PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637018
(AUTONOMOUS)
B.E. - CIVIL ENGINEERING
REGULATIONS 2023
CURRICULUM

SEMESTER III

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23301	Transform Techniques and Partial Differential Equations	3	1	0	4
2	ES	CE23301	Strength of Materials	3	0	0	3
3	PC	CE23302	Fluid Mechanics	3	0	0	3
4	PC	CE23303	Surveying	3	0	0	3
5	MC	MC23302	Human Values and Gender Equality	2	0	0	0
Theory With Practical							
6	PC	CE23304	Construction Materials and Techniques	3	0	2	4
Practical							
7	PC	CE23305	Surveying Laboratory	0	0	4	2
8	PC	CE23306	Strength of Materials Laboratory	0	0	4	2
9	EE	GE23301	Professional Development I	0	0	2	1
			TOTAL	**17**	**1**	**12**	**22**

SEMESTER IV

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23401	Statistics and Numerical Methods	3	1	0	4
2	PC	CE23401	Concrete Technology	3	0	0	3
3	PC	CE23402	Applied Hydraulic Engineering	3	0	0	3
4	PC	CE23403	Water Supply and Waste Water Engineering	3	0	0	3
5	MC	MC23401	Environmental Sciences and Sustainability	2	0	0	0
Theory With Practical							
6	PC	CE23404	Soil Mechanics	3	0	2	4
Practical							
7	PC	CE23405	Water and Waste Water Analysis Laboratory	0	0	4	2
8	PC	CE23406	Hydraulic Engineering Laboratory	0	0	4	2
9	EE	GE23401	Professional Development II	0	0	2	1
			TOTAL	**17**	**1**	**12**	**22**

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Civil Engineering
3/5/24
AUTONOMOUS

MA23301	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4

(Common to Aero, Agri, BME, Biotech, Civil, Chemical, EEE, Food, Pharma, Mech, MCT, R&A)

COURSE OBJECTIVES

To enable the students to

1.	develop the knowledge of periodic and non-periodic functions and their representations using fourier series.
2.	acquaint the student with Fourier transform techniques used in wide variety of situations.
3.	introduce the basic concepts of PDE for solving standard partial differential equations.
4.	acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
5.	develop Z transform techniques for discrete time systems.

UNIT I	FOURIER SERIES	12

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Statement of Complex form of Fourier Series; Parseval's identity; Harmonic Analysis.

UNIT II	FOURIER TRANSFORMS	12

Fourier integral theorem (without proof); Fourier transform pair; Sine and Cosine transform - Properties; Transforms of elementary functions; Convolution theorem; Parseval's identity.

UNIT III	PARTIAL DIFFERENTIAL EQUATIONS	12

Formation of partial differential equations; Lagrange's linear equation; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV	FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS	12

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V	Z -TRANSFORMS AND DIFFERENCE EQUATIONS	12

Z-transforms - Elementary properties; Inverse Z-transform; Method of partial fraction; Residue method; Convolution theorem; Solution of difference equations by Z-transform.

	TOTAL PERIODS	60

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	classify the properties of periodic and non-periodic vibrations with the help of fourier series.	Applying (K3)
CO2	apply the fourier transform to convert the function from frequency domain to time domain.	Applying (K3)

CO3	demonstrate partial differential equations that occur in many engineering applications.	Applying (K3)
CO4	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	Applying (K3)
CO5	apply knowledge of Z transform to analyse linear time invariant systems.	Applying (K3)

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, (2018).

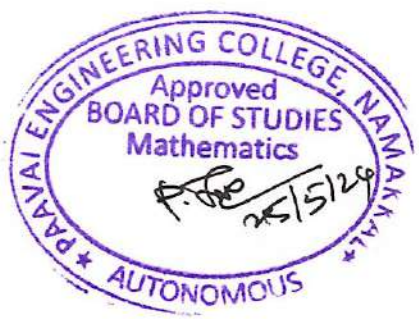
REFERENCES

1. Erwin Kreyszig , "Advanced Engineering Mathematics ", 10th Edition, Wiley Publications, New Delhi, India, 2016.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, New Delhi (2010).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, 6th Edition, New Delhi, 2012.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes
(3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak

COs	Programmes Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	2	2
CO2	2	3	3	2	-	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO5	2	3	2	2	-	-	-	-	-	-	-	2	2	1



CE23301	STRENGTH OF MATERIALS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	learn the fundamental concepts of stress in simple and complex states.
2	know the mechanism of load transfer in beams and the induced stresses due to simple bending and unsymmetrical bending.
3	determine the deformation in determinate beams.
4	examine the basic concepts of indeterminate beams.
5	realize the concepts of unsymmetrical bending of beams, shear centre, thick cylinders and its application.

Prerequisite: Engineering Mechanics

UNIT I	SIMPLE AND COMPOUND STRESSES	9

Stresses in simple and compound bars - Thermal stresses, Elastic constants; Biaxial state of stress - Principal stresses and principal planes, Mohr's circle of stresses; Torsion on circular shafts; Thin cylindrical and spherical shells

UNIT II	BENDING OF BEAMS	9

Beams and Bending - Types of loads, supports, Types of beams and transverse loadings - Shear force and bending moment for simply supported, Cantilever and Over-hanging beams; Theory of simple bending - Bending stress distribution, Shear stress distribution.

UNIT III	DEFLECTION OF BEAMS	9

Double Integration method - Macaulay's method and Area moment method; Conjugate beam method; Strain energy method for determinate beams.

UNIT IV	INDETERMINATE BEAMS	9

Propped Cantilever and Fixed Beam - Fixed end moments reactions, slope and deflection for standard cases of loading; Continuous beams - support reactions and moments; Theorem of three moments - Shear Force and Bending Moment diagrams.

UNIT V	ADVANCED TOPICS	9

Unsymmetrical bending of beams - shear centre; Thick cylinders; Theories of failure - Principal stress, principal strain, shear stress, strain energy and distortion energy theories, application problems.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain the concepts of stress and strain, principal stresses and principal planes.	Understanding (K2)

CO2	determine shear force and bending moment in beams and understand concept of theory of simple bending.	Applying (K3)
CO3	calculate the deflection of beams by different methods and selection of method for determining slope or deflection.	Applying (K3)
CO4	analyze propped cantilever, fixed beams and continuous beams for external loadings.	Analyzing (K4)
CO5	determine the stresses due to unsymmetrical bending of beams, locate the shear center and study the various theories of failure.	Applying (K3)

TEXT BOOKS

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", Chand & company Ltd., New Delhi, 2019.
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures" (SMTS) Vol -II, Laxmi Publishing Pvt.Ltd, New Delhi 2017.

REFERENCES

1. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., NewDelhi, 2012.
2. Ramamrutham.R. "Strength of Materials", 18th Edition, Dhanpat Rai Publishing company, 2014.
3. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016.
4. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	2

CE23302	FLUID MECHANICS	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	understand the fundamental dimensions and derived units used in fluid mechanics and concepts of fluid hydrostatics.
2	understand the concept of total pressure exerted by a fluid on different types of surfaces.
3	classify fluid flow based on characteristics such as velocity profiles, turbulence and Reynolds number.
4	understand the conditions under which boundary layer separation occurs.
5	learn about geometric, kinematic and dynamic similarity in model analysis.

UNIT I	FLUID PROPERTIES, FLUID PRESSURE AND ITS MEASUREMENT	9

Dimensions and units; Fluid properties; Types of fluids; Hydrostatic law - Pascal's law, Atmospheric, Absolute, Gauge and Vacuum pressures - Measurement of pressure by various types of manometers and mechanical gauges.

UNIT II	FLUID STATICS, BUOYANCY AND FLOATATION	9

Total pressure on plane and curved surfaces, Centre of pressure for vertical and inclined plane surfaces: Buoyancy and Meta-centre - Determination of Meta-centric height - Analytical and experimental methods; Conditions of equilibrium of submerged and floating bodies.

UNIT III	FLUID KINEMATICS AND DYNAMICS	9

Classification of fluid flow; Stream line - Streak line and Path lines; Continuity equation - Velocity potential function and Stream function; Flow net properties and its uses; Energy possessed by a fluid body in motion; Euler's equation of motion; Bernoulli's equation and its applications - Discharge measurement, Venturimeter and Orifice meter.

UNIT IV	BOUNDARY LAYER	9

Boundary layer - boundary layer thickness and classification, displacement and momentum; Separation of boundary layer; Methods of controlling boundary layer separation.

UNIT V	DIMENSIONAL ANALYSIS, SIMILITUDE AND MODEL ANALYSIS	9

Methods of Dimensional Analysis - Rayleigh's method, Buckingham's theorem; Hydraulic Similitude - model analysis; dimensionless numbers; Model testing of partially submerged bodies - Types of models.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	interpret and use dimensional parameters to describe physical phenomena and experimental results.	Analyzing (K4)

CO2	apply theoretical principles to calculate total pressure on plane and curved surfaces.	Applying (K3)
CO3	analyze flow characteristics and predict behavior using appropriate flow classification criteria.	Analyzing (K4)
CO4	identify boundary layer separation based on flow conditions and surface characteristics.	Understanding (K2)
CO5	apply geometric similarity to design and construct models of hydraulic structures and systems.	Applying (K3)

TEXT BOOKS

1. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2018.
2. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2017.

REFERENCES

1. Subramanya. K "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
2. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
3. Kumar K L , "Engineering Fluid Mechanics", S Chand & Company Ltd, New Delhi, 2013.
4. Rajput P K, "Textbook of Fluid Mechanics and Hydraulic Machines", S Chand and Company Ltd, New Delhi, 2014.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	-	1	2	-	-	-	-	-	3	3	2
CO2	3	2	-	-	1	2	-	-	-	-	-	3	3	3
CO3	3	2	3	2	1	2	-	-	-	-	-	3	3	2
CO4	3	3	3	2	1	3	-	-	-	-	-	3	3	3
CO5	3	3	3	2	1	3	-	-	-	-	-	3	3	2

CE23303	SURVEYING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	calculate the land area measurement by chaining, compass and plane table.
2	gain knowledge about the elevation of points using dumpy level.
3	analyze the horizontal and vertical angles by theodolite.
4	acquire knowledge on the application of total station surveying.
5	measure the angles and distance using GPS.

UNIT I	FUNDAMENTALS OF SURVEYING	9

Chain surveying - Principles, Classification, Ranging and chaining, Corrections; Scales; well-conditioned triangles; Compass - Prismatic compass, Surveyors compass, Bearing, Systems and conversions, Local attraction, Adjustment of errors; Plane table Surveying - Accessories and its methods.

UNIT II	LEVELING AND CONTOURING	9

Leveling - Level line, Horizontal line, Spirit level, Sensitiveness, Benchmarks, Types of levelling, Booking and Reduction, Curvature and Refraction, Calculation of areas and volumes; Contouring - Characteristics and uses of contours, Calculation of Earth work volume, Capacity of reservoirs.

UNIT III	THEODOLITE SURVEYING AND CURVE SETTING	9

Theodolite - Description and uses, Horizontal angles, Vertical angles, Traversing, Closing error and distribution, omitted measurements; Curves - Types, components and elements of simple curve, setting out a simple curve, Transition curves, Functions and requirements.

UNIT IV	TACHOMETRIC AND TRIANGULATION SURVEYING	9

Tachometric systems - Tangential and stadia methods, Stadia systems, Horizontal and inclined sights, Vertical staffing, Fixed and Movable hairs, Determination of Stadia constants, Anallactic lens; Triangulation - Trilateration, Corrections; Satellite station; Reduction to Centre; Trigonometric Levelling - Single and Reciprocal observations.

UNIT V	TOTAL STATION AND GPS SURVEYING	9

Total station - Basic Principle, Classifications; Electro-optical system - Measuring principle, working principle, Sources of Error; Microwave system - Measuring principle, Working principle, Sources of Error; GPS - Basic segments, Different segments, space, control and user segments; Satellite configuration - signal structure, Orbit determination and representation; Anti Spoofing and Selective availability; Task of control segment - Hand Held and Geodetic receivers, Data processing; DGPS - Application of GPS and DGPS.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to	BT Mapped (Highest Level)

CO1	estimate the land area by chain, compass and plane table.	Understanding (K2)
CO2	determine the height of a point using dumpy level.	Applying (K3)
CO3	calculate the horizontal angles and vertical angles using theodolite.	Applying (K3)
CO4	determine the horizontal distances and vertical distances using total station.	Applying (K3)
CO5	compute the angles and distance from GPS.	Applying (K3)

TEXT BOOKS

1. Dr. B. C. Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol. I and II, Lakshmi Publications Pvt.Ltd, New Delhi, Eighteenth Edition, 2022.
2. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

REFERENCES

1. Kanetkar.T.P, "Surveying and Levelling" Vol. I and II, United Book Corporation, Pune, 2008.
2. K.R. Arora, Surveying Vol I & II, Standard Book house, 12th, Edition. 2013.
3. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	3	-	-	-	-	-	-	2	3	2
CO2	3	3	2	2	3	-	-	-	-	-	-	2	3	2
CO3	3	3	2	1	3	-	-	-	-	-	-	2	3	2
CO4	3	3	2	2	3	-	-	-	-	-	-	2	3	2
CO5	3	3	2	2	3	-	-	-	-	-	-	2	3	2

MC23302	HUMAN VALUES AND GENDER EQUALITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1	define different types of human values and their impact on individual behavior and societal norms.
2	apply principles of personal development such as self-confidence, self-discipline, and resilience to navigate modern challenges effectively.
3	evaluate the role of values in shaping professional ethics, civic sense and global citizenship.
4	examine the socio-economic factors influencing gender inequality and explore avenues for empowerment and advocacy.
5	critically analyze prevalent issues and challenges faced by women, including gender-based violence, discrimination, and cultural biases, and propose measures for their eradication.

UNIT I	HUMAN VALUES	6

Value Education - Definition, Types of values; Human values - Acceptance, Consideration. Appreciation, Listening. Empathy, Sympathy, Honesty, Integrity, Wisdom, Decision making, Self- actualization, Character formation towards positive personality, Contentment; - Religious Values - Humility, Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II	PERSONALITY DEVELOPMENT	6

Personal Development - Introspection, Self-confidence, Self-discipline; Flexibility -Peer pressure - Sensitization towards Gender Equality; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition, Positive and Negative attitudes; Family values; Self- improvement - Physical exercises, Meditation ,Yoga.

UNIT III	VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT	6

Professional Values -. Integrity, Responsibility, Punctuality, Dedication - Perseverance - Competence; Civic sense and Responsibility; Global Values - Computer Ethics, Moral Leadership, Code of Conduct; Corporate Social Responsibility; Aesthetic values; National Integration and International understanding of Religious Values – Spirituality, thought process.

UNIT IV	GENDER EQUALITY	6

Gender Equality - Definition, Empowerment, Economic Equality; Condition of Women in India - Education, Healthcare, Political Representation, Gender-based Violence; Challenging Stereotypes: Parental and Caregiving Responsibilities; Legal and Policy Reform; Cultural Shifts; Global Perspective; Male Chauvinism; Sustainable Development.

UNIT V	WOMEN ISSUES AND CHALLENGES	6

Women Issues and Challenges - female feticide, violence against women; Domestic violence- dowry related abuse and deaths, Physical violence, Emotional abuse; Sexual assault; Honour killing; Eve-teasing- Stalking, e-stalking (cyber-crime).

	TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	discuss the concept of human values and their significance in personal and societal development.	Understanding (K2)
CO2	demonstrate introspective skills to enhance personal growth and self-awareness.	Applying (K3)
CO3	recognize the importance of gender equality in promoting a just and equitable society.	Understanding (K2)
CO4	cultivate a sense of social responsibility and ethical conduct towards achieving national and global development.	Analyzing (K4)
CO5	analyse the challenges faced by women in various spheres and identify strategies for addressing them.	Analyzing (K4)

TEXT BOOKS

1. A Foundation Course in Human Values and Professional Ethics: Presenting a Universal Approach to Value Education - Through Self-exploration. New Delhi, 2016.
2. Aurther, John. Personality Development. Lotus Press, 2018.

REFERENCES

1. Joshi, Dhananjay. Value Education in Global Perspective. Lotus Press, 2014.
2. Mahrotra, Mamta. Gender Inequality in India: Challenging Social Norms. Prabhat Books, 2015.

CO PO MAPPING

CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	-	1	1	1	2	3	2	1	1	3	1	1
CO2	-	1	-	1	1	1	3	3	2	2	1	1	1	1
CO3	-	1	-	1	1	1	2	3	1	1	1	3	2	1
CO4	-	1	-	1	1	1	2	3	2	2	1	2	2	2
CO5	-	1	-	1	1	1	1	3	2	2	1	3	2	2

CE23304	CONSTRUCTION MATERIALS AND TECHNIQUES	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	describe the various methods of building construction.
2	elaborate various properties of building materials.
3	learn various concrete making materials.
4	explore the concepts of construction equipment.
5	gain the knowledge on construction techniques.

UNIT I	INTRODUCTION TO BUILDING CONSTRUCTION	9

Types of structure - Load Bearing Structure, Framed Structure; Components of building and its function; Site planning - Precaution in selection of sites, Situations and surrounding of site for various types of building, Procedure for site analysis; Sub structure - Functional requirement of a foundation, Bearing capacity of soil, Types of foundation and their construction, Suitability.

UNIT II	BUILDING MATERIALS	9

Bricks - Manufacturing process, Classification, Testing, Bricks for special use, Refractory bricks; Stone as building material - Criteria for selection, Tests on stones, Application; Timber - Market forms and Industrial forms, Properties, Seasoning and Preservative treatment; Structural steel-Shapes, Applications; Flooring and roofing - Materials, Suitability, Types; Pipes - Types, Sizes and Application; Paints - Varnishes, Distempers, Bitumen; Concrete blocks - Lightweight concrete blocks, Applications.

UNIT III	CONCRETE MAKING MATERIALS	9

Lime - Preparation of lime mortar; Cement - Ingredients, Manufacturing process, Types and Grades, Properties of cement and Cement mortar, Hydration, Compressive strength, Tensile strength, Fineness, Soundness and consistency, Setting time, Storage of cement; Aggregate - Classification, Fine aggregates, River sand, Artificial sand - Properties, Bulking of sand, Fineness modulus; Coarse Aggregates - Crushing strength, Impact strength, Flakiness Index, Elongation Index, Abrasion Resistance, Grading.

UNIT IV	CONSTRUCTION EQUIPMENTS	9

Construction equipments - Factors affecting selection of construction equipment, Selection of equipment for earthwork excavation, concreting; Material handling and erection of structures; Dewatering and pumping equipment.

UNIT V	CONSTRUCTION TECHNIQUES	9

Lintel - Functions of lintel and sunshade, Types of lintel; Arches - Construction, Elements, Classification; Doors and Windows - Types and their suitability, Stair and stair cases - Location and classification of stairs, Requirement of good stair; Formworks - Centering and Shuttering, Scaffoldings, Shoring and Underpinning, Slip forms.

LIST OF EXPERIMENTS

TEST ON FINE AGGREGATES

1. Grading of fine aggregates
2. Test for specific gravity
3. Compacted and loose bulk density of fine aggregate
4. Test for Water Absorption

TEST ON COARSE AGGREGATES

5. Grading of Coarse aggregates
6. Test for specific gravity
7. Test for water absorption

TEST ON CEMENT

8. Determination of fineness and specific gravity
9. Determination of consistency, initial and final setting time
10. Test on Soundness
11. Compressive strength of cements cubes

TEST ON BRICKS

12. Test for compressive strength of bricks
13. Test for water absorption of bricks

TOTAL PERIODS	**75**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	study the various forms of building construction.	Remembering (K1)
CO2	discuss various properties of building materials.	Understanding (K2)
CO3	discover about various concrete making materials.	Applying (K3)
CO4	identify the concepts of construction equipment.	Analyzing (K4)
CO5	ensure the knowledge on construction techniques.	Analyzing (K4)

TEXT BOOKS

1. S.S Bhavikatti., "Building Material and Construction", Vikas Publishing House, 2014.
2. Varghese.P.C, "Building construction", Prentice Hall India Learning Private Limited, 2nd edition, 2015.

REFERENCES

1. Neville A.M., Properties of concrete, fourth edition, Pearson education Ltd.2012
2. Shetty.M.S., Concrete Technology (Theory and Practice), S Chand and company limited 2015.
3. Gambhir. M.L. and Neha Jamwal. "Building Materials, products, properties and systems", Tata McGraw-Hill Educations Pvt. Ltd, New Delhi, 2012.
4. Punmia, B.C Building Construction, Laxmi publication Pvt.Ltd, 2016.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												PSO's	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	-	-	2	-	-	1	-	2	2	3	3
CO2	3	2	2	-	-	1	-	-	2	-	2	3	3	3
CO3	3	2	3	2	-	1	-	-	2	-	2	2	3	3
CO4	3	2	2	2	3				1	-	2	2	3	3
CO5	3	2	2	3		2			2	-	2	2	3	3

CE23305	SURVEYING LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	acquire practical knowledge on handling basic chain survey equipment.
2	calculate the elevation of ground surface using dumpy level.
3	measure the height and distance using tachometer.
4	understand the working procedure of modern equipments.

LIST OF EXPERIMENTS

1. Study on Chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset.
2. Study on Radiation method and intersection methods by plane table survey.
3. Setting out works - Foundation marking using tapes single Room and Double Room.
4. Compass Traversing - Measuring Bearings and arriving included angles.
5. Fly levelling using Dumpy level and Tilting level.
6. Check levelling.
7. Measurements of horizontal angles by Reiteration and Repetition and Vertical angles using theodolite.
8. Determination of elevation of an object using single plane method, when base is accessible and inaccessible.
9. Determination of Tacheometric Constants, Heights and distances by stadia and Tangential Tacheometry.
10. Area and Volume Calculation by using Total Station.
11. Total Station - Measuring Horizontal and vertical angles.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	use conventional surveying tools such as chain, tape, compass, plane table in the field of Civil Engineering applications.	Applying (K3)
CO2	draw planimetric map and contour map using dumpy level.	Applying (K3)
CO3	calculate the horizontal and vertical distance by using tacheometer.	Applying (K3)
CO4	determine the horizontal and vertical distance by total station.	Applying (K3)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	-	2	1	-	-	2	1	-	3	3	1
CO2	3	2	1	-	2	1	-	-	2	1	-	3	3	1
CO3	3	2	1	-	2	1	-	-	2	1	-	3	3	1
CO4	3	2	1	-	2	1	-	-	2	1	-	3	3	2

PAAVAI ENGINEERING COL. Approved BOARD OF STUDIES Civil Engineering 31/5/24 AUTONOMOUS

CE23306	STRENGTH OF MATERIALS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	impart knowledge on mechanical properties of materials subject to different types of loading on steel and wood.
2	apply the knowledge of testing steel rod subjected to tension and torsion.
3	acquire practical knowledge on double shear test and impact test on metal.
4	gain practical knowledge on compression and tension test on springs.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Torsion test on mild steel rod.
3. Compression test on wood.
4. Double Shear test on metal.
5. Hardness test on metal - Rockwell and Brinell.
6. Charpy and Izod Impact test.
7. Deflection test on metal beam.
8. Compression test on helical spring.
9. Deflection test on carriage spring.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	compare the steel and wood for apply loadings.	Understanding (K2)
CO2	determine the tension and torsion on steel rod.	Applying (K3)
CO3	calculate the double shear and impact strength on metal.	Applying (K3)
CO4	examine the compression and tension test on spring.	Analyzing (K4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	2	3	-	-	2	-	-	2	2	2
CO2	3	2	2	3	2	3	-	-	2	-	-	3	3	3
CO3	3	2	2	2	2	3	-	-	2	-	-	2	2	2
CO4	3	2	2	2	3	3	-	-	2	-	-	3	3	2

GE23301	PROFESSIONAL DEVELOPMENT I	0	0	2	1

COURSE OBJECTIVES

To enable students to

1	enhance and evaluate the student's potential strength, personality skills and reduce weakness to survive.
2	enhance and develop the students behavioral, speaking and listening skills to face the interview.
3	solve the quantitative aptitude problems and improve their problem-solving skills.
4	improve their reasoning skills to get placed in reputed companies.

UNIT I	SELF - UNDERSTANDING AND PERSONALITY ENHANCEMENT SKILLS	7

Introduction: Self Exploration, SWOT Analysis - Types and Barriers - Effective Communication in Workplace - Leadership Skills - Decision Making - Problem Solving - Goal Setting - Critical, Strategic and Lateral Thinking, JAM Level - 1, Basic Resume Building Level – 1.

UNIT II	BEHAVIOURAL SKILLS, LISTENING AND SPEAKING SKILLS	7

Behavioral Skills: Time Management - Emotional Intelligence - Analytical Thinking; Listening - Listening and Hearing - Self Introduction - Group Discussion: Types and Importance - Evaluation Criteria - Do's and Don'ts of GD - GD Level-1.

UNIT III	QUANTITATIVE APTITUDE	8

Number System - LCM and HCF - Simple Interest and Compound Interest - Average - Pipes and Cisterns - Area - Profit and Loss.

UNIT IV	LOGICAL REASONING	8

Logical Sequence - Analogy - Classification - Causes and Effect - Making Judgment – Directions.

TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	define and analyze soft skills to improve the leadership skills.	Analyzing (K4)
CO2	demonstrate the behavioral skills through various activities.	Applying (K3)
CO3	develop the problem solving skills through quantitative aptitude.	Applying (K3)
CO4	illustrate the logical reasoning Skills to solve real world problems.	Analyzing (K4)

TEXTBOOKS

1. Agarwal, R.S. "Objective General English", S.Chand&Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand&Co.2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill.2023.
2. Agarwal, R.S." A Modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, newdelhi.2021
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications.2021.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (PO's)													
	P01	P02	P03	PO4	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	1
CO2	-	-	-	-	-	-	2	3	2	3	-	3	2	1
CO3	3	2	2	2	-	-	1	-	-	-	-	-	1	2
CO4	2	3	3	2	-	3	3	1	-	1	2	-	2	2

MA23401	STATISTICS AND NUMERICAL METHODS	3	1	0	4
	(Common to Civil, Chemical, Mech, MCT, R&A)				

COURSE OBJECTIVES

To enable the students to

1.	determine the concepts of hypotheses testing, its need and applications.
2.	equip with statistical techniques for designing experiments, analyzing, interpreting and presenting research data.
3.	apply various numerical techniques for solving algebraic/transcendental equations and system of linear equations.
4.	develop the knowledge of numerical differentiation and numerical integration techniques.
5.	acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	12

Sampling theory; Large sample - Tests for single mean, proportion and difference of means; Small sample - Test for single mean and difference of means; Test equality of variances; Chi square test - Goodness of fit, Independence of attributes.

UNIT II	DESIGN OF EXPERIMENTS	12

Completely randomized design; Randomized block design; One way and two way classifications- Latin square design - 2^2 factorial design.

UNIT III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	12

Solution of algebraic and transcendental equations; Fixed point iteration method; Newton Raphson method; Solution of linear system of equations; Gauss elimination method – Pivoting; Gauss Jordan method; Iterative methods of Gauss Jacobi and Gauss Seidel; Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	12

Interpolations - Newton's forward and backward difference interpolation; Approximation of interpolation polynomials; Divided differences; Lagrangian methods for equal and unequal intervals; Numerical differentiation and integration by trapezoidal and Simpson's 1/3 rules.

UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	12

Single step methods: Taylor's series method; Euler's method, Modified Euler's method; Fourth order Runge-Kutta method for solving first order differential equations; Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

	TOTAL PERIODS	60

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	apply the concept of testing of hypothesis for small and large samples in real life problems	Applying (K3)
CO2	analyse the principles to be adopted for designing the experiments.	Analysing(K4)

CO3	apply various numerical techniques to solve algebraic and transcendental equations.	Applying(K3)
CO4	derive the concepts of numerical differentiation and integration.	Applying (K3)
CO5	compute the solution of first order ordinary differential equations by numerical techniques.	Applying (K3)

TEXT BOOKS

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4thEdition, 2007.
2. Sankar Rao K " Numerical Methods for Scientists and Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium,1-Weak

COs	Programmes Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	3	1	1
CO2	3	3	2	3	-	-	-	-	-	-	-	3	1	1
CO3	3	3	2	3	-	-	-	-	-	-	-	2	3	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	2

CE23401	CONCRETE TECHNOLOGY	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	acquire a sound technical knowledge on the constituents of concrete.
2	understand the concepts of mix proportioning and durability.
3	gain the properties of concrete and quality assessment.
4	know the ability of concrete resist deterioration.
5	recognize about the uses of modern concrete.

UNIT I	INGREDIENTS OF CONCRETE	9

Cement - ASTM classification of cement, Chemical composition, Heat of hydration, Field and laboratory tests for cement; Aggregates - Coarse and Fine Aggregates, IS Specifications, Classification of aggregates, Importance of grading, Standard Grading Curve, Interfacial Transition Zone; Water - Quality of water for use in concrete, Use of sea water and its effects in concrete.

UNIT II	ADMIXTURES AND MIX PROPORTIONS	9

Admixtures - Functions, Classification, Types, Effects of admixture on concrete properties, Mineral Admixtures, Chemical Admixtures, IS Specifications; Principles of mix proportioning - Factors influencing mix design, IS method of mix design - RCC, FRC with admixture.

UNIT III	FRESH AND HARDENED CONCRETE PROPERTIES	9

Workability - Tests for workability of concrete, Determination of density and air content of fresh concrete, Segregation and Bleeding; Strength Properties of Hardened concrete - Elasticity, Creep, Shrinkage and temperature effects, Gain of strength with age, Stress and Strain characteristics of concrete; Non Destructive Tests for concrete - Rebound hammer and Ultrasonic pulse velocity test.

UNIT IV	DURABILITY PROPERTIES OF CONCRETE	9

Durability of concrete - Tests for durability, Strength and durability relationship, Factors affecting durability of concrete, RCPT, Sorptivity, Alkali Aggregate Reaction, Chemical attack, Corrosion tests; Cracks in concrete; Permeability.

UNIT V	SPECIAL CONCRETES	9

Light weight concrete; Foam concrete; Self compacting concrete; Vacuum concrete; Bacterial concrete; Fiber reinforced concrete; Ferrocement; HVFA concrete; SIFCON; Ready mix concrete; Polymer concrete; Geopolymer Concrete; Pumped concrete; Roller compacted concrete; Transparent concrete; Permeable concrete.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	identify the properties of various constituents present in concrete.	Remembering (K1)

CO2	calculate mix proportions for concrete with and without admixtures.	Applying (K3)
CO3	determine the fresh and hardened properties of concrete.	Applying (K3)
CO4	explain the durability performance of concrete,	Understanding (K2)
CO5	infer the types of special concrete with its characteristics and applications.	Analyzing (K4)

TEXT BOOKS

1. Shetty M.S., "Concrete Technology Theory and Practice", 8th Edition, S.Chand & Company Ltd., New Delhi, 2019.
2. Santhakumar.A.R., "Concrete Technology", Oxford University Press, New Delhi, 2018.

REFERENCES

1. Gambhir.M.L., "Concrete Technology", Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2013.
2. Neville A.M, "Concrete Technology", 27th Edition, Pearson India Education Services, 2020.
3. IS456 - 2000 and IS10262 - 2019 Indian standard concrete mix design.
4. ACI 211, Standard Practice for selecting proportions for concrete.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	3	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO3	3	2	3	3	3	-	-	-	-	-	-	3	3	2
CO4	3	2	3	3	3	-	-	-	-	-	-	3	3	2
CO5	2	2	-	3	-	-	-	-	-	-	-	3	3	2

CE23402	APPLIED HYDRAULIC ENGINEERING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	measure the velocity of fluid flow at a specific point in a pipe.
2	understand the factors contributing to energy losses in fluid flow through pipes.
3	learn and apply empirical formulas to calculate velocity distribution in open channels.
4	understand the working principle of various pumps and its characteristics.
5	learn how to calculate the forces exerted by fluid jets on stationary and moving curved vanes.

Prerequisite: Fluid Mechanics

UNIT I	FLOW MEASUREMENT	9

Velocity measurement - Pitot tube, Current meter; Discharge measurement – Orifices, mouthpieces - notches and weirs – Rectangular, Triangular, Cippoletti weir, submerged weir; Time of emptying reservoirs through orifices - mouthpieces and notches.

UNIT II	FLOW THROUGH PIPES	9

Energy losses in pipes - Darcy Weisbach's formula, flow through pipes in series, flow through pipes in parallel pipes, flow through branched pipes, equivalent pipe; Water hammer in pipes; Laminar flow through circular pipes - Hagen Poiseuilles' equation, Turbulent flow through circular pipes; Velocity distribution.

UNIT III	FLOW IN OPEN CHANNELS	9

Types of flow in channels; Velocity distribution - Chezy's formula, Manning's formula; Most economical channel section; Computation of Specific energy and Critical depth; hydraulic jump and backwater curves.

UNIT IV	PUMPS AND HYDRAULIC DEVICES	9

Classification of pumps; Centrifugal pumps, Multistage pumps, Minimum speed to start the pump, Specific speed and Characteristic curves; Reciprocating pumps - negative slip, Indicator diagram, functions of air vessels; Pressure booster pumps - Hydraulic press, hydraulic accumulator, hydraulic intensifier and hydraulic ram, hydraulic jacks.

UNIT V	IMPACT OF JETS AND TURBINES	9

Applications of momentum equation; Force exerted by fluid jet on stationary and moving curved vanes; General layout of a Hydroelectric power plant; Classification of turbines; Specific speed and Characteristic curves; Draft tube and Cavitation.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	determine the velocity of fluid flow at a specific point in a pipe.	Analyzing (K4)

CO2	evaluate and optimize pipe designs to minimize energy losses and improve efficiency.	Analyzing (K4)
CO3	design the most economical sections using various laws.	Applying (K3)
CO4	design the components of pumps and study their characteristics.	Applying (K3)
CO5	determine the forces exerted by fluid jets on stationary and moving curved vanes, understanding their practical applications.	Analyzing (K4)

TEXT BOOKS

1. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt.Ltd., New Delhi, 2018.
2. Jain.A. K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers 12th Edition, 2016.

REFERENCES

1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2017.
2. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.
3. Kumar K.L, "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., 2009.
4. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	2	2	-	-	-	-	3	3	2
CO2	3	3	2	2	-	2	2	-	-	-	-	3	3	2
CO3	3	3	3	3	1	2	2	-	-	-	-	3	3	2
CO4	3	3	2	1	-	-	2	-	-	-	-	3	3	2
CO5	3	3	2	1	-	2	2	-	-	-	-	3	3	3

CE23403	WATER SUPPLY AND WASTE WATER ENGINEERING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	know the various methods used for collection and conveyance of water.
2	realize the concept of conventional and advanced water treatment process.
3	investigate the water distribution system.
4	examine the different methods of sewerage system.
5	design the sewage treatment plant and disposal methods.

UNIT I WATER SUPPLY **9**

Public water supply system - Objectives; Design period; Population forecasting; Water demand; Sources of water and their characteristics; Standards for drinking water; Intake structures-functions and drawings; Types of pipes and pumps; Transmission main design; Laying, Jointing and testing of pipes.

UNIT II WATER TREATMENT **9**

Unit operations and processes; Principles, functions and design of water treatment plant process - Aeration, Sedimentation, Coagulation and Flocculation, Sand filter, Disinfection, Removal of Iron and Manganese, Defluoridation, Water softening, Desalination process; Residue management; Construction, Operation and Maintenance aspects of water treatment plants.

UNIT III WATER STORAGE AND DISTRIBUTION **9**

Requirements of water distribution; Layouts of distribution networks; Methods of distribution: Storage and Distribution reservoirs; Analysis of distribution network; Leakage detection in underground distribution pipes; Appurtenances in distribution system; Plumbing systems for buildings.

UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM **9**

Characteristics and composition of sewage; Population Equivalent; Sanitary sewage flow estimation; Sewer materials; Hydraulics of flow in sanitary sewers - Sewer design; Storm runoff estimation; Sewer appurtenances; Sewage pumping; Plumbing systems for drainage.

UNIT V SEWAGE TREATMENT AND DISPOSAL **9**

Selection of Treatment Methods; Principles and Functions - Activated Sludge Process, Trickling filters, Sequencing Batch Reactor(SBR), UASB, Waste Stabilization Ponds: Dilution - Self-purification of surface water bodies; Land disposal – Sewage farming: Discharge standards for Effluents: Sludge treatment and disposal.

TOTAL PERIODS **45**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	select the various sources and conveyance of water.	Remembering (K1)
CO2	compute the various water treatment system.	Understanding (K2)

CO3	classify the water distribution system and water supply in buildings.	Applying (K3)
CO4	compare the various waste water treatment process.	Analyzing (K4)
CO5	analyze the proper disposal methods of sewage and sludge.	Analyzing (K4)

TEXT BOOKS

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010
2. Garg, S.K., Environmental Engineering Vol.II, Khanna Publishers, New Delhi, 2019.

REFERENCES

1. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.
2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2023.
3. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2013.
4. Syed R.Qasim "Waste water Treatment Plants", CRCPress,WashingtonD.C.,2010.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	-	3	3	1	-	-	-	2	3	2
CO2	3	3	3	3	-	3	3	1	-	-	-	2	3	3
CO3	3	3	3	2	-	3	3	1	-	-	-	2	3	2
CO4	3	3	3	3	-	3	3	1	-	-	-	2	3	3
CO5	3	3	3	3	-	3	3	1	-	-	-	2	3	3

MC23401	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1	establish the knowledge of precious resources of the environment and their various impacts.
2	create awareness on ecosystem and biodiversity preserve.
3	learn scientific and technological solutions to current day pollution issues.
4	analyze climate changes, concept of carbon credit and the challenges of environmental management.
5	understand green materials, energy cycles and the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND NATURAL RESOURCES	6

Definition, scope and importance of Environment. Forest resources: Use and over-exploitation, deforestation, - mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems. Food resources: effects of modern agriculture, fertilizer-pesticide problems. Role of an individual in conservation of natural resources.

UNIT II	ECOSYSTEMS AND BIODIVERSITY	6

Concept of an ecosystem: Structure and function of an ecosystem - ecological succession - food chains and food webs. Ecosystems- Types of ecosystem: Introduction - forest ecosystem and lake ecosystems. Biodiversity: Introduction - definition (genetic - species - ecosystem). Diversity - Value of biodiversity - Hotspots of biodiversity - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III	ENVIRONMENTAL POLLUTION	6

Pollution: Définition - air pollution - water pollution - marine pollution - noise pollution. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Electronic waste -Sources-Causes and its effects- Pollution case studies-Field study of local polluted site – Industrial/Agricultural

UNIT IV	SUSTAINABILITY AND ENVIRONMENT	6

Sustainability - from unsustainability to sustainability-millennium development goals, and protocols. Sustainable development goals-targets, indicators and intervention areas. Climate change— acid rain - ozone layer depletion. Regional and local environmental issues and possible solutions-case studies. Concept of carbon credit, carbon footprint. Environmental management in industry-A case study.

UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment - Sustainable energy: Non-conventional Sources, Green materials, Energy Cycles - carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	find the method of conservation of natural resources.	Understanding (K2)

CO2	understand ecosystem and the conservation of biodiversity.	Understanding (K2)
CO3	aware of environmental pollution and interpret its effects.	Understanding (K2)
CO4	apply sustainable development for technological advancement and societal development.	Applying (K3)
CO5	measure the sustainability practices for green energy cycles.	Analyzing (K4)

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, 1st edition, 2017.
2. Gilbert M. Masters, Wendell P. Ela " Introduction to Environmental Engineering and Science", 3rd edition, Pearson, 2022.

REFERENCES

1. William P. Cunningham and Mary Ann Cunningham, "Environmental Science: A Global Concern", McGraw Hill, 16th edition, 2023.
2. C. S. Rao, "Environmental Pollution and Control Engineering", New Age International (P) ltd Publication, New Delhi, 4th edition, 2021.
3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., edition, 2020.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 4th Edition, 2015.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	1	-	-	-	2	-	-	1	1	-	-	1	2
CO2	-	2	-	-	1	1	-	1	-	-	-	-	2	1
CO3	2	-	1	1	-	-	-	2	-	-	-	2	2	2
CO4	-	2	-	-	1	-	3	1	1	-	1	1	2	2
CO5	2	2	-	1	-	-	2	1	-	-	-	1	2	2

CE23404	SOIL MECHANICS	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	classify the soil based on Index properties and Engineering properties.
2	realize the concept of effective stress and permeability.
3	choose the methods of compaction and consolidation of soil
4	interpret the concept of shear strength.
5	summarize the soil stabilization techniques and slope protection measures.

UNIT I **INDEX PROPERTIES AND IS CLASSIFICATION** **9**

Soil - Origin of soil, rocks and its classification; Index Properties - Phase Diagram, and their interrelationships, Determination of Index properties; Types of soil structures and Clay Minerals; IS classification of Soil.

UNIT II **SOIL WATER AND EFFECTIVE STRESS ANALYSIS** **9**

Soil water - Modes of occurrence of soil water; Stress condition in soil - Effective stress and neutral Pressures; Permeability - Darcy's law, factors affecting Permeability, coefficient of permeability, Determination of coefficient of permeability (Constant head permeability test and falling head permeability test), permeability of stratified soils; Seepage; Flow net - Application of flow net.

UNIT III **COMPACTION AND CONSOLIDATION** **9**

Compaction - Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction; Components of settlement - immediate and consolidation settlement; Terzaghi's one dimensional consolidation theory - computation of rate of settlement, $\sqrt{t}$ and log t methods, e-log p relationship.

UNIT IV **SHEAR STRENGTH** **9**

Shear strength of cohesive and cohesion less soils - Mohr-Coulomb failure theory; Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests, Factors affecting shear strength of soils.

UNIT V **SOIL STABILISATION AND SLOPE STABILITY** **9**

Soil stabilisation - mechanical stabilisation, cement stabilisation, lime stabilisation, bituminous stabilisation, chemical stabilisation, Thermal stabilisation, Electrical stabilisation, stabilisation by grouting, stabilisation by geotextile and fabrics, Reinforced earth; slope - types of slopes, slope protection measures;

LIST OF EXPERIMENTS

1. Specific gravity of soil grains
2. Grain size distribution - Sieve analysis
3. Determination of plasticity index of soil
4. Field density Test (Sand replacement and Core cutter method)
5. Determination of moisture - density relationship using standard proctor compaction test.
6. Permeability determination (Constant head and Falling head methods)
7. Direct shear test in cohesion less soil

8. Unconfined compression test in cohesive soil	
9. California Bearing Ratio Test	
10. Vane shear Test	
11. Tri-axial compression Test (Demonstration only)	
12. One Dimensional Consolidation Test (Demonstration only)	
	TOTAL PERIODS 75

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	identify the index properties of soil and solve problems related to three phase system.	Analyzing (K4)
CO2	determine the permeability characteristics and solve the problems related to effective stress and seepage.	Applying (K3)
CO3	compute the settlement of the structure for different soil conditions.	Applying (K3)
CO4	calculate the shear strength parameters for various soil conditions.	Applying (K3)
CO5	analyse the various types of soil stabilisation and slope stability..	Analyzing (K4)

TEXT BOOKS

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt..Ltd. New Delhi, 2017.
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd International Publisher New Delhi, 2016.

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1. Dr.K.R.Arora., "Soil Mechanics and Foundations", Standard publishers distributors, New Delhi, 2019.
2. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi, 2018.
3. Dr.P.N.Modi., "Soil Mechanics and Foundation engineering" , Standard Book House, New Delhi 2019.
4. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt. Ltd. New Delhi, 2011.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	1	3	-	-	-	-	3	-	-	2	2	3
CO2	3	2	3	3	-	-	-	-	2	-	-	2	3	3
CO3	3	3	3	2	2	-	-	-	3	-	-	3	3	2
CO4	3	3	2	3				-	2	-	-	2	3	3
CO5	3	2	2					-	2	-	-	3	3	3

CE23405	WATER AND WASTE WATER ANALYSIS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	understand the concepts of sampling and preserving water and waste water.
2	acquire the knowledge on the principles of testing of water and waste water.
3	learn different analysis methods for water and waste water.
4	ensure the importance of oxygen in water and waste water.

LIST OF EXPERIMENTS

1. Determination of pH and Turbidity in water
2. Determination of Hardness in water
3. Determination of Optimum coagulant dosage in water
4. Determination of Chlorides in water
5. Determination of Fluoride in water by spectrophotometric method
6. Determination of Residual chlorine in water
7. Determination of Total, suspended and dissolved solids in waste water
8. Determination of Sludge volume index in waste water
9. Determination of Dissolved Oxygen and BOD for the given sample
10. Determination of COD for given sample

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	study the concept of pH and turbidity of water and waste water.	Remembering (K1)
CO2	classify the different characteristics of water and waste water as per standards.	Understanding (K2)
CO3	examine the different analysis methods of water and waste water.	Applying (K3)
CO4	analyze the importance of oxygen in waste water.	Analyzing (K4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	1	-	3	3	2	2	-	-	2	1	2
CO2	2	3	2	1	-	3	3	1	2	-	-	2	2	2
CO3	2	3	2	2	-	2	3	2	2	-	-	2	2	2
CO4	2	3	2	2	-	2	3	1	2	-	-	2	3	3

CE23406	HYDRAULIC ENGINEERING LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	understand various flow measuring techniques available to measure the discharge of liquids flowing through pipes and in open channels.
2	determination of losses in closed channel.
3	gain thorough knowledge about various types of turbines.
4	study of performance of various types of pumps.

LIST OF EXPERIMENTS

1. Determination of Co-efficient of discharge for orifice and Mouthpiece
2. Determination of Co-efficient of discharge for notches
3. Determination of Co-efficient of discharge for Venturimeter
4. Determination of Co-efficient of discharge for orifice meter
5. Determination of losses in pipes
6. Bernoulli's Experiment
7. Characteristics of Pelton turbine
8. Characteristics of Francis turbine
9. Characteristics of Kaplan turbine
10. Characteristics of Centrifugal pumps
11. Characteristics of Reciprocating pump
12. Characteristics of Gear pump

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	determine the flow in pipes and in open channels.	Applying (K3)
CO2	compute the major and minor losses in pipe flow.	Applying (K3)
CO3	determine the performance characteristics of turbine.	Applying (K3)
CO4	determine the performance characteristic of pumps.	Applying (K3)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	3	-	2	-	-	1	-	-	2	3	3
CO2	3	2	1	3	-	2	-	-	1	-	-	2	3	3
CO3	3	3	2	3	-	2	-	-	1	-	-	2	3	3
CO4	3	3	2	3	-	2	-	-	1	-	-	2	3	3

GE23401	PROFESSIONAL DEVELOPMENT II	0	0	2	1

COURSE OBJECTIVES

To enable students to

1	enhance their own behavioral skills to survive in corporate world.
2	evaluate their listening and speaking skills to face the interviews in a successful way.
3	solve the quantitative aptitude problems and improve their problem-solving skills.
4	improve their reasoning skills to get placed in reputed companies

UNIT I	WRITING SKILLS	7

Email Writing - fixing and cancelling appointments, paper submission for seminars and conferences - Business communication, Stress Management - Body Language - Dress Code - Self Introduction II - Update Resume Building II - JAM Level - 3.

UNIT II	PRESENTATION SKILLS	7

Presentation Skills: Types and Methods of Delivering Presentation - Ways and Methods to improve Presentation Skills; Mini Presentation in smaller groups - Situational Role Play; Face to Face interview, Group Discussion Level II - JAM Level - 4.

UNIT III	QUANTITATIVE APTITUDE	8

Simplification - Time, Speed and Distance - Trains - Boats and Streams - Ratio and Proportion - Partnership - Percentage.

UNIT IV	LOGICAL REASONING	8

Seating Arrangement - Arithmetic Reasoning - Character Puzzle - Syllogisms - Matching - Definitions - Statements and Arguments.

TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	interpret the personality development through various activities.	Understanding (K2)
CO2	examine speaking and Listening Skills to excel in their jobs.	Analyzing (K4)
CO3	develop the quantitative skills and analytical skills to face the interview	Applying (K3)
CO4	extend the reasoning abilities by scoring exceeded percentage to get placed in reputed companies	Understanding (K2)

TEXTBOOKS

1. Agarwal, R.S. "Objective General English", S.Chand&Co., 2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand&Co., 2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill., 2023.
2. Agarwal, R.S." A Modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, newdelhi., 2021
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications., 2021.

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (PO's)													
	P01	P02	P03	PO4	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	1
CO2	-	-	-	-	-	-	2	3	2	3	-	3	2	1
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	2
CO4	2	3	3	2	-	3	3	1	-	1	2	-	1	1