design the structure for serviceability.
CO5	Student will be able to design compression member (column) by limit state method.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Student will be able to design singly reinforced beam of different spans and loading.	3	2	2	1	2	1	0	0	1	0	0	1
CO2	Student will be able to design doubly reinforced beam of different spans and loading.	3	2	2	1	2	1	0	0	1	0	0	1
CO3	Student will be able to design beams for shear reinforcement and can determine development length.	3	2	2	1	2	1	0	0	1	0	1	1
CO4	Student will be able to design slab and design the structure for serviceability.	3	2	3	1	2	1	0	0	1	0	1	1
CO5	Student will be able to design compression member (column) by limit state method.	3	2	3	1	2	1	0	0	1	0	1	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE OBJECTIVES:**

- To provide knowledge of design and construction of roads, railways, airports and harbours.
- To study various road materials and their properties.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students who successfully complete this module will be able to understand factors influencing highway geometric design and will be able to perform horizontal & vertical alignment of the highway. They will also be able to apply basic science principles in determining stopping & overtaking sight distance.
CO2	Students who successfully complete this module can identify factors affecting pavement design. The student will develop ability to comprehend data from India Roads Congress codes for pavement design and stress calculations in the same.
CO3	Students are expected to identify parameters defining traffic state of transportation systems and design traffic signals, perform level of service analysis, collect & process traffic data and determine capacity of road segments.
CO4	Students develop understanding of the basic working of railway track system. They can also perform geometric design and capacity analysis of railway permanent way.
CO5	Students develop a basic understanding of factors affecting airport and runway design. They can also perform basic layout of Harbor components.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students who successfully complete this module will be able to understand factors influencing highway geometric design and will be able to perform horizontal & vertical alignment of the highway. They will also be able to apply basic science principles in determining stopping & overtaking sight distance.	3	0	3	0	0	1	0	1	1	0	1	0
CO2	Students who successfully complete this module can identify factors affecting pavement design. The student will develop ability to comprehend data from India Roads Congress codes for pavement design and stress calculations in the same.	3	1	2	1	0	0	0	1	1	0	0	0
CO3	Students are expected to identify parameters defining traffic state of transportation systems and design traffic signals, perform level of service analysis, collect & process traffic data and determine capacity of road segments.	2	1	2	0	0	0	0	1	1	0	1	0
CO4	Students develop understanding of the basic working of railway track system. They can also perform geometric design and capacity analysis of railway permanent way.	3	0	3	0	0	1	0	0	0	0	0	0
CO5	Students develop a basic understanding of factors affecting airport and runway design. They can also perform basic layout of Harbor components.	2	0	2	0	0	1	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: GEOTECHNICAL ENGINEERING -I**  
**COURSE CODE: CE304**

**COURSE OBJECTIVES:**

- To learn about soil formation and its types.
- Soil particle size classification as per Indian standard.
- To learn about Index and Engineering properties of soil.
- To learn about stresses in soil and subsequently their calculation by various methods.
- To learn about the concept of Shear Strength of soil.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the process of soil formation and its index properties.
CO2	Understand the Engineering properties of soil (such as Compaction, Consolidation etc.) and solve the problems related to it.
CO3	Compute the shear strength of the soil for different field conditions.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand the process of soil formation and its index properties.	3	2	3	1	2	1	0	0	0	0	0	0
CO2	Understand the Engineering properties of soil (such as Compaction, Consolidation etc.) and solve the problems related to it.	2	2	2	2	2	1	0	0	0	0	0	0
CO3	Compute the shear strength of the soil for different field conditions.	3	2	2	2	2	0	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: ENGINEERING GEOLOGY**  
**COURSE CODE: CE305**

**COURSE OBJECTIVES:**

- To understand the basic knowledge of types natural materials like rocks & minerals and soil
- To understand the basic concept of earthquake, type, causes and its measurement
- To learn about dam, types, failure and its geological investigation of site
- To know the Ground water availability, zones of ground water and groundwater investigations.
- To understand the basic concept of Soil profile and classification, engineering properties of soil, geological problems related with tunneling,

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able to understand and identify different types natural materials like rocks & minerals and soil
CO2	Students are able to understand the concept of earthquake, type, causes and its measurement.
CO3	Students are able to understand about the dam, types, failure and its geological investigation.
CO4	To understand the Ground water, zones of ground water, groundwater investigations. Concept of water shed management, Ground water Pollution, Impact of mining activity on
CO5	Students are able to understand the concept of Soil profile and classification, engineering properties of soil, geological problems connected with tunneling, geological consideration in

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able to understand and identify different types natural materials like rocks & minerals and soil	2	1	2	3	1	2	3	1	2	2	2	2
CO2	Students are able to understand the concept of earthquake, type, causes and its measurement.	1	3	3	1	1	2	3	1	1	2	1	1
CO3	Students are able to understand about the dam, types, failure and its geological investigation.	2	3	3	2	2	1	3	2	3	3	2	2
CO4	To understand the Ground water, zones of ground water, groundwater investigations. Concept of water shed management, Ground water Pollution, Impact of mining activity on	2	2	3	2	3	2	3	1	2	2	1	2
CO5	Students are able to understand the concept of Soil profile and classification, engineering properties of soil, geological problems connected with tunneling, geological consideration in	3	2	2	2	1	2	2	2	1	2	1	1

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: WATER RESOURCES ENGINEERING**  
**COURSE CODE: CE306**

**COURSE OBJECTIVES:**

- To study about precipitation, its types, forms and measurement of rainfall.
- To understand the run off & rainfall relationships through various hydrographs
- To understand the analysis of floods
- To know the importance of ground water hydrology
- To understand about irrigation engineering

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able to understand about various types and forms of precipitation and its measurement, Evaporation and evapotranspiration estimation methods.
CO2	Students are able to understand the concept of runoff, hydrographs, unit hydrograph and S- hydrograph.
CO3	Students are able to understand about peak flood estimation, its return period prediction, flood control management.
CO4	Students are able to understand the Ground water, zones of ground water and yield determination of wells.
CO5	Students are able to understand the concept of irrigation, its types, merits & demerits, water requirement of crops, soil moisture.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able to understand about various types and forms of precipitation and its measurement, Evaporation and evapotranspiration estimation methods.	2	2	1	3	1	1	0	0	0	0	1	2
CO2	Students are able to understand the concept of runoff, hydrographs, unit hydrograph and S- hydrograph.	3	2	2	2	2	1	2	0	1	1	0	0
CO3	Students are able to understand about peak flood estimation, its return period prediction, flood control management.	3	3	2	2	1	2	0	1	2	2	1	2
CO4	Students are able to understand the Ground water, zones of ground water and yield determination of wells.	2	2	2	2	3	2	1	2	1	1	2	2
CO5	Students are able to understand the concept of irrigation, its types, merits & demerits, water requirement of crops, soil moisture.	3	3	2	2	2	2	1	1	2	1	2	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE:** STRUCTURAL ANALYSIS LAB  
**COURSE CODE:** CE307

**COURSE OBJECTIVES:**

- To share the load influence over a structure.
- To share the critical loads over structure such as beam and columns.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	The students will aware about the influences over a beam due to load when applied (externally).
CO2	The students will aware about the critical load to secure the structural member such as beam and column.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	The students will aware about the influences over a beam due to load when applied (externally).	3	0	0	0	0	0	0	0	0	0	0	0
CO2	The students will aware about the critical load to secure the structural member such as beam and column.	3	0	0	0	0	0	0	0	0	0	0	0

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: TRANSPORTATION ENGINEERING LAB**  
**COURSE CODE: CE308**

**COURSE OBJECTIVES:**

- To provide practical knowledge about tests conducted on road aggregates.
- To provide skills so that learner can conduct tests on bitumen and bitumen mixes.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to determine the whether suitability of road aggregates as per Indian Codes.
CO2	Learner will be able to determine properties of Bitumen as well as bitumen mixes by performing tests on them and ascertain their suitability for varies field conditions.
CO3	Learner will be able to perform traffic volume survey on field.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will be able to determine the whether suitability of road aggregates as per Indian Codes.	2	0	0	2	0	1	0	3	1	0	3	0
CO2	Learner will be able to determine properties of Bitumen as well as bitumen mixes by performing tests on them and ascertain their suitability for varies field conditions.	2	0	0	3	0	1	0	3	1	0	3	0
CO3	Learner will be able to perform traffic volume survey on field.	2	0	0	2	0	0	0	3	1	0	3	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE OBJECTIVES:**

- To impart the knowledge of Water Quality Assessment.
- To inculcate the basic concept of Sedimentation and Coagulation.
- To enhance the fundamentals of Water Filtration and Softening.
- To impart the knowledge of Storage and Distribution of Water.
- To develop the knowledge of Air Pollution Engineering.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learner will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learners will be able to explain about importance and necessity for planned water supplies, determine variations in demand, design periods, forecast Population and assess drinking water quality parameters according to IS-10500:2012.
CO2	Learners will be able to comprehend the fundamental of water treatment, suggest design criteria for Screens, plain sedimentation tank and clariflocculators.
CO3	Learners will be able to illustrate filtration its mechanism, compare Slow Sand, Rapid Sand And Pressure Filter. They will be able to explain the process of disinfection, its methods, kinetics, and calculate doses for softening process for water treatment.
CO4	Learners will be able to have comprehensive understanding of Distribution System, Detect of Leakage in the Distribution Pipes, Analyze the Pipe Network by using Hardy-Cross Method and Equivalent Pipe Method. They will also be able to suggest various appurtenances used in the Distribution System. Plumbing System, House Water Connection.
CO5	Learners will be able to explain about air pollution its causes, consequences, control methods of Particulate & Gaseous Pollutants.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learners will be able to explain about importance and necessity for planned water supplies, determine variations in demand, design periods, forecast Population and assess drinking water quality parameters according to IS-10500:2012.	3	3	3	0	0	2	0	0	0	0	0	0
CO2	Learners will be able to comprehend the fundamental of water treatment, suggest design criteria for Screens, plain sedimentation tank and clariflocculators.	3	3	3	0	1	2	0	0	0	0	0	0
CO3	Learners will be able to illustrate Filtration Theory, Types Of Filter, and Mechanism, compare Operation Of Slow Sand, Rapid Sand And Pressure Filter and suggest design criteria. They will be able to understand the process of disinfection, its methods, kinetics, and calculate doses for softening process for water treatment.	3	3	3	2	2	2	0	0	0	0	1	0
CO4	Learners will be able to have comprehensive understanding of Distribution System, Detect of Leakage in the Distribution Pipes, Analyze the Pipe Network by using Hardy-Cross Method and Equivalent Pipe Method. They will also be able to suggest various appurtenances used in the Distribution System. Plumbing System, House Water Connection.	3	3	3	3	2	1	0	2	1	0	1	1
CO5	Learners will be able to explain about air pollution its causes, consequences, control methods of Particulate & Gaseous Pollutants.	3	3	3	0	2	1	0	2	1	0	2	0

3: Strong contribution, 2: average contribution, 1: Low contribution



**COURSE: DESIGN OF REINFORCED CONCRETE STRUCTURES II**  
**COURSE CODE: CE 311**

**COURSE OBJECTIVES:**

- To understand the general mechanical behavior of torsion on reinforced concrete beams and footing in order to design according to Indian Standard Guidelines.
- To recognize the need of flat slab and circular slab according to architectural-structural demand, to familiarize with the methods used for designing flat and circular slab.
- To design water tank according to Indian Standard Guidelines.
- To understand the structural behavior of retaining wall in order to check stabilities and to perform design.
- To introduce pre stress concrete, losses and variation of stresses.

**COURSE OUTCOMES (CO):**

*After the successful course completion, a learner will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	In-depth understanding of torsion on beams and behavior of footing with the ability to perform design of isolated, combined footing as per Indian Standard Guidelines.
CO2	Designing of flat and circular slab with in depth knowledge of the failures and requirement.
CO3	Skill to select the type of water tank and perform designing based on demand capacity as per Indian Standard Guidelines.
CO4	Ability to conduct the stability checks, dimensioning and designing of retaining wall with or without shear keys as per Indian Standard Guidelines.
CO5	Ability to calculate the losses in pre-stress and plot the variation of stress across cross section in pre tensioned and post tensioned concrete.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	In-depth understanding of torsion on beams and behavior of footing with the ability to perform design of isolated, combined footing as per Indian Standard Guidelines.	3	0	3	0	0	0	0	3	0	0	0	3
CO2	Designing of flat and circular slab with in depth knowledge of the failures and requirement.	3	0	3	1	0	0	0	3	0	0	0	0
CO3	Skill to select the type of water tank and perform designing based on demand capacity as per Indian Standard Guidelines.	3	0	3	1	0	0	0	3	0	0	0	3
CO4	Ability to conduct the stability checks, dimensioning and designing of retaining wall with or without shear keys as per Indian Standard Guidelines. .	3	1	3	3	0	0	0	3	0	0	0	3
CO5	Ability to calculate the losses in pre-stress and plot the variation of stress across cross section in pre tensioned and post tensioned concrete.	3	3	0	3	0	0	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE OBJECTIVES:**

- To develop the knowledge of different boring process and sub soil exploration.
- To develop the knowledge of different boring capacity of soil and ascertain the type of failure.
- To develop the knowledge about pile and well foundation and their design method.
- To develop the concept of slope failures.
- To develop the detail knowledge of earth pressure behind retaining structures.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the different methods of penetration test and boring process and became well versed in sub soil exploration.
CO2	Able to determine the bearing capacity of soil using different test procedures and understand the causes of shear failure and settlements.
CO3	Able to understand concept of pile and well foundation and their design methods and their field test.
CO4	Able to explain the type of slope failures and how to stabilize the soil slopes.
CO5	Able to understand concept of theories of active and passive earth pressure for cohesive and cohesionless soil as backfill of retaining wall and able to check the stability of a retaining wall.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Able to understand the different methods of penetration test and boring process and became well versed in sub soil exploration.	2	3	1	3	2	1	1	0	2	2	0	1
CO2	Able to determine the bearing capacity of soil using different test procedures and understand the causes of shear failure and settlements.	3	3	2	3	2	1	0	0	2	2	0	1
CO3	Able to understand concept of pile and well foundation and their design methods and their field test.	3	3	3	2	2	1	0	0	2	2	0	1
CO4	Able to explain the type of slope failures and how to stabilize the soil slopes.	2	2	2	2	2	1	0	0	2	1	0	1
CO5	Able to understand concept of theories of active and passive earth pressure for cohesive and cohesionless soil as backfill of retaining wall and able to check the stability of a retaining wall.	3	3	3	2	2	2	1	0	2	1	0	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: TRAFFIC ENGINEERING**  
**COURSE CODE: CE313**

**COURSE OBJECTIVES:**

- To study the fundamentals of traffic engineering.
- To gain knowledge about traffic intersection and its control measures.
- To study various types of traffic surveys.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to understand fundamentals of traffic engineering and hierarchy of roads in India.
CO2	Learner will be able to understand traffic flow theories & regulations related to traffic and able to evaluate a given area for compliances.
CO3	Learner will be able understand basis of traffic surveys & be able to traffic surveys and its analysis.
CO4	Learner will be able to design signalized intersections meeting Indian code requirements and they will be acquainted with traffic control measures.
CO5	Learner will learn about traffic management measures & understand road safety aspects and be able to select the desired type of control at intersection under given traffic conditions.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will be able to understand fundamentals of traffic engineering and hierarchy of roads in India.	3	2	0	0	0	0	0	0	1	0	0	0
CO2	Learner will be able to understand traffic flow theories & regulations related to traffic and able to evaluate a given area for compliances.	0	0	3	0	0	0	0	0	2	1	2	0
CO3	Learner will be able understand basis of traffic surveys & be able to traffic surveys and its analysis.	2	1	2	1	1	0	0	0	1	0	0	0
CO4	Learner will be able to design signalized intersections meeting Indian code requirements and they will be acquainted with traffic control measures.	2	0	0	0	0	0	2	0	1	0	0	0
CO5	Learner will learn about traffic management measures & understand road safety aspects and be able to select the desired type of control at intersection under given traffic conditions.	0	2	0	0	2	2	0	0	2	2	0	0

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: OPEN CHANNEL FLOW****COURSE CODE: CE314****COURSE OBJECTIVES:**

- To learn open channel flow, to give idea on different types of flow and channels and hydraulic design principles of channels
- To give the idea about gradually varied flow GVF and types of equation used in different types of flow
- To introduce the basic principles and assumptions in analysis of flow profile and numerical analysis
- To give the idea about rapidly varied flow RVF and condition of formation of different types of hydraulic jump.
- To give the idea of design of hydraulic channel in non-linear alignment and design of culvert

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To understand the basic concept of open channel flow, different types of flow, channels.
CO2	To understand the basic concept of gradually varied flow and its equation.
CO3	To understand the basic concept of gradually varied flow profile and numerical analysis
CO4	To understand the basic concept of rapidly varied flow and condition of formation of different types of hydraulic jump.
CO5	To understand the basic concept of design of hydraulic channel in non-linear alignment

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To introduce of importance of study of open channel flow, to give idea on different types of flow and channels and hydraulic design principles of channels	1	0	2	2	1	1	2	1	1	0	2	1
CO2	To give the idea about gradually varied flow and types of equation used in different types of flow	2	1	2	1	0	1	1	1	1	2	2	2
CO3	To introduce the basic principles and assumptions in analysis of flow profile and numerical analysis	1	0	2	1	2	1	1	1	1	2	0	2
CO4	To give the idea about rapidly varied flow and condition of formation of different types of hydraulic jump.	1	2	0	2	1	2	2	1	0	1	2	1
CO5	To give the idea of design of hydraulic channel in non-linear alignment and design of culvert	2	2	2	2	2	2	1	1	2	1	3	2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: MATRIX METHODS OF STRUCTURAL ANALYSIS****COURSE CODE: CE315****COURSE OBJECTIVES:**

- To understand the Basic concept of Structural analysis.
- To understand and analyse the structural using matrix methods.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Able to determine static & kinematic determinacy and to understand the basic concept of matrix methods of structural analysis.
<b>CO2</b>	Able to analyses rigid joined and pin jointed plane frame using matrix methods.
<b>CO3</b>	Able to analyses three dimensional structural by displacement method.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Able to determine static & kinematic determinacy and to understand the basic concept of matrix methods of structural analysis.	2	2	1	1	1	1	0	0	1	1	0	1
<b>CO2</b>	Able to analyses rigid joined and pin jointed plane frame using matrix methods.	2	2	0	1	1	1	0	0	1	1	0	1
<b>CO3</b>	Able to analyses three dimensional structural by displacement method.	2	2	1	1	2	1	0	0	1	1	1	1

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: SUSTAINABLE CONSTRUCTION TECHNIQUES****COURSE CODE: CE316****COURSE OBJECTIVES:**

- To make them aware about the ways to attain sustainable construction and to overcome sustainable challenges.
- To comprehend the fundamentals of energy efficiency in regards of Sustainability.
- To make them understand the application of advanced material used in construction industry to prepare a sustainable architecture.
- To make them understand about the modern housing scenario to impart sustainability in construction cycle.
- To make them capable to perform cost analysis using latest pre-fabrication technologies.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to understand the Importance of sustainability & their challenges in construction sector.
CO2	Learner will be able to understand the need of energy efficient buildings to overcome the after effects of manmade materials.
CO3	Learner will be able to choose an innovative Building material comprised of sustainable properties to attain sustainable construction.
CO4	Learner will be able to understand the housing scenario as per the land usage, financial terms and strategically approaches for Urban and rural areas.
CO5	Learner will be able to impart engineering knowledge based on Precast and Prefabrication structures using latest technology.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will be able to understand the Importance of sustainability & their challenges in construction sector.	3	0	0	0	0	3	3	1	0	0	0	0
CO2	Learner will be able to understand the need of energy efficient buildings to overcome the after effects of manmade materials.	3	2	0	0	0	1	3	0	0	0	0	2
CO3	Learner will be able to choose an innovative Building material comprised of sustainable properties to attain sustainable construction.	3		3	0	0	3	3	2	0	0	0	3
CO4	Learner will be able to understand the housing scenario as per the land usage, financial terms and strategically approaches for Urban and rural areas.	3	0	0	0	0	0	3	2	0	1	0	3
CO5	Learner will be able to impart engineering knowledge based on Precast and Prefabrication structures using latest technology.	3	0	0	3	2		3	0	0	0	0	2

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: GROUND IMPROVEMENT TECHNIQUES****COURSE CODE: CE317****COURSE OBJECTIVES:**

- To learn about the importance of Ground improvement technique (Dewatering)
- To learn about Compaction and consolidation in soils
- To discuss the role of Geo-synthetics in soil.
- To learn about earth reinforcement using stone columns, lime piles.
- To learn about the grouting techniques and its necessity/importance in soil stabilization.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the importance of ground improvement.
CO2	To acknowledge the problems in soil and their prevention.
CO3	To learn the techniques of improving soil and its shear strength.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand the importance of ground improvement.	2	1	0	1	2	2	0	0	0	0	0	0
CO2	To acknowledge the problems in soil and their prevention.	3	0	1	2	2	1	0	0	0	0	0	0
CO3	To learn the techniques of improving soil and its shear strength.	3	0	0	1	3	1	0	0	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: DOCK HARBOR TUNNEL ENGINEERING**  
**COURSE CODE: CE320**

**COURSE OBJECTIVES:**

- To study principle of Harbor planning.
- To gain knowledge about components and structures of a Harbor.
- To study tunneling and its methods.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to analyze and select design criteria Harbor using the knowledge of natural phenomena and their effect on Harbor of components.
CO2	Learner will be able to have basic knowledge of functioning of harbor structures.
CO3	Learner will be able to understand the working of docks and will be able to recommend type of dock structure for particular case.
CO4	Learner will be able to comprehend geotechnical considerations in tunneling and determine suitable tunneling technique.
CO5	Learner will be understood micro tunneling techniques and suitable ventilation technique given the conditions of tunnel.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will be able to analyze and select design criteria Harbor using the knowledge of natural phenomena and their effect on Harbor of components.	3	2	0	0	0	0	0	0	1	0	0	0
CO2	Learner will be able to have basic knowledge of functioning of harbor structures.	0	0	3	0	0	0	0	0	2	2	1	0
CO3	Learner will be able to understand the working of docks and will be able to recommend type of dock structure for particular case.	3	2	1	1	1	0	0	0	1	0	0	0
CO4	Learner will be able to comprehend geotechnical considerations in tunneling and determine suitable tunneling technique.	2	0	0	0	0	0	0	0	2	0	0	0
CO5	Learner will be understood micro tunneling techniques and suitable ventilation technique given the conditions of tunnel.	0	2	0	0	0	0	0	0	1	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													



**COURSE: DESIGN OF HYDRAULIC STRUCTURES****COURSE CODE: CE321****COURSE OBJECTIVES:**

- To study about hydraulic structures failures and their prevention
- To understand about head works and cross drainage works features, natural material and their consequences
- To study about dams and reservoirs
- To know about gravity dam
- To understand about earth dams and spillways

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Students are able to understand about various causes of hydraulic structures failures, Bligh and Khosla theories.
CO2	Students are able to understand the concept of head works and cross drainage works.
CO3	Students are able to understand about investigation and planning of dams and reservoirs.
CO4	Students are able to understand about elementary profile of gravity dams and modes of failure of gravity dams.
CO5	Students are able to understand the concept of earth dams and spillways.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Students are able to understand about various causes of hydraulic structures failures, Bligh and Khosla theories.	3	2	1	2	1	1	0	0	0	0	2	2
CO2	Students are able to understand the concept of head works and cross drainage works.	2	2	3	2	2	1	2	0	1	2	0	0
CO3	Students are able to understand about investigation and planning of dams and reservoirs.	3	2	2	3	1	2	0	1	2	3	1	2
CO4	Students are able to understand about elementary profile of gravity dams and modes of failure of gravity dams.	2	3	2	2	3	2	1	2	1	2	2	2
CO5	Students are able to understand the concept of earth dams and spillways.	2	3	2	3	2	2	1	2	2	1	2	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: MAINTENANCE & REHABILITATION OF STRUCTURES**  
**COURSE CODE: CE322**

**COURSE OBJECTIVES:**

- To make the students aware regarding maintenance of structures in construction Industry.
- To impart the knowledge of latest repair tools and techniques available and used in repairing of a structure to enhance quality.
- To make them aware about the identification of Damages in structure using various Tests and Techniques.
- To develop problem solving skills to overcome problems such as corrosion, cracks and demolition in construction industry.
- Able to get knowledge of repair techniques to overcome problems such as chemical disruption, fire and marine exposes.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To make students familiar with the importance, facets and assessment of maintenance in a damaged structure.
CO2	Understand the parameters such and strength, Durability, cracks, climate effects in concrete in accordance with Quality assurance.
CO3	To make the students aware about the advanced and globally recognized material used in repair of structures.
CO4	Learner will be able to understand the problems associated with corrosion, cracks and demolition of structures.
CO5	To facilitate the need to understand the various types of repairs of structures based on weathering effects and exposure conditions.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To make students familiar with the importance, facets and assessment of maintenance in a damaged structure.	2	0	0	2	3	0	0	0	0	0	0	3
CO2	Understand the parameters such and strength, Durability, cracks, climate effects in concrete in accordance with Quality assurance.	3	3	0	0	0	0	0	0	0	0	0	0
CO3	To make the students aware about the advanced and globally recognized material used in repair of structures.	3	0	1	0	3	0	0	0	0	0	0	0
CO4	Learner will be able to understand the problems associated with corrosion, cracks and demolition of structures.	2	3	2	0	1	0	0	0	0	0	0	2
CO5	To facilitate the need to understand the various types of repairs of structures based on weathering effects and exposure conditions.	3	0	0	0	0	0	0	2	0	0	3	2

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: OCCUPATIONAL HEALTH AND SAFETY ENGINEERING**  
**COURSE CODE: CE323**

**COURSE OBJECTIVES:**

- To develop the knowledge of role of safety in industries and different features of OSHAS.
- To develop the knowledge of occupational health hazard.
- To develop the knowledge of hazards due electricity.
- To develop the knowledge of fire hazards in mining industry and their control.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Able to understand the importance of industrial safety and promote role of safety and health training as per the guideline of OHSAS-18001
CO2	Able to promote safety measures in construction industry in connection with excavation work, scaffolding work, welding and cutting and during transportation of men and material.
CO3	Able to understand the effects of electrical hazard in an industry and their control.
CO4	Able to understand effects of fire hazards in mining industry and their contract using different fire extinguisher.
CO5	Able to prepare guidelines using different preventive technique and planning for implementation of training for safety awareness.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Able to understand the importance of industrial safety and promote role of safety and health training as per the guideline of OHSAS-18001	1	1	2	0	0	2	1	0	2	0	0	1
CO2	Able to promote safety measures in construction industry in connection with excavation work, scaffolding work, welding and cutting and during transportation of men and material.	2	0	0	0	0	3	2	0	2	1	0	1
CO3	Able to understand the effects of electrical hazard in an industry and their control.	1	1	3	1	0	2	1	0	2	1	0	1
CO4	Able to understand effects of fire hazards in mining industry and their contract using different fire extinguisher.	1	1	3	1	0	2	1	0	2	1	0	1
CO5	Able to prepare guidelines using different preventive technique and planning for implementation of training for safety awareness.	1	0	3	1	0	2	1	0	2	1	0	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: PRINIPLE OF TOWN PLANNING AND ARCHITECTURE**  
**COURSE CODE: CE324**

**COURSE OBJECTIVES:**

- To impart the knowledge how planning of towns are governed
- To give the knowledge of various types of town planning can be done
- To give the knowledge of various material and techniques in the development of town planning
- To impart the knowledge of various elements of Architectural design.
- To give the knowledge and impact of Architecture effects on town planning and functioning planning of building as per Architecture.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To enable the student to understand the historical aspects of Architecture planning
CO2	To enable the student the various types of town planning in the past
CO3	To enable the student , the effect of materials and techniques in the development of township
CO4	To enable the student in understanding the various elements of Architectural design and its effect on town planning
CO5	To make the student to understand the function of planning of building

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To enable the student to understand the historical aspects of Architecture planning.	1	2	1	2	1	3	1	2	1			0
CO2	To enable the student the various types of town planning in the past.	1	3	2	2	1	2	3	2	1			0
CO3	To enable the student , the effect of materials and techniques in the development of township.	1	1	2	2	3	1	2	2	1			0
CO4	To enable the student in understanding the various elements of Architectural design and its effect on town planning.	1	2	1	2	1	2	1	2	1			0
CO5	To make the student to understand the function of planning of building	2	1	3	1	2	1	2	1	2			0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: SUBJECT: ENVIRONMENTAL ENGINEERING LAB-I**  
**COURSE CODE: CE 327**

**COURSE OBJECTIVES:**

- To impart the experimental knowledge of water quality parameters assessment to be applied in environmental

**COURSE OUTCOMES (CO):**

*After the successful course completion, learner will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learners will be able to determine, explain, analyze and compare various physical, chemical and biological water quality parameters according to the guidelines for drinking water quality code IS-10500:2012.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learners will be able to determine, explain, analyze and compare various physical, chemical and biological water quality parameters according to the guidelines for drinking water quality code IS-10500:2012.	3	3	3	3	3	3	3	3	3	3	0	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: GEOTECHNICAL ENGINEERING LAB**  
**COURSE CODE: CE328**

**COURSE OBJECTIVES:**

- To learn the process/procedure to determine the various ‘**Index Properties**’ of soil practically.
- To learn the process/procedure to calculate various ‘**Engineering Properties**’ of soil practically.
- To perform various ex-situ practical do understand the behavior and nature of soil.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Determine various index and engineering properties of soil.
<b>CO2</b>	Calculate Compaction and consolidation in soil.
<b>CO3</b>	Determine the shear strength of the soil

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Determine various index and engineering properties of soil.	2	3	3	3	2	0	0	1	0	0	0	0
<b>CO2</b>	Calculate Compaction and consolidation in soil.	2	3	3	2	2	0	0	1	0	0	0	0
<b>CO3</b>	Determine the shear strength of the soil	2	3	3	2	2	0	0	1	0	0	0	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: ENVIRONMENTAL ENGINEERING-II**  
**COURSE CODE: CE401**

**COURSE OBJECTIVES:**

- To study about the basic management skill in given environmental condition and various characteristics of sewage.
- To study about various design criteria of sewer.
- To understand various treatment process and engineering knowledge for filter design.
- To study about sewage stabilization and environmental condition of sewage.
- To study about the waste management in given environmental condition in given location.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	The learner will learn basic management skill in given environmental condition about various characteristics of sewage.
CO2	Learner will learn basic management Skills and design criteria of sewer.
CO3	To understand various treatment process and engineering knowledge for filter design.
CO4	The learner will learn about sewage stabilization and environmental condition of sewage.
CO5	To learn the waste management in given environmental condition in given location.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	The learner will learn basic management in given environmental condition and various characteristics of sewage	1	0	2	2	1	1	2	1	1	0	2	1
CO2	Learner will learn basic management Skills and design criteria of sewer	2	1	2	1	0	1	1	1	1	2	2	2
CO3	The students will understand about various treatment process and engineering knowledge for filter design.	1	0	2	1	2	1	1	1	1	2	0	2
CO4	The learner will learn about sewage stabilization and environmental condition of sewage	1	2	0	2	1	2	2	1	0	1	2	1
CO5	To learn the waste management in given environmental condition in given location	2	2	2	2	2	2	1	1	2	1	3	2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: CONSTRUCTION TECHNOLOGY AND MANAGEMENT**  
**COURSE CODE: CE402**

**COURSE OBJECTIVES:**

- To make the students aware regarding general construction practices used in past and in upcoming future.
- To impart the practical knowledge of Construction Management tools and methods used in Project monitoring and Control.
- To make them aware about the construction safety and its guidelines to ensure safe construction environment
- To develop problem solving skills to overcome practical/situation based site execution problems in construction industry
- To enhance the skills by using operation, maintenance and productivity ethics for Equipment end use.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To make students familiar with the past and recent trends of construction industry using project management tools.
CO2	Understand the information based on construction activity monitoring and to analyses the problems using Network diagram techniques.
CO3	To make the students aware about the globally recognized guidelines, theories for safety and other economic benefits.
CO4	Learner will be able to understand the problems associated with contract administration & bidding due to poor management of construction projects.
CO5	To facilitate the need to understand the productivity of construction equipment based on various construction works.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To make students familiar with the past and recent trends of construction industry using project management tools.	3	0	0	0	0	0	0	0	0	0	3	3
CO2	Understand the information based on construction activity monitoring and to analyses the problems using Network diagram techniques.	3	3	0	0	0	0	0	0	0	0	3	0
CO3	To make the students aware about the globally recognized guidelines, theories for safety and other economic benefits.	3	0	0	0	0	3	0	0	0	0	3	0
CO4	Learner will be able to understand the problems associated with contract administration & bidding due to poor management of construction projects.	3	0	0	0	0	0	0	0	0	0	3	3
CO5	To facilitate the need to understand the productivity of construction equipment based on various construction works.	2	0	0	0	0	0	0	2	0	0	3	2

3: Strong contribution, 2: average contribution, 1: Low contribution



**COURSE: STEEL STRUCTURES****COURSE CODE: CE403****COURSE OBJECTIVES:**

- Learner will understand the types and requirement of connections in steel members, then they should be able to design connection given conditions by following guide line of code IS: 800 of code IS: 800
- Learner will understand the behavior & significance of different parameter of compression member, and should be able to design of compression member by following guide line of Indian codes.
- Learner will understand the behavior & mode of failures of tension member, then they be should able to design of tension member by following guide line of Indian codes.
- Learner will understand the behavior flexural member, then they be should able to design members by following guide line of Indian codes.
- Learner will understand the behavior and requirement Industrial building, then they be should able to design of elements of industrial building by following guide line of Indian codes.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Learner should be able to design the various steel structural connections as per conditions and requirements.
<b>CO2</b>	Learner should be able to apply the principles, procedures and codal requirements to the analysis and design compression members by knowing its loading conditions.
<b>CO3</b>	Learner should be able to apply the principles, procedures and codal requirements to the analysis and design tension members for given loading conditions.
<b>CO4</b>	Learner should be able to Apply the principles, procedures and codal requirements to the analysis and design flexure members for given loading conditions.
<b>CO5</b>	Learner should be able to define the requirement of industrial structure and also able design its components for given requirements.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Learner should be able to design the various steel structural connections as per conditions and requirements	3	3	3	3	0	0	0	0	0	0	0	3
<b>CO2</b>	Learner should be able to apply the principles, procedures and codal requirements to the analysis and design compression members by knowing its loading conditions	3	3	3	3	0	0	0	0	0	0	0	3
<b>CO3</b>	Learner should be able to apply the principles, procedures and codal requirements to the analysis and design tension members for given loading conditions	3	3	3	3	0	0	0	0	0	0	0	3
<b>CO4</b>	Learner should be able to Apply the principles, procedures and codal requirements to the analysis and design flexure members for given loading conditions	3	3	3	3	0	0	0	0	0	0	0	3
<b>CO5</b>	Learner should be able to define the requirement of industrial structure and also able design its components for given requirements	3	3	3	3	0	0	0	0	0	0	0	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: TRANSPORTATION SYSTEM PLANNING**  
**COURSE CODE: CE404**

**COURSE OBJECTIVES:**

- To introduce the student to fundamentals of Transport System and it's planning.
- To gain knowledge about transportation system planning and its economic analysis.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will acquire knowledge about fundamentals of transportation system, role of transportation for various aspects & hierarchy of roads in India.
CO2	Learner will be able to evaluate the concepts of public transport selection & will be able to preliminary design few transport infrastructure.
CO3	Learner will be able to understand the fundamentals of transportation costs, demand & supply and all effects of transportation on environmental.
CO4	Learner will understand basis of transport planning process & will be able to do economic evaluation of transport projects.
CO5	Learner will understand fundamentals about system operations & intelligent transportation systems.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will acquire knowledge about fundamentals of transportation system, role of transportation for various aspects & hierarchy of roads in India.	2	2	3	1	3	0	1	0	1	0	2	1
CO2	Learner will be able to evaluate the concepts of public transport selection & will be able to preliminary design few transport infrastructure.	1	1	3	1	2	3	1	1	0	0	0	0
CO3	Learner will be able to understand the fundamentals of transportation costs, demand & supply and all effects of transportation on environmental.	2	1	3	3	1	0	3	0	0	0	1	0
CO4	Learner will understand basis of transport planning process & will be able to do economic evaluation of transport projects.	1	3	2	3	0	0	0	2	1	1	3	0
CO5	Learner will understand fundamentals about system operations & intelligent transportation systems.	0	0	0	0	3	1	2	0	1	0	1	0
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: ADVANCED CONCRETE DESIGN**  
**COURSE CODE: CE405**

**COURSE OBJECTIVES:**

- To understand the nature of stresses in spherical domes and to design reinforced concrete domes.
- To understand the nature of stresses overhead water tanks, codal provisions and to design the rectangular and circular water tanks.
- To know about various element of intze tank and designing of these elements.
- To know about different load acting on building frames, analysis and design of building frame by different methods.
- To get knowledge about different types of bridges, various loads acting on it, stresses due to loads and designing of deck slab.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	With given shape learner will be able to understand the nature of stresses in spherical domes and able to design reinforced concrete domes.
CO2	For circular and rectangular overhead water tank learner will be able to understand the nature of stresses and be able to design with codal provisions
CO3	Knowing the conditions of Intze tank learner will be able to analyse the stresses and be able to design different element
CO4	Following the criteria of IS875, learner will be able to analyse the portal frame and design the the element
CO5	With given design requirements learner will be able to analyse for critical stresses and optimum design of deck slab of reinforced concrete bridge

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	With given shape learner will be able to understand the nature of stresses in spherical domes and able to design reinforced concrete domes.	3	2	3	0	0	0	0	0	0	0	0	2
CO2	For circular and rectangular overhead water tank learner will be able to understand the nature of stresses and be able to design with codal provisions	3	2	3	0	0	0	0	0	0	0	0	2
CO3	Knowing the conditions of Intze tank learner will be able to analyse the stresses and be able to design different element	3	2	3	0	0	0	0	0	0	0	0	2
CO4	Following the criteria of IS875, learner will be able to analyse the portal frame and design the the element	3	3	3	0	0	0	0	0	0	0	0	2
CO5	With given design requirements learner will be able to analyse for critical stresses and optimum design of deck slab of reinforced concrete bridge	3	2	3	0	0	0	0	0	0	0	0	2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: ENVIRONMENTAL POLLUTION CONTROL**  
**COURSE CODE: CE406**

**COURSE OBJECTIVES:**

- Realize the importance of ecosystem, its elements and biodiversity for maintaining ecological balance.
- Identifying air pollution sources, effects, its measurement and control devices.
- Identifying the sources of water pollution and classify the pollutants and analyze the waste water sample.
- Identify the type of land pollution and understand solid waste management.
- Identifying noise pollution sources, effects, its measurement, prevention and control.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to understand the importance of ecosystem, its elements and biodiversity for maintaining ecological balance.
CO2	Learner will be able to identify air pollution sources, effects, its measurement and control devices to be used.
CO3	Given the utilization conditions, the learner will be able to identify sources of water pollution and classify the pollutants and analyze the wastewater sample.
CO4	Identify the type of land pollution and understand solid waste management.
CO5	The learner will be able to identify noise pollution, its sources, effects, measurement, prevention and control methods.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will be able to understand the importance of ecosystem, its elements and biodiversity for maintaining ecological balance.	1	2	0	1	0	0	0	0	0	0	1	0
CO2	Learner will be able to identify air pollution sources, effects, its measurement and control devices to be used.	3	1	3	0	0	1	3	0	0	0	0	1
CO3	Given the utilization conditions, the learner will be able to identify sources of water pollution and classify the pollutants and analyze the wastewater sample.	3	1	3	3	0	2	2	0	0	0	0	1
CO4	Identify the type of land pollution and understand solid waste management.	1	1	2	0	0	1	2	0	0	0	0	1
CO5	The learner will be able to identify noise pollution, its sources, effects, measurement, prevention and control methods.	3	1	2	0	0	1	2	0	0	0	0	1

3: Strong contribution, 2: average contribution, 1: Low contribution

**COURSE: DESIGN OF WASTEWATER SYSTEM****COURSE CODE: CE407****COURSE OBJECTIVES:**

- To give the basic knowledge about the characteristics of wastewater and oxygen requirement of organic material for the decomposition
- To give the basic idea about the primary treatment of the wastewater
- To give the knowledge of secondary treatment of wastewater and design process of activated sludge units
- To give the idea of design of trickling filter and calculation of efficiency of the trickling filters
- To learn about the waste stabilization pond, Oxidation ditches and Rotating Biological Contactors

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	To give the basic knowledge about the characteristics of wastewater and oxygen requirement of organic material for the decomposition
CO2	To give the basic idea about the primary treatment of the wastewater
CO3	To give the knowledge of secondary treatment of wastewater and design process of activated sludge units
CO4	To give the idea of design of trickling filter and calculation of efficiency of the trickling filters
CO5	To learn about the waste stabilization pond, Oxidation ditches and Rotating Biological Contactors

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	To give the basic knowledge about the characteristics of wastewater and oxygen requirement of organic material for the decomposition	2	1	1	1	1	2	3	1	2	2	2	2
CO2	To give the basic idea about the primary treatment of the wastewater	1	1	3	1	1	2	3	1	1	1	3	1
CO3	To give the knowledge of secondary treatment of wastewater and design process of activated sludge units	1	3	3	2	2	1	3	1	3	2	2	2
CO4	To give the idea of design of trickling filter and calculation of efficiency of the trickling filters	2	2	3	2	1	2	2	1	2	2	3	2
CO5	To learn about the waste stabilization pond, Oxidation ditches and Rotating Biological Contactors	3	2	2	1	1	2	2	1	1	2	1	2
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: EARTHQUAKE RESISTANT DESIGN****COURSE CODE: CE410****COURSE OBJECTIVES:**

- To introduce the students the basics of structural dynamics
- To design Earthquake Resistant Structures using codal provisions.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Develop understanding of structural dynamics and determining response of structural system under free and forced vibration.
CO2	Knowledge of various codal provisions and modern techniques in earthquake resistant design.
CO3	Attainment of knowledge of soil structural interaction and design of machine foundation.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop understanding of structural dynamics and determining response of structural system under free and forced vibration.	3	2	1	1	1	1	1	1	0	0	0	1
CO2	Knowledge of various codal provisions and modern techniques in earthquake resistant design.	2	2	2	1	2	3	1	2	0	0	0	1
CO3	Attainment of knowledge of soil structural interaction and design of machine foundation.	2	1	2	1	1	1	1	1	0	0	0	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: ADVANCED FOUNDATION DESIGN****COURSE CODE: CE411****COURSE OBJECTIVES:**

- Students will be well versed with basis of design criteria of shallow foundation and also the affecting factors to access the bearing capacity of soil.
- Students will be able to know the load carrying capacity of pile in various ground condition also the basic of well foundation.
- Basic design criteria of machine foundation and management to control the vibration through isolation.

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the design criteria and various effects responsible for settlements of shallow foundation.
CO2	Understand the load carrying capacity of piles and basis of well foundation.
CO3	Aware the design criteria of machine foundation on natural soil system.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Understand the design criteria and various effects responsible for settlements of shallow foundation.	2	1	3	2	0	1	0	0	0	0	2	1
CO2	Understand the load carrying capacity of piles and basis of well foundation.	2	1	1	0	1	2	0	1	0	0	2	2
CO3	Aware the design criteria of machine foundation on natural soil system.	3	2	2	1	0	2	0	0	0	0	2	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: IMPACT OF CLIMATE CHANGE FOR CIVIL ENGINEERING PROJECTS****COURSE CODE: CE412****COURSE OBJECTIVES:**

- To understand the basic concept of weather and climate change in civil engineering.
- To understand the basic concept of impact of climate change on hydrological cycle and its components.
- To understand the basic concept of the Climate change dilemma for civil engineering
- To understand the basic concept of the Montreal Protocol, effect of climate change on a Global Scale.
- To understand the basic concept of the Climate Change Adaptation and Carbon sequestration – Carbon capture and storage (CCS).

**COURSE OUTCOMES (CO):***After the successful course completion, learners will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Students are able to understand Basic meteorology, Earth's Climate System, Green House Gases and Global Warming.
<b>CO2</b>	Students are able to understand the Impact of climate change on hydrological cycle and impact on water quality and quantity.
<b>CO3</b>	Students are able to understand the Climate change dilemma for engineering, and statistical methods for risk assessment and management.
<b>CO4</b>	Students are able to understand The Montreal Protocol, effect of climate change on a Global Scale and in India, and impacts on urban water systems
<b>CO5</b>	Students are able to understand the Climate Change Adaptation and Mitigation Measures in various sectors like Water, Transport, and Energy.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Students are able to understand Basic meteorology, Earth's Climate System, Green House Gases and Global Warming.	2	2	3	3	2	2	3	2	2	3	1	2
<b>CO2</b>	Students are able to understand the Impact of climate change on hydrological cycle and impact on water quality and quantity.	3	3	3	2	3	3	3	2	2	2	1	1
<b>CO3</b>	Students are able to understand the Climate change dilemma for engineering, and statistical methods for risk assessment and management.	2	2	2	3	2	2	2	2	3	3	2	2
<b>CO4</b>	Students are able to understand The Montreal Protocol, effect of climate change on a Global Scale and in India, and impacts on urban water systems	3	3	2	2	3	2	3	2	2	2	2	1
<b>CO5</b>	Students are able to understand the Climate Change Adaptation and Mitigation Measures in various sectors like Water, Transport, and Energy.	2	2	2	2	2	2	2	2	1	2	1	1
3: Strong contribution, 2: average contribution, 1: Low contribution													



**COURSE: ENVIRONMENTAL POLLUTION CONTROL**  
**COURSE CODE: CE413**

**COURSE OBJECTIVES:**

- Understand the concept of reserve strength of steel and the basics of plastic analysis theory.
- Understanding the methods of plastic analysis and analysing the beams and frames.
- Identifying the factors affecting the plastic moment capacity of the section
- Plastic design of beams and frames.
- Design of steel structures using minimum weight design.

**COURSE OUTCOMES (CO):**

*After the successful course completion, learners will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learner will be able to understand the concept of reserve strength of steel and the basics of plastic analysis theory.
CO2	Learner will be able to understand the methods of plastic analysis and do the analysis of beams and frames.
CO3	Learner will be able to identify the factors affecting the plastic moment capacity of the section.
CO4	Learner will be able to do the plastic design of beams and frames.
CO5	Learner will be able to design the steel structures using minimum weight design method.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learner will be able to understand the concept of reserve strength of steel and the basics of plastic analysis theory.	1	1	0	0	0	0	0	0	0	0	0	1
CO2	Learner will be able to understand the methods of plastic analysis and do the analysis of beams and frames.	2	2	0	0	0	0	0	0	0	0	0	1
CO3	Learner will be able to identify the factors affecting the plastic moment capacity of the section.	2	2	0	0	0	0	0	0	0	0	0	1
CO4	Learner will be able to do the plastic design of beams and frames.	2	2	1	0	0	1	0	0	0	0	0	1
CO5	Learner will be able to design the steel structures using minimum weight design method.	2	2	1	0	0	1	0	0	0	0	0	1
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE:** ENVIRONMENTAL ENGINEERING LAB-II

**COURSE CODE:** CE 418

**COURSE OBJECTIVES:**

- To impart the experimental knowledge of wastewater quality assessment to be applied in environmental engineering

**COURSE OUTCOMES (CO):**

*After the successful course completion, learner will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learners will be able to determine, explain, analyze and compare various characteristics of domestic and industrial wastewater according to the guidelines prescribed by IS code

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Learners will be able to determine, explain, analyze and compare various characteristics of domestic and industrial wastewater according to the guidelines prescribed by IS code	3	3	3	3	3	3	3	3	3	3	0	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: MINOR PROJECT**

**COURSE CODE: CE 420**

**COURSE OBJECTIVES:**

- To enable students to work as a team and to select B.Tech project topic.

**COURSE OUTCOMES (CO):**

*After the successful course completion, a learner will develop following attributes:*

<b>COURSE OUTCOME (CO)</b>	<b>DESCRIPTION</b>
<b>CO1</b>	Skill to work in a team and to select the best project per the ability and strength of a team to carry out the literature review work.

**CO-PO MAPPING:**

<b>CO</b>	<b>DESCRIPTION</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	Skill to work in a team and to select the best project per the ability and strength of a team to carry out the literature review work.	0	3	0	3	3	0	0	3	3	3	3	3
3: Strong contribution, 2: average contribution, 1: Low contribution													

**COURSE: B.TECH PROJECT**  
**COURSE CODE: CE499**

**COURSE OBJECTIVES:**

- To enable students to work as a team to develop the methodology for the project..
- To develop the capability to apply the engineering principles to carry out the project work.
- To define the conclusion of the project undertaken with in depth understanding of the topic.

**COURSE OUTCOMES (CO):**

*After the successful course completion, a learner will develop following attributes:*

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Ability to work as a team to plan the execution of the undertaken project.
CO2	Capability to use the engineering knowledge and principles on an undertaken project.
CO3	Capacity to complete the undertaken project on time with effective communication to deliver the project successfully.

**CO-PO MAPPING:**

CO	DESCRIPTION	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Ability to work as a team to plan the execution of the undertaken project.	0	0	0	3	3	2	1	3	3	3	3	3
CO2	Capability to use the engineering knowledge and principles on an undertaken project.	3	3	3	3	3	2	1	3	3	3	3	3
CO3	Capacity to complete the undertaken project on time with effective communication to deliver the project successfully.	3	3	3	3	3	2	1	3	3	3	3	3
3: Strong contribution, 2: average contribution, 1: Low contribution													