SREEPATHY INSTITUTE OF MANAGEMENT AND TECHNOLOGY

COURSE HANDBOOK

DEPARTMENT OF CIVIL ENGINEERING

SEMESTER 3

CE 201 MECHANICS OF SOLIDS

COURSE INFORMATION SHEET:

Program: **Civil Engineering**	Degree :**B-Tech**
Course**: Mechanics of Solids**	Course code**: CE 201**
L-T-P**:3-1-0**	Credit**:4**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY% MARKS
I	Review of statics, Concept of stress and strain – types, Stress – strain relation - Hooke's law, Young's modulus of elasticity. Stress-strain diagram of mild steel. Factor of safety, working stress. Axially loaded bars with uniform cross section–stress, strain and deformation. Deformation of axially loaded bars with varying cross section and bars with varying axial loads. Statically indeterminate systems (number of unknowns restricted to two).	8	20
II	Temperature effects, temperature stress in composite bars. Shear stress and shear strain, Modulus of rigidity, simple shear, punching shear. Lateral strain, Poisson's ratio,volumetric strain. Bulk modulus of elasticity, relationships between elastic constants. Strain energy – concept.Strain energy due to normal stress. Strain energy in bars carrying axial loads. Instantaneous stress in bars due to gradual, sudden and impact loads.Strain energy due to shear stress. Stresses in thin cylinders and spheres due to internal pressure.	8	20
III	Beams – different types. Types of loading on beams. Concept of bending moment and shear force. Relationship between intensity of load, shear force and bending moment. Shear force and bending moment diagrams of cantilever beams, simply supported beams and overhanging beams for different type of loads. Point of contraflexure.	8	20
IV	Theory of simple bending, assumptions and limitations. Calculation of normal stress in beams, moment of resistance Shear stress in beams. Beams of uniform strength.Strain energy due to bending – calculation of strain energy in beams. Differential equation for calculating the deflection of beams. (Introduction and demonstration only.Students are not expected to solve deflection problems.)	9	20
V	Stresses on inclined sections for uniaxial and biaxial stress fields. Principal stresses and principal planes in 2D problems, maximum shear stress. Strains along principal directions. Mohr's circle of stress for 2D problems. Short columns – direct and bending stress. Kern of a section. Slender columns – Euler's buckling load, slenderness ratio, limitation of Euler's formula. Rankine formula. Torsion of circular and hollow circular shafts, Power transmitted by circular shafts and hollow circular shafts. Strain energy due to torsion.	12	20

TEXT BOOKS:

1	H. J. Shah andS. B. Junnarkar, Mechanics of Structures Vol - I, Charotar Publishing House
2	R. K. Bansal, A Text book of Strength of Materials, Laxmi Publications (P) Ltd, New Delhi.
3	B. C. Punmia, Ashok K. Jain, Arun Kumar Jain, Mechanics of Materials, Laxmi Publications (P) Ltd, New Delhi.

REFERENCES:

1	Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall International Series
2	James M Gere, S.P. Timoshenko, Mechanics of Materials, CBS Publishers and Distributors, New Delhi.
3	R.C. Hibbeler, Mechanics of Materials (edn.10), Pearson
4	S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Co (P) Ltd.
5	Rattan, Strength of Materials, McGraw Hill Education India

PREREQUISITE:EST 100 Engineering Mechanics

COURSE OBJECTIVES:

1	To enable the students to calculate stresses and strains generated in material due to external loads for various types of loading conditions

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Recall the fundamental terms and theorems associated with mechanics of linear elastic deformable bodies.
2	Explain the behavior and response of various structural elements under various loading conditions.
3	Apply the principles of solid mechanics to calculate internal stresses/strains, stress resultants and strain energies in structural elements subjected to axial/transverse loadsand Bending / twisting moments.
4	Choose appropriate principles or formula to find the elastic constants of materials making use of the information available.
5	Perform stress transformations; identify principal planes/ stresses and maximum shear stress at a point in a structural member.
6	Analyze the given structural member to calculate the safe load or proportion the cross section to carry the load safely

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	1													2		
CO2	2	1												2		
CO3	3	2												2		
CO4	3	2												2	2	
CO5	3	2												2	2	
CO6	3	3	1											2		

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	PO1	1	Students will able to explain concept of stress,strain,various elastic constants and fundamental knowledge about internal forces in members subjected to different load conditions
CO2	PO1	2	Fundamental knowledge about the behavior and response of various structural elements under various loadings
	PO2	1	Analyze and apply the engineering knowledge
CO3	PO1	3	Apply the knowledge of engineering fundamentals to compute internal forces
	PO2	2	Identify and formulate engineering problems reaching conclusion from principles of engineering science and mathematics to compute different types of stresses
CO4	PO1	3	Application of fundamental engineering knowledge to compute stress in composite materials
	PO2	2	Use engineering principles to solve problems in composite materials
CO5	PO1	3	Apply the knowledge from engineering fundamentals to find principal stresses
	PO2	2	Identify and formulate engineering problems reaching conclusion from fundamentals of engineering science and mathematics to compute the principal stresses
CO6	PO1	3	Apply knowledge from engineering fundamentals to compute cylindrical presssure
	PO2	3	Apply knowledge from engineering fundamentals to find out stresses in columns
	PO3	1	Identify and formulate engineering problems reaching conclusion from fundamentals to compute cylindrical pressure and stresses in columns

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO1**	**2**	Graduates shall acquire good knowledge in analysis, design etc with good foundation in mathematics, basic science etc.
CO2	**PSO1**	**2**	Graduates shall acquire good knowledge in analysis, design etc with good foundation in mathematics, basic science etc.
CO3	**PSO1**	**2**	Graduates shall acquire good knowledge in analysis, design etc with good foundation in mathematics, basic science etc.
CO4	**PSO1**	**2**	Graduates shall acquire good knowledge in analysis, design etc with good foundation in mathematics, basic science etc.
	PSO2	**2**	Understand about infrastructural developments.
CO5	**PSO1**	**2**	Graduates shall acquire good knowledge in analysis, design etc with good foundation in mathematics, basic science etc.
	PSO2	**2**	Understand about infrastructural developments

CE 203 FLUID MECHANICS AND HYDRAULICS

COURSE INFORMATION SHEET:

Program:**Civil Engineering**	Degree :**B-Tech**
Course**: Fluid mechanics**	Course code**: CE 203**
L-T-P**: 3-1-0**	Credit**: 4**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Introduction to the subject-Fluid properties (mass density, specific weight, viscosity, specific gravity), Classification of Fluids (prerequisite no questions from this section) Fluid statics-variation of pressure in a fluid, measurement of fluid pressure using piezometers and manometers, U-tube manometers, Forces on immersed plane placed vertical and inclined positions. Hydrostatic force on curved surfaces – Practical application of total pressure on spillway gates	9	20
II	Buoyancy and Floatation: Buoyant force, Principle of floatation, stability of floating and submerged bodies, metacentre and metacentric height, analytical and experimental determination of metacentric height Hydrodynamics- Methods of describing fluid motion, Lagrangian and Eulerian methods, velocity and acceleration, types of fluid flow, description of fluid flow- streamline, pathline and streakline; continuity equation in one, two and three dimensions	9	20
III	Fluid kinetics-forces considered in describing fluid motion, Derivation of Bernoulli's equation by integration of Euler's equation along a streamline, kinetic energy correction factor, Applications of Bernoulli's equation- Venturimeter, Pitot tube and Orificemeter; Hydraulic coefficients of orifices and their experimental determination, Discharge through small orifice and large rectangular orifices Pipe flow- computation of major and minor losses in pipes, hydraulic gradient line and total energy line, pipes in series-equivalent pipe, flow through parallel pipes	9	20
IV	Open channel flow – comparison between pipe flow and open channel flow, velocity distribution in open channels, types of channels, type of flow, geometric elements of channel section, uniform flow computations (Chezy's equation, Kutter's and Manning's formula); Most economical sections – rectangular, triangular and trapezoidal channels, condition for maximum discharge and maximum velocity through circular channels, conveyance and section factor Flow measurement in channels – notches and weirs – Discharge computations using weirvelocityof approach and end contraction,discharge equations of rectangular weir, triangularweir, trapezoidal and Cipoletti weir, submerged weir, broad crested weir	9	20

V	Specific energy- specific energy diagram and discharge diagram, Critical flow and its computation. Gradually varied flow- Dynamic equation of gradually varied flow different forms, types and characteristics of water surface profiles in rectangular prismatic channels. Computation of length of water surface profiles by direct step method Specific force, Rapidly varied flow-Hydraulic jump-conjugate or sequent depths, expression for sequent depths and energy loss for a hydraulic jump in horizontal rectangular channels, types uses and characteristics of hydraulic jump	12	20

TEXT BOOKS:

1	Modi P. N. and S. M. Seth, Hydraulics & Fluid Mechanics, S.B.H Publishers, New Delhi, 2002.
2	Subramanya K., Theory and Applications of Fluid Mechanics, Tata McGraw-Hill, 1993.
3	Subramanya K., Flow in Open channels, Tata McGraw-Hill, 2009.

REFERENCES:

1	Streeter.V.L. Fluid Mechanics, Mc Graw Hill Publishers.
2	Bruce R Munson, Donald F Young . Fundamentals of Fluid Mechanics, John Wiley & sons, 2011.
3	Jain A. K., Fluid Mechanics, Khanna Publishers, Delhi, 1996.
4	Joseph Katz, Introductory Fluid Mechanics, Cambridge University Press, 2015
5	Arora.K.R. Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Publishers, 2005.
6	Narasimhan S., A First Course in Fluid Mechanics, University Press (India) Pvt. Ltd., 2006
7	Frank.M.White, Fluid Mechanics, Mc Graw Hill, 2013.
8	Mohanty.A.K. Fluid Mechanics, Prentice Hall, New Delhi, 2011
9	Narayana Pillai,N. Principles of Fluid Mechanics and Fluid Machines, University Press, 2011.
10	Kumar.D.N. Fluid Mechanics and Fluid power Engineering, S.K.Kataria& sons, 2013.

PREREQUISITE: Elementary mathematics, concepts in engineering mechanics

COURSE OBJECTIVES:

1	To understand the basic properties of the fluid, fluid statics, kinematics, and fluid dynamics so as to analyze and appreciate the complexities involved in solving the fluid flow problems
2	To give an introduction to the fundamentals of fluid flow and its behaviour so as to equip the students to learn related subjects and their applications in the higher semesters.
3	To develop the skill for applying the fluid statics, kinematics and dynamics of fluid flow concepts for solving civil engineering problems.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Recall the relevant principles of hydrostatics and hydraulics of pipes and open channels
2	Identify or describe the type, characteristics or properties of fluid flow
3	Estimate the fluid pressure, perform the stability check of bodies under hydrostatic Condition
4	Compute discharge through pipes or estimate the forces on pipe bends by applying hydraulic principles of continuity, energy and/or momentum
5	Analyze or compute the flow through open channels, perform the design of prismatic Channels

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	**2**	**2**												**3**		
CO2	**2**	**2**												**3**		
CO3	**3**	**3**												**3**	**2**	
CO4	**3**	**3**												**3**	**2**	
CO5	**3**	**3**												**3**		

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**2**	Basics of fluid mechanics from the basis of knowledge of a civil engineer to encounter any problem in the field of water resource engineering
	PO2	**2**	The student will able to find the forces acting on different surfaces by fluids
CO2	**PO1**	**2**	Stability of floating and submerged bodies in water is essential engineering knowledge for those who aspire to study fluid-structure interactions.
	PO2	**2**	The Civil Engineer needs to understand how to analyse a flow without having to consider the forces causing the motion
CO3	**PO1**	**3**	Help to build logic about simple methods that are used to determine the discharge and velocity of flow without using any electronic equipment
	PO2	**3**	Introducing principles ofsimple instruments like venturi meter and pitot tube so that students can develop similar simple instruments using those principles
CO4	**PO1**	**3**	Providing a fundamental engineering knowledge about the flow through an open channel, helps to solve engineering problems associated with it
	PO2	**3**	Help to build idea about flow measurement in channels and associated structures and the student can identify them and solve the problems associated with it
CO5	**PO1**	**3**	Providing an overall idea on how to design a prismatic channel so that they can design them without any fail
	PO2	**3**	The Students can analyze and compute the flow through a channel so that it can be used in civil engineering infrastructure associated with it
	PO3	**2**	Give a logic idea about computation of length of water surface profiles and can resolve the problems

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO1**	**3**	Graduates will demonstrate knowledge in analysis of fluid flow systems and will analyze pressure of a fluid at rest
CO2	**PSO1**	**3**	Graduates will analysis the stability condition of a body in a fluid using the acquired knowledge
CO3	**PSO1**	**3**	Graduates will understand and will be able to apply the knowledge of fluid kinematics
CO4	**PSO1**	**3**	Graduates will analyze different numerical problems using Bernoulli's equation.
CO5	**PSO1**	**3**	Graduates will be able to analyze pipe flow problems
CO6	**PSO1**	**2**	Graduates will understand the basic concept of boundary layer

CE 205 SURVEYING AND GEOMATICS

COURSE INFORMATION SHEET:

Program: **Civil Engineering**	Degree :**B-Tech**
Course**: Surveying and Geomatics**	Course code**: CE 205**
L-T-P**:3-0-0**	Credit**:4**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Introduction to Surveying- Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines,Local attraction, Declination, Methods of orientation (by compass and by backsighting)Levelling: Principles of levelling-Dumpy level, booking and reducing levels, Methods- simple, differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level,Errors in levelingContouring: Characteristics, methods, uses.	9	20
II	Area and Volume: computation of area by offsets to base line, by dividing area into number of triangles; volume of level section by prismoidal and trapezoidal formulae.Mass diagram: Construction, Characteristics and uses Theodolite survey: Instruments, Measurement of horizontal and vertical angle, principles ofstadia and tangential tacheometry (introduction only) Triangulation: Triangulation figures, Triangulation stations, Inter visibility of stations, SatelliteStations and reduction to Centre	9	20
III	Traverse Surveying - Methods of traversing, Checks in closed traverse, Traverse computations, Balancing the traverse- Bowditch's rule, Transit rule, graphical method based on Bowditch's rule, omitted measurements (a line and an angle only) Theory of Errors – Types, theory of least squares, Weighting of observations, Most probable value, Computation of indirectly observed quantities - method of normal equations	9	20
IV	Curve Surveying – Elements of simple and compound curves – Methods of setting out (Angular methods only)– Elements of Reverse curve (Introduction only)– Transition curve – length of curve – Elements of transition curve - Vertical curve (Introduction only) Total Station – concept of EDM, principles and working, advantages and applications	9	20
V	Global Positioning Systems-Components and principles, satellite ranging-calculating position,signal structure, application of GPS, GPS Surveying methods-Static, Rapid static, Kinematic methods – DGPS Remote Sensing : Definition- Electromagnetic spectrum-Energy interactions with atmosphere and earth surface features-spectral reflectance of vegetation, soil and water- Classification of sensors- Active and Passive, Resolution-spatial, spectral radiometric and Temporal resolution, Multi spectral scanning-Along track and	9	20

	across track scanning Geographical Information System-components of GIS, GIS operations, Map projections methods, Coordinate systems-Geographic and Projected coordinate systems, Data Types-Spatial and attribute data, Raster and vector data representation		

TEXT BOOKS:

1	Dr. B.C. Punmia , Ashok Kumar Jain &Arun Kumar Jain - Surveying , Laxmi publications (P) Ltd , 2005
2	Chang,K , "Introduction to Geographic Information Systems", Tata McGraw-Hill Publishing Co. Ltd, 2008
3	George Joseph, "Fundamentals of Remote Sensing", University Press, 2003

REFERENCES:

1	C. Venkatramaiah, Textbook of Surveying, Universities Press (India) Private Limited 2011
2	James M Andersen, Edward M Mikhail, Surveying Theory and Practice, McGraw Hill Education
3	Prof. T.P.Kenetkar&Prof.S.V.Kulkarni - Surveying and Levelling , Pune VidyarthiGriha Prakashan,2004
4	N NBasak, Surveying and Levelling, McGrawHill Education
5	R.Agor - A Text book of Surveying and Levelling, Khanna Publishers, 2005
6	S.K.Duggal - Surveying Vol. I, Tata McGraw Hill Ltd ,Reprint 2015.
7	S.K. Duggal - Surveying Vol. II, Tata McGraw Hill Ltd ,Reprint 2015
8	Iliffe, C.J., Datums and Map Projections for Remote Sensing, GIS and Surveying, Whittles Publishing, 2006
9	James M Andersen, Edward M Mikhail, Surveying Theory and Practice, McGraw Hill education, 7e, 1998
10	Kang-tsung Chang, „Introduction to GIS" , Tata McGraw-Hill Publishing Co. Ltd, 8e, 2016
11	Lillesand M and Kiefer W, "Remote Sensing and Image Interpretation". John Wiley and Sons,Inc., 2000
12	Burrough P , Principles of Geographical Information systems, Oxford University Press, 1998

PREREQUISITE: Nil

COURSE OBJECTIVES:

1	To impart an awareness on the principles of surveying, various methods and instruments of surveying, errors associated with field measurements and advanced surveying techniques.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

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

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	**3**	**3**		**2**	**2**									**1**		
CO2	**3**	**3**		**2**										**1**		
CO3	**3**	**3**						**1**	**2**					**2**		
CO4	**3**	**2**												**3**		
CO5	**3**	**2**	**1**	**1**				**1**	**2**							**3**
CO6	**3**			**2**	**2**			**1**				**2**		**2**		

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	The basics used in surveying form the basis of knowledge of civil engineer to encounter any problem in civil engineering
	PO2	**3**	Basic knowledge of how area and volume can be calculated on a given plot or between the given points on ground
	PO4	**2**	Knowledge about principles of levelling and contouringhelps to deal with field conditions
	PO5	**2**	Modern tools are introduced day by day. So, we need to haveknowledge on different instruments used for surveying andhow it will useful when new updates come
CO2	**PO1**	**3**	With the help of sophisticated different instruments one canone can find solution for any complex problems related tosurveying
	PO2	**3**	With the help of measurements taken from the field we candesign solutions for complex states of surveying liketriangulations

	PO4	**2**	Identify or analyze any kind of surveying problem whichcomes under triangulation surveying
CO3	**PO1**	**3**	Applying different methods of traversing for solving field problems
	PO2	**3**	Applying the methods for calculating omitted measurement to solve problems in daily life of a civil engineer
	PO8	**1**	Applying basic mathematic in solving the engineering problems
	PO9	**2**	Knowledge about the graphical methods to solve traversing related problems
CO4	**PO1**	**3**	Applying the knowledge of errors thus by adjusting thetriangulation figures in order to get proper results of survey
	PO2	**2**	Analysing the indirectly observed quantities is a real-life challenge for an engineer
CO5	**PO1**	**3**	Setting out of a curve is an important knowledge for a civil engineer
	PO2	**2**	Knowledge about elements of curve helps to identify them in fields
	PO3	**1**	Ideas about vertical curve is important when a highway engineer has to deal with two gradient surfaces
	PO4	**1**	The student gets general idea regarding different types of curve
	PO8	**1**	Application of basic mathematical problems to solve engineering problems
	PO9	**2**	The student will able to solve problems when they are laying a road or rail where gradients to be change or when directions to be change
CO6	**PO1**	**3**	The student gets an idea about advanced and sophisticated instruments in surveying
	PO4	**2**	Applying knowledge about advanced technologies in the field of surveying
	PO5	**2**	Getting an idea about principle behind these technologies
	PO8	**1**	The student will get an idea about how survey and geomatics are inter related
	PO12	**2**	Knowing the application of advanced technologies and sophisticated tools to solve field problems of a civil engineer

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO2**	**1**	The graduates will be able to assess enough knowledge in surveying principles
CO2	**PSO2**	**1**	The graduates will be able to know about modern surveying methods
CO3	**PSO2**	**2**	The graduates will be able to identify the error and correct it
CO4	**PSO2**	**3**	The graduates can demonstrate their knowledge in area and volume computation
CO5	**PSO2**	**3**	The graduates will be able to work with modern instruments
CO6	**PSO2**	**2**	The graduates will be able to identify latest surveying instruments

CEL 201 CIVIL ENGINEERING PLANNING & DRAFTING LAB

COURSE INFORMATION SHEET:

Program: **Civil Engineering**	Degree :**B-Tech**
Course**: Civil Engineering Planning & Drafting**	Course code**: CEL 201**
L-T-P**:0-0-3**	Credit**:2**

List of Experiments (Any 12 experiments out of 15 need to be performed mandatorily. Manual drafting and drafting using computer aided drafting software is mandatory for the experiments)

1.Draw sectional details and elevation of paneled doors

2. Draw sectional details and elevation of glazed windows and ventilators in wood.

3. Draw sectional details, detailing on fixing arrangement and elevation of steel windows.

4. Draw elevation, section and detailing of connection between members, arrangement for fixing at the support for steel roof truss.

5. Draw plan, section and elevation of dog legged staircase.

6. Draw sectional details of a load bearing wall over strip footing, RCC Column over isolated footing and pile Footing with pile cap.

7. Draw plan, section and elevation of single storied residential buildings with flat roof.

8. Draw plan, section and elevation of two storied residential building.

9. Draw plan, section and elevation of a community hall having corrugated GI sheet roof.

10. Prepare a site plan and service plan as per latest building rules (KPBR or KMBR)

11. Prepare detailed drawing on building services (for single and two storied buildings only) and on-site Waste water disposal systems like septic tank and soak pit.

12. Draw plan, section and elevation of multi-storied framed buildings.

13. Draw plan, section and elevation of a public buildings–office complex, public health centre, post office, bank etc

14. Draw plan, section and elevation of an industrial building with corrugated GI steel roof and PEB based Walling elements.

15. Create 3D model of a two storied residential building and render the model.

PREREQUISITE: Engineering Graphics

COURSE OBJECTIVES:

1	To introduce the fundamentals of Civil Engineering drawing.
2	To understand the principles of planning
3	To learn drafting of buildings.
4	To impart knowledge on drafting software such as AutoCAD.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Illustrate ability to organize civil engineering drawings systematically and professionally
2	Prepare building drawings as per the specifiedguidelines
3	Assess a complete building drawing to include allnecessary information
4	Create a digital formof the building plan using anydrafting software

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	**3**							**2**	**3**	**3**				**3**		**1**
CO2	**3**							**2**	**3**	**3**				**3**		**1**
CO3	**3**							**2**	**3**	**3**				**3**		**1**
CO4	**3**							**2**	**2**	**3**				**3**		**1**

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	Students can attain the knowledge and ability of drafting civil engineering drawings by means of analyzing the fundamentals.
	PO8	**2**	Students will formulate and analyze complex problems related to partial elevations of Steel truss and theconnections involve
	PO9	**3**	Roof trusses are an eminent component of any modern day house and hence are the knowledge about how to select one.
	PO10	**3**	Students can attain the ability to engage in the broadest context of technologicalchange and in other civil engineering practices by knowing the drafting of civilengineering drawings with short time.
CO2	**PO1**	**3**	Students can attain the ability of drafting civil engineering drawings.

	PO8	**2**	The plan, section and elevation of a house are the skeleton of civil engineering design and hence the knowledge is paramount for a Civil Engineer.
	PO9	**3**	Students will formulate and analyze complex problems related to plan, section and elevation of single storied and double storied buildings from given line sketches
	PO10	**3**	Students will be able to apply knowledge of basic fundamentals while designing any house is the conflicting ideas of space allocation and practicing an optimum between aesthetic requirements and functional requirements
CO3	**PO1**	**3**	Students can create and apply appropriate techniques and innovations using Civilengineering drafting software like AutoCAD in the planning of civil engineering projects.
	PO8	**2**	Students will design solutions for complex engineering problems and develop line sketches and working drawings of single storied RCC residential buildings as per area and functional requirements
	PO9	**3**	Students will develop the ability to engage in independent and life-long learning in the broadest context of technological change by drawing single storied RCC residential buildings as per area and functional requirements
	PO10	**3**	Students can demonstrate knowledge and understanding of engineering and management principles using computer aided software and can apply these to one's own work, as a member and leader in a team.
CO4	**PO1**	**3**	The idea of designing is made simpler and faster by software like AutoCAD and hence the knowledge of working on the software is also of high importance.
	PO8	**2**	Students will design solutions for complex engineering problems and develop site plan of a given building using Kerala Building Rules
	PO9	**2**	Students will make use of model tool Auto CAD software for preparation of plan, elevation and section of a building
	PO10	**3**	Students will formulate and analyse complex problems for preparation of plan, elevation and section of a building

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO1**	**3**	Graduates shall demonstrate knowledge in the planning and drafting of civil engineering projects.
	PSO3	**1**	Graduates will demonstrate ability to function within modern computer aided software and can apply it in own working practices for analyzing various civil engineering structures.
CO2	**PSO1**	**3**	Graduates shall demonstrate knowledge in the drafting of civil engineering projects with short period of time.
	PSO3	**1**	Graduates will demonstrate ability to function within modern computer aided software and can apply it in own working practices for analyzing various civil engineering structures.
CO3	**PSO1**	**3**	Graduates shall demonstrate knowledge in the drafting of civil engineering infrastructures using computer aided software like AutoCAD with short period of time.
	PSO3	**1**	Graduates will demonstrate ability to function within modern computer aided software AutoCAD and can apply it in own working practices.

CE231 SURVEYING LAB

Program: **Civil engineering**	Degree :**B-Tech**
Course **:Surveying**	Course code**: CE233**
L-T-P**:0-0-3**	Credit**:2**

EXPERIMENT NO:	CONTENTS Any twelve experiments are mandatory	HOURS
1	**Introduction to conventional surveying** a. Chain surveying b. Compass surveying	**3**
2	**Levelling** Simple levelling	**3**
3	Differential levelling	**3**
4	fly levelling	**3**
5	contouring	**3**
6	**Theodolite surveying** Distance between accessible points (horizontal angle)	**3**
7	Distance between inaccessible points (horizontal angle)	**3**
8	Level difference between points (vertical angle)	**3**
9	Tangential tacheometry (vertical angle)	**3**
10	Height of building (vertical angle)	**3**
11	**Total station survey** Heights and distances	**3**
12	Area computation	**3**
13	Contouring	**3**
14	Downloading	**3**
15	Study of instruments a. Automatic level b. Digital level c. Handheld GPS	**3**

PREREQUISITE: Nil

COURSE OBJECTIVES:

1	To equip the students to undertake survey using tacheometer
2	To equip the students to undertake survey using total station
3	To impart awareness on distomat and handheld GPS

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

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

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	**3**							**1**	**2**						**2**	**1**
CO2	**3**			**1**				**1**	**2**					**3**		**1**
CO3	**3**			**1**				**1**	**2**					**3**		**1**
CO4	**3**			**1**	**3**			**1**	**2**			**2**		**1**		
CO5	**3**				**3**			**1**				**2**		**2**		

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	Apply the knowledgeof survey by the method of traverse
	PO8	**1**	Knowledge about use of chain and compass in field
	PO9	**2**	Function effectively as an individual, and as a member or leader in teams while doing open survey.
CO2	**PO1**	**3**	Apply the mathematical knowledge in computing the level difference by both rise and fall method and height of collimation method
	PO4	**1**	Getting knowledge about the contouring method and plotting the same
	PO8	**1**	Apply the knowledge of checking the values obtained in the field
	PO9	**2**	Function effectively as an individual, and as a member or leader in teams while doing levelling.
CO3	**PO1**	**3**	The student will get knowledge about how to deal with inaccessible points
	PO4	**1**	Applying basic mathematical knowledge for calculating the distance in the field
	PO8	**1**	Applying knowledge how to calculate the height of a building
	PO9	**2**	The student can apply basic mathematical concepts to solve field problems

	PO1	**3**	Knowledge about using the modern instrument to solve field problems
	PO4	**1**	The student will get an idea of getting data from sophisticated technologies
CO4	**PO5**	**3**	The student can apply modern technologies for solving field problems
	PO8	**1**	Getting aware about total station
	PO9	**2**	By using modern instruments like total station helps to use resection or method of coordinate for the measurement of area using a Total Station Instrument.
	PO12	**2**	Function effectively as an individual, and as a member or leader in teams while determining angles from theodolite by repetition method
CO5	**PO1**	**3**	The student will get an exposure to new instruments that can help them save time
	PO5	**3**	The student will get an overall idea about advantages and disadvantages of using these instruments
	PO8	**1**	Knowledge about different companies that produce these survey instruments
	PO12	**2**	Increase the enthusiasm to know different technologies ,especially advanced technology

CO-PSO MAPPING JUSTIFICATION:

CO's	PSO's	LEVEL	JUSTIFICATION
CO1	**PSO2**	**2**	The graduates of the program me are able understand the societal and safety factors involved while doing open traverse.
CO2	**PSO2**	**3**	Graduates will able to understand the environmental, societal and safety factors involved while doing leveling.
CO3	**PSO1**	**3**	The graduates of the program me are able understand the reiteration method
CO4	**PSO1**	**1**	The graduates of the program me are able understand the reiteration method
CO5	**PSO1**	**2**	The graduates of the program me are able understand the repetition method

MA201 PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS

COURSE INFORMATION SHEET:

Program:**Civil Engineering**	Degree :**B-Tech**
Course**: Partial Differential Equations And Complex Analysis**	Course code**: MA201**
L-T-P**:3-1-0**	Credit**:4**

SYLLABUS:

MODULE	CONTENT	HOURS	UNIVERSITY% MARKS
I	Partial differential equations, Formation of partial differential equations –elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equations, Equations solvable by direct integration, Linear equations of the first orderLagrange's linear equation, Non-linear equations of the first order -Charpit's method, Solution of equation by method of separation of variables.	8	20
II	One dimensional wave equation- vibrations of a stretched string, derivation, solution of the wave equation using method of separation of variables, D'Alembert's solution of the wave equation, One dimensional heat equation, derivation, solution of the heat equation	10	20
III	Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations, harmonic functions, finding harmonic conjugate, Conformal mappings- mappings $w = z^2$, , $w = e^z$,. Linear fractional transformation $w = \frac{1}{z}$, fixed points, Transformation $w = sinz$	9	20
IV	Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method-indefinite integration and substitution of limit, second evaluation method-use of a representation of a path, Contour integrals, Cauchy integral theorem (without proof) on simply connected domain,Cauchy integral theorem (without proof) on multiply connected domain Cauchy Integral formula (without proof), Cauchy Integral formula for derivatives of an analytic function, Taylor's series and Maclaurin series.,	9	20
V	Laurent's series(without proof), zeros of analytic functions, singularities, poles, removable singularities, essential singularities, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral using residue theorem, Residue integration of real integrals – integrals of rational functions of $cos\theta$ and $sin\theta$, integrals of improper integrals of the form $\int_{-\infty}^{\infty} f(x)\,dx$ with no	9	20

	poles on the real axis. $\int_A^B f(x)dx$ whose integrand become infinite at a point in the interval of integration is excluded from the syllabus),		

TEXT BOOKS:

1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.
2	Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2016

REFERENCES:

1	Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012

PREREQUISITE: A basic course in partial differentiation and complex numbers.

COURSE OBJECTIVES:

1	To impart an awareness on the principles of surveying, various methods and instruments of surveying, errors associated with field measurements and advanced surveying techniques.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Understand the concept and the solution of partial differential equation.
2	Analyze and solve one dimensional wave equation and heat equation
3	Understand complex functions, its continuity differentiability with the use of Cauchy-Riemann equations.
4	Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula; understand the series expansion of analytic function
5	Understand the series expansion of complex function about a singularity and Apply residue theorem to compute several kinds of real integrals.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1						2				
CO2	3	3	3	3	2	1						2				

CO3	**3**	**3**	**3**	**3**	**2**	**1**						**2**				
CO4	**3**	**3**	**3**	**3**	**2**	**1**						**2**				
CO5	**3**	**3**	**3**	**3**	**2**	**1**						**2**				

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	PO1	3	Using of P.D.E to solve various equations
	PO2	3	Using of PDE to solve problems
	PO3	3	The solutions for various engineering problems requires mathematical modelling
	PO4	3	Use of PDE can help to solve complex problems
	PO5	2	Using of P.D.E for modelling
	PO6	1	DE can model various daily life problems
	PO12	2	DE is a mathematical field which needs lot of research
CO2	PO1	3	Using PDE for solving boundary-value problems related to the diffusion of heat, waves etc.
	PO2	3	Use of wave and heat equations to solve problems
	PO3	3	PDE is used to mathematically formulate and thus aid the solution of physical and other problems involving functions of several variables such as propagation of heat or sound
	PO4	3	PDE can design various experiments
	PO5	2	In the field of acoustic, electromagnetic and fluid dynamics wave equations are used.
	PO6	1	For society we can use the P.D.E to solve problems
	PO12	2	DE is a mathematical field which needs lot of research
CO3	PO1	3	Fundamental knowledge in complex analysis will help to analyse engineering problems easily
	PO2	3	Basic knowledge in conformal mapping will help to model various problems in engineering fields
	PO3	3	Complex analysis helps in design and development of solution to complex problems
	PO4	3	Utilize the knowledge of mathematics to identify analytic functions and harmonic functions
	PO5	2	Design system components by Identifying conformal mappings and find regions that are mapped under certain transformation for engineering problems.
	PO6	1	Complex analysis may address various society related problems
	PO12	2	Complex analysis is a long field with great research opportunities
CO4	PO1	3	Complex integration will help to simplify problems with high complexity in Engineering
	PO2	3	The integral techniques are useful for many problems arising solid and fluid mechanics.
	PO3	3	Identify, formulate and analyze complex engineering and real life problems and provide eco-friendly and economical solutions by identifying different types of functions.
	PO4	3	Complex integration will help to design solutions to various complex engineering problems
	PO5	2	Complex integration helps in solving problems of various branches of engineering

	PO6	1	Complex analysis may address various society related problems
	PO12	2	Complex analysis is a long field with great research opportunities
CO5	PO1	3	Singularities and Series expansions will help to enrich the analysis of Engineering problems
	PO2	3	Utilize the knowledge of mathematics to evaluate real definite integrals as applications of residue theorem
	PO3	3	Singularities and Series expansions will help to design solutions to various complex engineering problems
	PO4	3	Use of residue theorem and series expansions to evaluate various complex problems
	PO5	2	Digital filters are designed by looking the locations of zeros and poles in the complex plane
	PO6	1	Complex analysis may address various society related problems
	PO12	2	Complex analysis is a long field with great research opportunities

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
CO1	**PO1**	**3**	Apply the knowledge of ,mathematics, science and engineering fundamentals and engineering specialization to the complex engineering problems
	PO2	**3**	Identify, formulate and analyze engineering problems using first principle of mathematics and engineering sciences
CO2	**PO1**	**3**	Apply the knowledge of ,mathematics, science and engineering fundamentals and engineering specialization to the complex engineering problems
	PO2	**3**	Identify, formulate and analyze engineering problems using first principle of mathematics and engineering sciences
CO3	**PO1**	**3**	Apply the knowledge of ,mathematics, science and engineering fundamentals and engineering specialization to the complex engineering problems
	PO2	**3**	Identify, formulate and analyze engineering problems using first principle of mathematics and engineering sciences
CO4	**PO1**	**3**	Apply the knowledge of ,mathematics, science and engineering fundamentals and engineering specialization to the complex engineering problems
	PO2	**3**	Identify, formulate and analyze engineering problems using first principle of mathematics and engineering sciences
	PO1	**3**	Apply the knowledge of ,mathematics, science and engineering fundamentals and engineering specialization to the complex engineering problems
CO5	**PO2**	**3**	Identify, formulate and analyze engineering problems using first principle of mathematics and engineering sciences
CO6	**PO1**	**3**	Apply the knowledge of ,mathematics, science and engineering fundamentals and engineering specialization to the complex engineering problems
	PO2	**3**	Identify, formulate and analyze engineering problems using first principle of mathematics and engineering sciences

EST200 DESIGN AND ENGINEERING

COURSE INFORMATION SHEET:

Program: **Civil Engineering**	Degree :**B-Tech**
Course**: Design And Engineering**	Course code**: EST200**
L-T-P**:3-1-0**	Credit**:4**

SYLLABUS

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Design Process:- Introduction to Design and Engineering Design, Defining a Design Process-:Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design	5	20
II	Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment.	5	20
III	Design Communication (Languages of Engineering Design):-Communicating Designs Graphically, Communicating Designs Orally and in Writing. Mathematical Modeling In Design, Prototyping and Proofing the Design.	5	20
IV	Design Engineering Concepts:-Project-based Learning and Problem-based Learning in Design. Modular Design and Life Cycle Design Approaches. Application of Biomimicryn, Aesthetics and Ergonomics in Design. Value Engineering, Concurrent Engineering, and Reverse Engineering in Design.	5	20
V	Expediency, Economics and Environment in Design Engineering:-Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design	5	20

TEXT BOOKS:

1	YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285
2	Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051

REFERENCES:

1	Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.

2	Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
3	Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
4	Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

PREREQUISITE: Nil

COURSE OBJECTIVES:

1	Introduce the undergraduate engineering students the fundamental principles of design engineering
2	make them understand the steps involved in the design process
3	Familiarize them with the basic tools used and approaches in design.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Explain the different concepts and principles involved in design engineering.
2	Apply design thinking while learning and practicing engineering
3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	**2**	**1**					**1**			**1**						
CO2		**2**				**1**		**1**				**2**				
CO3			**2**			**1**	**1**		**2**	**2**		**1**				

CO-PO MAPPING JUSTIFICATION:

CO's	PO's	LEVEL	JUSTIFICATION
C01	PO1	2	Students could use the knowledge to develop solutions for problems
	PO2	1	Understanding the concepts of design leads to Identify, formulate, research literature, and analyze engineering problems.
	PO7	1	Understanding of user centered design will be in the interest of sustainable development of society
	PO10	1	Appreciating the different concepts and principles involved in design engineering help to communicate effectively with the engineering community and with society at large.
CO2	PO2	2	Design thinking help to Identify, formulate, research literature, and analyze engineering problems to reach at relevant solutions
	PO6	1	Students will analyze design based on society, safety
	PO8	1	Students will understand ethical principles and commit to professional ethics and responsibilities of the engineering practice.
	PO12	2	Analyze and improvise the designs around them on their own and keep up the process to full extent
CO3	PO3	2	Students will be able to come up with different design solutions for complex engineering problems
	PO6	1	Students will analyze design based on society, safety
	PO7	1	Understandings of user centered design will be in the interest of sustainable development of society
	PO9	2	Students will appreciate the teamwork including the multidisciplinary settings.
	PO10	2	Students will be able to communicate effectively with the engineering community, able to comprehend and write effective reports, make effective presentations, and give and receive clear instructions.
	PO12	1	Study the designs around them on their own and keep up the process to full extent

MCN201 SUSTAINABLE ENGINEERING

COURSE INFORMATION SHEET:

Program: **Civil Engineering**	Degree :**B-Tech**
Course**: Sustainable Engineering**	Course code**: MCN201**
L-T-P**:2-0-0**	Credit**: Nil**

SYLLABUS

MODULE	CONTENT	HOURS	UNIVERSITY % MARKS
I	Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM)	5	20
II	Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection	6	20
III	Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.	6	20
IV	Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy	4	20
V	Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.	4	20

TEXT BOOKS:

1	Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport

REFERENCES:

1	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall
2	Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
3	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
5	ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
6	Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
7	Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS)
8	Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

PREREQUISITE: Nil

COURSE OBJECTIVES:

1	Introduce the undergraduate engineering students the fundamental principles of design engineering,
2	Make them understand the steps involved in the design process
3	Familiarize them with the basic tools used and approaches in design.

COURSE OUTCOMES:

After successful completion of the course, the students should be able to:

CO's	DESCRIPTION
1	Understand the relevance and the concept of sustainability and the global initiatives in this direction
2	Explain the different types of environmental pollution problems and their sustainable solutions
3	Discuss the environmental regulations and standards
4	Outline the concepts related to conventional and non-conventional energy
5	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1						**2**	**3**									
CO2						**2**	**3**									
CO3						**2**	**3**									
CO4						**2**	**3**									
CO5						**2**	**3**									

CO-PO MAPPING JUSTIFICATION

C01	PO6	2	Fundamental awareness about the concept and importance of sustainability is essential for the existence in future world
	PO7	3	The basic knowledge in sustainability helps to identify and analyze the impact caused to the environment by human activities
	PO12	2	Awareness about concept and importance of sustainability and the impact caused to the environment by human activities develops a strong desire in students for lifelong learning in the broadest context of technological change.
CO2	PO6	2	The study of zero waste and 3R waste concepts helps to assess societal, health, safety, legal and cultural issues
	PO7	3	Learning the basic concepts about types, causes and effects of pollution in sustainability helps to identify and analyze the environmental issues and derive solutions for the same
	PO12	2	Study of environmental pollution problems and its effect on environment develops keenness in students for lifelong learning in the broadest context of technological change.
CO3	PO6	2	Fundamental knowledge about Environmental Impact Assessment creates an awareness about various engineering applications in environmental management
	PO7	3	LCA and EIA study helps the students to understand impact of the engineering solutions in minimizing the environmental pollution to a greater extent
	PO12	2	Study of importance of ISO standards in environment management develops a thirst in students for lifelong learning in the broadest context of technological change.
CO4	PO6	2	Idea about conventional and nonconventional energy sources helps to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

	PO7	3	Basic knowledge of various types of conventional and nonconventional energy sources helps to understand the impact of the professional engineering solutions in societal and environmental contexts.
	PO12	2	Understanding importance of nonconventional energy sources develops a desire in students for lifelong learning in the broadest context of technological change.
CO5	PO6	2	Basic sustainability principles help in understanding the importance of role that sustainability plays in the future existence of society
	PO7	3	Study of sustainable buildings, cities and transportation helps to Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
	PO12	2	Study of importance of sustainable habitat develops a desire in students for lifelong learning in the broadest context of technological change.