E.G.S.PILLAY ENGINEERING COLLEGE

(Autonomous)

NAGAPATTINAM – 611002.

(Affiliated to Anna University, Chennai| Accredited by NAAC with „A++"Grade
Accredited by NBA| Approved by AICTE, New Delhi)

REGULATION-2023
B.E CIVIL ENGINEERING

Full Time Curriculum and Syllabus

Second Year – Fourth Semester

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	C	MAX.MARKS		
							CA	ES	TOTAL
Theory Courses									
2302CE401	Mechanics of Solids-II	PCC	3	0	0	3	40	60	100
2302CE402	Applied Hydraulic Machinery	PCC	3	0	0	3	40	60	100
2302CE403	Concrete Technology	PCC	3	0	0	3	40	60	100
2302CE404	Geotechnical Engineering-I	PCC	3	0	0	3	40	60	100
2302CE405	Environmental Engineering	PCC	3	0	0	3	40	60	100
2301HSX01	Universal Human Values and Ethics	HSMC	3	0	0	3	40	60	100
2301MC409	Sustainable Development Goals (SDGs) for Engineers (MC -1)	MC	3	0	0	0	100	0	100
Laboratory Courses									
2302CE451	Hydraulic Machineries Laboratory	PCC	0	0	2	1	60	40	100
2302CE452	Environmental Engineering Laboratory	PCC	0	0	2	1	60	40	100
2302CE453	Computer Aided Civil Engineering Drawing Laboratory	PCC	0	0	2	1	60	40	100
2304GE451	Professional Development Course - II	ECC	0	0	2	1	100	0	100
TOTAL			**21**	**0**	**8**	**22**	**620**	**480**	**1100**

2301CE401	MECHANICS OF SOLIDS II	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Mechanics of solids I

COURSE OBJECTIVES:

1. To impart knowledge on Energy principles, stress, Strain and deformation of solids with applications to beams, cylinders and unsymmetrical sections.
2. To acquire the ability to analyze the mechanism of load transfer in columns.
3. To develop the clear understanding of the shear force and bending moment in indeterminate beams.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Determine the deflection of beams and frames using energy theorems.
CO2:	Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
CO3:	Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements.
CO4:	Compute the load carrying capacity of columns.
CO5:	Compute the load carrying capacity of thin cylinder.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	2	-
CO3	-	2	-
CO4	-	2	-
CO5	-	2	-

COURSE CONTENTS:

MODULE I	ENERGY PRINCIPLES	9 Hours

Principle of virtual work – unit load method – Application of energy theorems for computing deflections in determinate beams, plane frames and plane trusses – lack of fit and temperature effects – Williot Mohr's Diagram.		
MODULE II	**DEFLECTION OF BEAMS**	**9 Hours**
Double Integration method – Macaulay's method – Area moment method – Conjugate beam method - Strain energy method for determinate beams.		
MODULE III	**INDETERMINATE BEAMS**	**9 Hours**
Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.		
MODULE IV	**COLUMNS**	**9 Hours**
Columns: Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine Gordon formula for eccentrically loaded columns – middle third rule – core section		
MODULE V	**SYNCHRONOUS MOTOR DRIVE**	**9 Hours**
V/f and self-control of synchronous motor drive; Margin angle control and Power factor control; VSI and CSI fed synchronous motor drive; Permanent magnet synchronous motor - Construction, Types, BLPM DC motor and BLPM AC motor.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.*
2. *William A .Nash, "Theory and Problems of Strength of Materials", Schaum"s Outline Series, Tata McGraw Hill Publishing company, 2010.*
3. *Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.*
4. *PunmiaB.C."Theory of Structures" (SMTS) Vol 1&II, Laxmi Publishing Pvt Ltd, New Delhi 2018.*
5. *Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016.*
6. *Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2016.*
7. *https://nptel.ac.in/courses/112107146*
8. *https://easyengineering.net/ce6402-strength-of-materials-som_14/*
9. *https://karthikacivil.weebly.com/strength-of-materials.html*

2302CE402	APPLIED HYDRAULIC MACHINERY	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Fluid mechanics and machines

COURSE OBJECTIVES:

1. To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow.
2. To expose them to basic principles of working of hydraulic machineries.
3. To design pelton wheel, francis and kaplan turbine, centrifugal and reciprocating pumps.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Describe the basics of open channel flow, classifications and analysis of uniform flow in steady state conditions with specific energy concept and its application
CO2:	Analyze steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.
CO3:	Derive the relationship among the sequent depths of steady, rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
CO4:	Design and compute the efficiency and performance of turbines.
CO5:	Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	1	-
CO2	-	1	-
CO3	-	1	-
CO4	-	1	-
CO5	-	1	-

COURSE CONTENTS:

MODULE I	**UNIFORM FLOW**	**10 Hours**
Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of Open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow – Velocity distribution in open channel - Steady uniform flow: Chezy's equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.		
MODULE II	**VARIED FLOWS**	**9 Hours**
Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Change in Grades.		
MODULE III	**RAPIDLY VARIED FLOWS**	**8 Hours**
Application of the momentum equation for RVF - Hydraulic jumps -Types -Energy dissipation –Positive and Negative surges.		
MODULE IV	**TURBINES**	**9 Hours**
Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed-Minimum Speed to start the pump.		
MODULE V	**PUMPS**	**9 Hours**
Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work done.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.*
2. *Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.*
3. *Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019*
4. *Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.*

2302CE403	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Construction Materials and Technology.

COURSE OBJECTIVES:

1. To study the properties of concrete materials.
2. To learn about the knowledge of chemical and mineral admixtures in concrete.
3. To familiarize with the IS method of mix design as per the latest code.
4. To understand the fresh and hardened properties of concrete.
5. To know the importance and applications of special concretes.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Explain the dynamics of motor load system and types of loads along with their characteristics.
CO2:	Determine speed, current, voltage and torque of a rectifier / chopper fed DC drive in all four quadrants.
CO3:	Calculate the performance parameters of induction motor drives with appropriate power electronics converter in motoring and braking modes.
CO4:	Discuss about speed control techniques of VSI, CSI and cycloconverter fed synchronous motor drives.
CO5:	Design a speed and current controller for a closed loop drive system.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2	3	-
CO2	2	3	-
CO3	2	3	-
CO4	2	3	-
CO5	2	3	-

COURSE CONTENTS:

MODULE I	**CONSTITUENT MATERIALS**	**9 Hours**
Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications-Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements-Water- Quality of water for use in concrete.		
MODULE II	**CHEMICAL AND MINERAL ADMIXTURES**	**9 Hours**
Accelerators-Retarders- Plasticizers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline-Their effects on concrete properties		
MODULE III	**PROPORTIONING OF CONCRETE MIX**	**9 Hours**
Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples.		
MODULE IV	**FRESH AND HARDENED PROPERTIES OF CONCRETE**	**9 Hours**
Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.		
MODULE V	**SPECIAL CONCRETES**	**8 Hours**
Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferro cement - Ready mix concrete - SIFCON - Shotcrete – Polymer concrete - High performance concrete- self compacting concrete - Geopolymer Concrete.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Neville, A.M., "Properties of Concrete", Pitman Publishing Limited, London, 2011..*
2. *Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Co., New Delhi, 2004*
3. *Neville, A.M. and Brooks J.J., "Concrete Technology", Pearson Education, Indian Reprint, 2002.*
4. *IS: 269 – 1989, Specification for Ordinary Portland cement 33 Grade (Fourth Revision), 1998.*
5. *IS: 2386 (Part I to VIII) – 1963, Method of Tests for Aggregate for Concrete, Bureau of Indian Standards, New Delhi.*
6. *IS: 383 – 1970, Specification for Course and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi*
7. *IS: 516 – 1959, Method of Tests for Strength of Concrete, Bureau of Indian Standards, New Delhi.*
8. *IS: 10262 – 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.*
9. *ACI Committee 211.1,91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, ACI Manual of Concrete Practice Part 1, 1991, American Concrete Institute, Detroit.*

2302CE404	GEOTECHNICAL ENGINEERING - I	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Engineering Geology.
2. Mechanics of Fluids.

COURSE OBJECTIVES:

1. To understand the soil classification system and physical properties of soil.
2. To familiarize with the engineering properties of soils- compressibility, shear strength, and permeability.
3. To calculate the stress distribution and Shear Strength of soil.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Explain the three-phase system of soil and their relationship
CO2:	Calculate the permeability and effective stresses in the soil
CO3:	Determine the stress distribution and compaction of the soil
CO4:	Compute consolidation of the soil
CO5:	Determine the shear strength of the soil

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-

COURSE CONTENTS:

MODULE I	**SOIL CLASSIFICATION AND INDEX PROPERTIES**	**9Hours**

Soil formation – soil minerals – soil structure - three phase system – definitions- interrelationships – Index properties - IS soil classification – sol deposits in India.

MODULE II	**PERMEABILITY AND EFFECTIVE STRESSES**	**9 Hours**

Soil hydraulics: soil water – capillary phenomenon – geostatic stress - neutral and effective stress- permeability – Darcy's Law- field and laboratory test - seepage and flow nets.		
MODULE III	**STRESS DISTRIBUTION AND COMPACTION**	**9 Hours**
Stress Analysis- Stress due to concentrated load, due to uniformly loaded area, line load strip load- pressure distribution diagrams - contact stress - Westergarrd's analysis- Compaction – laboratory tests – field compaction.		
MODULE IV	**CONSOLIDATION**	**9 Hours**
One-dimension consolidation - consolidation process - consolidation theory – laboratory test – pre consolidation pressure – total settlement and time rate of settlement-curve fitting methods.		
MODULE V	**SHEAR STRENGTH**	**9 Hours**
Shear strength- Mohr – coulomb theory – shear strength parameter – direct shear, triaxial, and UCC tests – drainage conditions- pore pressure parameters – stress path – in situ shear strength - factors affecting shear strength - shearing characteristics of sand and clay.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Bowles,J.E., Physical and Geotechnical Properties of Soils, McGraw Hill, 1998.*
2. *Venkataramiah. C., Geo Technical Engineering, NAIP, 2002.*
3. *https://archive.nptel.ac.in/courses/105/105/105105168/.*
4. *Advanced Soil Mechanics - Course (nptel.ac.in).*
5. *https://civilenggforall.com/soil-mechanics-civil-engineering-gate-2020-study-material-free-download-pdf-civilenggforall/.*

2302EC405	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Fluid Mechanics.
2. Water Technology and Green Chemistry.
3. Environmental science and sustainability.

COURSE OBJECTIVES:

1. To introduce the components and design of conveyance system.
2. To create an ability to design and adopt the required water treatment system.
3. To train the students to analyze water distribution system and supply to buildings.
4. To understand the importance of planning and design of sewerage system.
5. To impart the signification of disposal of Sewage.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Outline the requirements for the conveyance of water.
CO2:	Select and design the conventional and advanced treatment units for the treatment of water
CO3:	Analyze the water distribution network and extend to the individual buildings
CO4:	Build a sewerage system by flow estimation and designing suitable size of sewers
CO5:	Design the components of wastewater treatment facilities for proper disposal.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-

COURSE CONTENTS:

MODULE I	WATER SUPPLY – SOURCE AND CONVEYANCE	9 Hours

Predicting demand for water – Sources of water – Source selection – Water quality – Standards for potable water – Intake structures – Pipes: Materials, Laying, Jointing, Testing – Pump selection.

MODULE II	WATER TREATMENT	9 Hours

Objectives – Selection of unit operations and processes – Principles of Screening, flocculation, sedimentation, filtration – Design principles of flash mixer, clariflocculator, settling tanks, sand filters – Disinfection – Softening – Desalination – Aeration – Iron and Manganese removal – Defluoridation – Residue management.		
MODULE III	**WATER DISTRIBUTION**	**9 Hours**
Requirements of water distribution – Storage and balancing reservoirs – Distribution Layouts - pipe appurtenances – Hydraulics – Analysis of distribution networks – operation and maintenance – Leak detection – House service connection.		
MODULE IV	**SEWERAGE SYSTEM – COLLECTION AND TRANSMISSION**	**9 Hours**
Sources and characteristics of sewage – Sanitary sewage flow estimation – Sewer materials, types, shape – Hydraulics of flow in sanitary sewers – Sewer design – Storm runoff estimation – Sewer appurtenances – Plumbing systems for drainage.		
MODULE V	**SEWAGE TREATMENT AND DISPOSAL**	**9 Hours**
Objectives – Selection of Treatment Methods – Septic tanks with soak pits – Activated Sludge Process and Extended aeration systems – Trickling filters – Sequencing Batch Reactor (SBR) – UASB – Waste Stabilization Ponds – Recent Advances in Sewage Treatment – Discharge standards – Sludge treatment – Disposal of sludge.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2003.*
2. *Metcalf and Eddy – Wastewater Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2010.*
3. *Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1997.*
4. *Garg, S.K., "Environmental Engineering", Vol.1 Khanna Publishers, New Delhi, 2005.*
5. *Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.*
6. *Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2005*

2301HSX01	UNIVERSAL HUMAN VALUES AND ETHICS	L	T	P	C
		1	0	2	2

PREREQUISITE:

1. Professional Ethics.

COURSE OBJECTIVES:

1. Reinstate India's rich cultural legacy and human values of which we are the custodians.
2. Focus on professional ethics, which help citizens to discern desirable and undesirable actions.
3. Re-emphasize constitutional values, universal values, and holistic education to create integrated citizens.
4. Lay down broader guidelines of human values and ethics for internal and external stakeholders.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Apply critical thinking skills to solve problems and make informed decisions in various contexts.
CO2:	Analyze the principles of effective governance and evaluate their implementation in different scenarios.
CO3:	Create innovative strategies for improving institutional management and evaluate their potential impact.
CO4:	Understand the importance of a fair and transparent system of rewards and reprimand and apply these principles in real-world situations.
CO5:	Evaluate the effectiveness of institutional policies in promoting human rights and create strategies to address ethical dilemmas.
CO6:	Analyze the role of community engagement in promoting social justice and create initiatives to empower marginalized groups.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-

CO4	-	-	-	
CO5	-	-	-	
CO6	-	-	-	

COURSE CONTENTS:

MODULE I	**INTRODUCTION TO INDIAN ETHOS**	**8 Hours**

Meaning of ethos and cultural essence of India – Scriptures as the base of the Indian Knowledge System (IKS) – Integrating the two methodologies: interiorization process for self-exploration, and exterior scientific pursuit for the prosperity of world – The Law of Karma and Nishkama Karma (The Law of action and selfless action).

Practical: Five hours of Yoga practice per week, Ethics through Music and Indian Poetry, Community Engagement.

MODULE II	**HUMAN VALUES AND ETHICS**	**9 Hours**

Knowing the Self and the universal values that we stand for - This is self-enquiry & self-discovery – Background conversations and deep listening - recognizing the assumptions that we make - the biases we have - and the implications for ethical action – Self-identity: distinguishing and embracing oneself (and others) four profiles (inner-potential, social, professional, personality) – Distinguish ideology, perspectives beliefs from embodying values.

Practical: Self-discovery, self-enquiry and Mindfulness, Yama & Niyama of Ashthang Yoga.

MODULE III	**CONSTITUTIONAL VALUES AND GLOBAL CITIZENSHIP**	**9 Hours**

Values embedded in the Preamble of the Indian Constitution Integration of Human Rights and duties – Directive principles and responsibilities as citizens of India – Sensibility and responsibilities towards global environment, Loksangraha and Vasudhaiva Kutumbakam.

Practical: Debates and Theatre on diversity and plurality, research on similarities and differences in the ethos of different countries

MODULE IV	**VALUES AND SKILLS FOR YOUTH**	**9 Hours**

Designing to make a difference through strategies using the Conscious Full Spectrum Response model – Listening for commitment behind complaints to transform contentious arguments and create a space for listening and change – Distinguishing judgement from discernment – Being assertive and confident (assertiveness incorporates self-confidence).

Practical : Development of concentration among students through music, fine arts, mathematics, sports, yoga and mindfulness.

MODULE V	**INTEGRATED PERSONALITY AND WELL-BEING**	**10 Hours**

The three gunas (qualities of sattva—purity and harmony, rajas —activity and passion, tamas —darkness and chaos), the four antah-karanas (inner instruments), and panchkosha (five sheaths) – Stress management: meditated personality and agitated personality – Oneness, non-duality, and equanimity – Physical, mental, social, and spiritual well-being.

Practical : Talks on importance of the Ayurvedic concept of wellbeing and nutrition, sports activities

TOTAL: 45 HOURS

REFERENCES:

1. Blanchard, Kenneth and Peale, Norman Vincent. 1988. The Power of Ethical Management. New York: William Morrow and Company, Inc.

2. Gandhi, Mohandas Karamchand. 1971. Pathway to God compiled by MS Deshpande. Ahmedabad: Navajivan Mudranalaya, Navjivan Trust.

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php

2301MC409	SUSTAINABLE DEVELOPMENT GOALS (SDGS) FOR ENGINEERS	L	T	P	C
		3	0	0	0

PREREQUISITE:

1. This course assumes no prior background in sustainable development, environmental studies, or related fields. It covers the fundamental principles of sustainability and the Sustainable Development Goals (SDGs) from the ground up, including the role of engineers in sustainable practices. The course is designed to be accessible to all engineering students, providing the necessary context and foundational knowledge for understanding and applying sustainable engineering.

COURSE OBJECTIVES:

1. Understand the principles of sustainable development and the role of engineers in achieving the United Nations Sustainable Development Goals (SDGs).
2. Analyze the environmental, social, and economic dimensions of sustainability and their interconnections.
3. Apply sustainable design principles and methodologies to develop innovative engineering solutions.
4. Evaluate the environmental and social impacts of engineering projects and propose improvements.
5. Communicate effectively on sustainability challenges and advocate for actionable solutions.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to

CO1:	**Understand** the principles and concepts of sustainable development and the role of engineers in achieving the SDGs
CO2:	**Analyze** the environmental, social, and economic dimensions of sustainability and their interconnections.
CO3:	**Apply** sustainable design principles and methodologies to engineering projects.
CO4:	**Evaluate** the environmental and social impacts of engineering solutions.
CO5:	**Communicate** effectively on sustainable development issues and propose innovative solutions.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

COURSE CONTENTS:

MODULE I	**INTRODUCTION TO SUSTAINABLE DEVELOPMENT**	**6 Hours**

Concepts of Sustainability

- Definition of sustainability.
- Historical context of sustainable development.
- The triple bottom line (economic, environmental, social)
- Sustainable development goals (SDGs) and their interconnections.

Role of Engineers in Sustainable Development

- Ethical considerations in engineering.
- Engineering for a sustainable future.
- Case studies of successful engineering projects that address SDGs

MODULE II	**ENVIRONMENTAL SUSTAINABILITY**	**12 Hours**

Climate Change and Its Impacts

- Causes and effects of climate change.
- Mitigation strategies (renewable energy, energy efficiency)
- Adaptation measures (disaster preparedness, sustainable infrastructure)

Resource Management and Conservation

- Water scarcity and management.
- Waste management and circular economy.

Sustainable materials and resource efficiency.

MODULE III	**SOCIAL SUSTAINABILITY**	**9 Hours**

Poverty and Inequality

- Global poverty and inequality trends.
- Social justice and equity in engineering projects.
- Community engagement and development initiatives.

Health and Well-being

- Sustainable healthcare and public health.
- Occupational health and safety.
- Inclusive design and accessibility.

MODULE IV	**ECONOMIC SUSTAINABILITY**	**9 Hours**

Sustainable Economic Growth

- Green economy and sustainable business practices.
- Sustainable finance and investment.
- Circular economy and resource efficiency.

Sustainable Infrastructure and Urban Development

- Smart cities and sustainable urban planning.
- Sustainable transportation and mobility.
- Sustainable housing and community development.

MODULE V	**ENGINEERING FOR SUSTAINABILITY**	**9 Hours**

Sustainable Design Principles

- Life cycle assessment (LCA)
- Cradle-to-cradle design.
- Sustainable materials and technologies.

Case Studies and Projects

- Group projects on developing sustainable solutions to local challenges.
- Presentation and evaluation of student projects.

TOTAL: 45 HOURS

REFERENCES:

1. M.P. Poonia and S.C. Sharma, Environmental Studies, Khanna Publishing, 2017.

2. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 2016.

3. G. N. Tiwari and Rajeev Singh, Fundamentals of Renewable Energy Resources, Narosa Publishing, 2016.

4. Rangaswamy Rajagopal, Sustainable Urban Planning in India, Springer, 2021.

2302CE451	HYDRAULIC MACHINERY LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Fluid mechanics-1 and applied hydraulic machinery.

COURSE OBJECTIVES:

1. To acquire knowledge about properties of fluid.
2. To understand knowledge about the losses in pipes.
3. To understand knowledge about the characteristics of pumps and turbines.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Measure the flow properties of fluid.
CO2:	Conduct the experiment to find the losses in flow through pipes.
CO3:	Conduct experiment to find characteristics curves of various pumps.
CO4:	Ccnduct experiment to find characteristics curves of various turbines.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-

LIST OF EXPERIMENTS:

1. Calibration of Rotometer.
2. Flow through Venturimeter Orifice meter.
3. Flowthrough variable ductarea -Bernoulli‟s Experiment.
4. Flow through Orifice, Mouthpiece and Notches.
5. Determination of friction coefficient in pipes.
6. Determination of loss coefficients for pipe fittings.
7. Characteristics of Centrifugal pumps.
8. Characteristics of Gear pump.
9. Characteristics of Submersible pump.
10. Characteristics of Reciprocating pump.

11. Characteristics of Pelton wheel turbine.
12. Characteristics of Francis turbine.
13. Characteristics of Kaplan turbine.
ADDITIONAL EXPERIMENTS:
1. Characteristics of multi stage Centrifugal pumps.
2. Characteristics of jet on vane.
TOTAL: 30 HOURS
REFERENCES:
1. Sarbjit Singh. "Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning
2. Private Limited, Delhi,2009.
3. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
4. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
5. Subramanya K. "Flow in open channels", Tata McGraw Hill Publishing. Company, 2001
6. Fluid Mechanics and Machinery Lab Manual – E.Venkatesan,, EGSPEC-2022

2302CE452	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Water Technology and Green Chemistry.
2. Environmental Engineering.

COURSE OBJECTIVES:

1. To know the basics, importance of water and wastewater parameters measurement.
2. To know about the calibration and handling of the equipment.
3. To beware of the procedure for quantifying quality parameters for water and wastewater.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Choose the accurate method for calibration and standardization of the equipment.
CO2:	Utilize the proper sample collection procedure for analysis.
CO3:	Select the suitable method for preserving the samples.
CO4:	Examine the collected water and wastewater for various parameters.
CO5:	Inference the result of the sample analysis to suggest the appropriate treatment method.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

LIST OF EXPERIMENTS:

1. Sampling and preservation methods for water and wastewater (Demonstration only).
2. Measurement of pH, Electrical conductivity, and turbidity.
3. Determination of Calcium, Potassium and Sodium.
4. Determination of Phosphate and Sulphate.
5. Determination of Optimum Coagulant Dosage by Jar test apparatus.
6. Determination of available Chlorine in Bleaching powder and residual chlorine in water.

7. Determination of Ammonia Nitrogen.
8. Estimation of suspended volatile and fixed solids.
9. Determination of Dissolved Oxygen.
10. Estimation of B.O.D.
11. Estimation of C.O. D.
12. Determination of total and fecal coliform (Demonstration only).
TOTAL: 45 HOURS
REFERENCES:
1. APHA, "Standard Methods for the Examination of Water and Wastewater", 22nd Ed. Washington, 2012.
2. "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist, H. – Second Edition, VCH, Germany, 3rd Edition, 1999.
3. "Methods of air sampling & analysis", James P. Lodge Jr (Editor) 3rd Edition, Lewis publishers, Inc, USA, 1989.

2302CE453	COMPUTER AIDED CIVIL ENGINEERING DRAWING LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Engineering graphics.

COURSE OBJECTIVES:

1. To impart knowledge and skill relevant to building drawing and detailing lab using computer software.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Draft the plan, elevation and sectional view of the load bearing and framed buildings.
CO2:	Draw the structural detailing of RCC elements.
CO3:	Draw the structural detailing of RCC water tanks, footings and retaining wall.
CO4:	Draw the structural detailing of steel structure.
CO5:	Draft the structural detailing of Industrial structures.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	3	2	-
CO4	3	2	-
CO5	3	2	-

LIST OF EXPERIMENTS:

1. Principles of planning and orientation.
2. Buildings with load bearing walls and RCC roof (Plan , section , elevation)
3. Buildings with sloping roof.
4. Buildings with Framed structures.
5. Building information modeling.
6. Reinforcement details of RCC structural elements (slab, beam and column)
7. Reinforcement details of footings (Isolated, stepped, combined footing)
8. Steel structures (Steel Connections detailing, beam to column connection, beam to beam

connection – bolt & Weld, Roof truss & purlin)
TOTAL: 30 HOURS
REFERENCES:
1. *V.B.Sikka, "A course in Civil Engineering Drawing" S.K.Kataria & Sons Publishers, Seventh Edition, 2015.*
2. *D.N.Ghose,"Civil Engineering Drawing and Design" CBS Publishers & Distributors Pvt.Ltd., 2nd Edition, 2010.*
3. *National Building Code of India 2016 (NBC 2016)*
4. *Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.*
5. *Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016.*