GOVERNMENT COLLEGE OF TECHNOLOGY, COIMBATORE – 641 013
B.E. CIVIL ENGINEERING (FULL TIME)
2022 REGULATIONS

THIRD SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22CBS307	Transform Calculus and Partial Differential Equations (*Common to Civil & IBT*)	BS	40	60	100	3	1	0	4
2	22CES307	Mechanics of Fluids	ES	40	60	100	3	0	0	3
3	22CES308	Engineering Geology	ES	40	60	100	3	0	0	3
4	22CPC301	Mechanics of Solids I	PC	40	60	100	3	0	0	3
5	22CPC303	Surveying	PC	40	60	100	3	0	0	3
THEORY WITH PRACTICAL COMPONENT										
6	22CPC302	Construction Materials and Technology	PC	50	50	100	2	0	2	3
PRACTICAL										
7	22CES309	Materials Testing Laboratory	ES	60	40	100	0	0	3	1.5
8	22CPC304	Survey Laboratory	PC	60	40	100	0	0	3	1.5
	TOTAL			**370**	**430**	**800**	**17**	**1**	**8**	**22**

FOURTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem. Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22CES410	Applied Hydraulics and Fluid Machinery	ES	40	60	100	3	0	0	3
2	22CPC405	Mechanics of Solids II	PC	40	60	100	3	0	0	3
3	22CPC406	Concrete Technology	PC	40	60	100	3	0	0	3
4	22CPC407	Design of Reinforced Concrete Elements	PC	40	60	100	3	0	0	3
5	22CPC408	Water Supply Engineering	PC	40	60	100	3	0	0	3
6	22CMC4Z2	Constitution of India (Common to all branches)	MC	40	60	100	3	0	0	0
PRACTICAL										
7	22CES411	Fluid Mechanics and Machinery Laboratory	ES	60	40	100	0	0	3	1.5
8	22CES412	Engineering Exploration	ES	60	40	100	0	0	3	1.5
9	22CPC409	Environmental Engineering Laboratory	PC	60	40	100	0	0	3	1.5
	TOTAL			**420**	**480**	**900**	**18**	**0**	**9**	**19.5**

22CBS307	TRANSFORM CALCULUS AND PARTIAL DIFFERENTIAL EQUATIONS *(Common to Civil and IBT Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

Course Objectives	To be familiar with Fourier Series. To gain the knowledge of solving Boundary value problems. To be familiar with Laplace and Inverse Laplace transforms to solve ordinary differential equations.To acquire knowledge on Fourier transforms.To be familiar with Z-transform to solve difference equations.

UNIT – I	**FOURIER SERIES**	**9 Periods**
Dirichlet's Conditions – General Fourier series – Odd and even functions - Half range Sine and Cosine series – Root Mean Square Value- Parseval's Identity on Fourier series–Harmonic Analysis		
UNIT – II	**BOUNDARY VALUE PROBLEMS**	**9 Periods**
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Infinite Stripes in cartesian coordinates only).		
UNIT – III	**LAPLACE TRANSFORMS**	**9 Periods**
Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties –Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transforms - Statement of Convolution theorem – Initial and final value theorems – Solution of linear ordinary differential equation of second order with constant coefficients using Laplace transformation techniques.		
UNIT – IV	**FOURIER TRANSFORMS**	**9 Periods**
Statement of Fourier integral Theorem – Fourier transform pair–Fourier Sine and Cosine Transforms – Properties – Transforms of Simple functions – Convolution Theorem – Parseval's Identity.		
UNIT – V	**Z TRANSFORMS**	**9 Periods**
Z-transforms - Elementary properties –Convergence of Z-transforms - Initial and Final value theorems - Inverse Z-transform using partial fraction and convolution theorem– Formation of difference equations - Solution to difference equations of second order with constant coefficients using Z- transform		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOKS:

1	*Veerarajan. T.,**"Transforms and partial Differential equations"**, Tata McGrawHill Publishing Co., New Delhi. 2015.*
2	*B.S.Grewal.,**"Higher Engineering Mathematics"**, Khanna Publishers, NewDelhi,44th Edition,2018.*

REFERENCES

1	*Kandasamy, Thilagavathy and Gunavathy.,**"Engineering Mathematics"** for III Semester, S. Chand & Co, Ramnagar, New Delhi.*
2	*N.P.Bali and Manish Goyal.,**"Transforms and partial Differential equations"**, University Science Press, New Delhi, 2010.*
3	*Veerarajan T.,**"Engineering Mathematics"** for Semester I&II, Tata McGraw Hill Education (India) Pvt. Ltd., New Delhi, Third Edition 2012.*
4	*Erwinkreyszig,**"Advanced Engineering Mathematics",**9th Edition, John Wiley & Sons,2006.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Express the periodic functions arising in the study of engineering problems as sine and cosine series.	K3
CO2	Solve the Partial Differential Equations arising in engineering problems like Wave, Heat flow and Laplace equation in steady state (Cartesian coordinates) using Fourier series.	K3
CO3	Apply Laplace transform technique to solve the given integral equations and ordinary differential equations.	K3
CO4	Find Fourier Transforms, infinite Fourier Sine and Cosine transforms.	K3
CO5	Apply Z - transform technique to solve difference equations	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	2	1
22CBS307	3	2	-	-	-	-	-	-	-	-	-	-	-	1	1
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2,1.3.1,1.4.1,2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.4.1
CO2	1.1.1, 1.1.2,1.21, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.4.1
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.4.1
CO4	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.4.1
CO5	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.4.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	**Rememberin g (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzin g (K4) %**	**Evaluatin g (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	50	-	-	-	100
CAT2	20	30	50	-	-	-	100
Individual Assessment 1/ Case Study 1/ Seminar 1/ Project1	20	30	50	-	-	-	100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	20	30	50	-	-	-	100
ESE	20	30	50	-	-	-	100

22CES307	MECHANICS OF FLUIDS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	To impart the knowledge on properties and behavior of fluid at static and dynamic conditions to solve various fluid flow problems.

UNIT – I	**BASICCONCEPTS ANDFLUIDSTATICS**	**9 Periods**

Properties of fluids- Density, specific gravity, viscosity, surface tension, capillarity, compressibility, bulk modulus. Fluid statics – Pascal's Law - Pressure measurement – Manometers. Hydrostatic forces on plane and curved surfaces –Stability of floating bodies – Buoyancy–Metacentre and metacentric height-simple problems.

UNIT – II	**PRINCIPLES OF MASS**	**9 Periods**

Eulerian Vs.Lagrangian descriptions – Classification of fluid flow – Stream line, path line and streakline – Continuity equation – Velocity – Acceleration of a fluid particle - tangential, normal, local and convective acceleration-Velocity potential and stream functions – Free and Forced vortex flow.

UNIT – III	**PRINCIPLE OF ENERGY**	**9 Periods**

Energy and its forms, Energy equation – Euler's and Bernoulli's equation – Applications - Venturimeter, Orificemeter and Pitot tube - Flow over Notches and Weirs.

UNIT – IV	**FLOW THROUGH CONDUITS**	**9 Periods**

Laminar flow in pipes and between parallel plates - Hagen Poiseuille equation for flow through circular pipes - Turbulent flow – Reynolds experiment –Frictional loss in pipe- Darcy – Weisbach equation - Hydro dynamically smooth and rough boundaries, velocity distributions for turbulent flow in smooth and rough pipes.

UNIT – V	**BOUNDARY LAYER AND FLOW AROUND IMMERSED BODIES**	**9 Periods**

Boundary layer - Definition – Boundary layer thickness - Displacement, energy and momentum thickness - Boundary layer separation - Flow around immersed objects – Drag and lift on immersed bodies – Magnus effect.

Contact Periods: **Lecture:45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOKS:

1	*R.K.Bansal,**"Fluid Mechanics and Hydraulic Machines"**,LaxmiPublications(P)Ltd., NewDelhi, 2019.*
2	*P.N.ModiandS.M.Seth,**"HydraulicsandFluidMechanics,IncludingHydraulicMachines"**,StandardBookHouse, NewDelhi, 2015.*

REFERENCES:

1	*K.L.Kumar,"**EngineeringFluid Mechanics**",Eurasia Publishing House(P)Ltd., New Delhi,2020.*
2	*R.K.Rajput,"**A Text Book of Fluid Mechanics and Hydraulic Machines**", S.Chand and Company, NewDelhi, 2015.*
3	*A.K.Jain,"**Fluid Mechanics**",Khanna Publishers,New Delhi,2021.*
4	*M.K.Natarajan"**Principles of Fluid Mechanics**", Anuradha Agencies,Vidayal Karuppur,Kumbakonam, 2008*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the properties of fluids and fluid statics	K2
CO2	Apply the continuity equation for solving fluid flow problems.	K3
CO3	Apply the principles of Euler's equation and Bernoulli's equation in real situation of fluid problems	K3
CO4	Examine the fluid flow behavior for laminar and turbulent flows.	K3
CO5	Analyze the boundary layer separation drag and lift on immersed bodies.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**	**PSO3**
CO1	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
CO2	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
CO4	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
CO5	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
22CES 307	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1
CO2	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1
CO3	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1
CO4	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1
CO5	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20				100
CAT2	40	40	20				100
Individual Assessment 1 / Case Study 1/ Seminar 1/ Project1	40	40	20				100
Individual Assessment 2 / Case Study 2/ Seminar 2/ Project 2	40	40	20				100
ESE	40	40	20				100

22CES308	ENGINEERING GEOLOGY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	This course will familiarize the students on the role and importance of geology in civil engineering, apart from learning the methods of surface and subsurface investigations using geological, geophysical and remote sensing methods.

UNIT – I	**INTRODUCTION AND GEOMORPHOLOGY**	**9 Periods**

Interrelationship between Geology and civil engineering – Branches of Geology – Earth Structure and composition –Concept of Plate tectonics, Geological processes, agents and kinds – Weathering, wind, rivers and their Engineering significance - Volcano – Landforms, Materials and Types of Eruptions, Ground water – Properties of rock – Geological work of ground water.

UNIT – II	**MINERALOGY**	**9 Periods**

Physical and Chemical properties of minerals – Study of the following rock forming minerals – Quartz family, Felspar family, Biotite, Muscovite, Calcite, Magnesite, Ore minerals - Hematite, Magnetite, Bauxite, Graphite, Coal and Oil and natural gas – Clay minerals – Properties and their economic uses.

UNIT – III	**PETROLOGY AND GEOTECHNICAL PROPERTIES OF ROCKS**	**9 Periods**

Formation of Igneous rocks, Sedimentary rocks and Metamorphic rocks, Texture and Structure, Classification and Engineering properties of Granite, Pegmatite, Dolerite and Basalt., formation and Engineering properties of Sandstone, Limestone and Shale. Agents, kinds and Engineering properties of metamorphic rocks - Quartzite, Marble, Slate, Gneiss and schist. Influence on strength of rocks. Rock Mass Rating (RMR), Rock Quality Designation (RQD), Geological Strength Index (GSI).

UNIT – IV	**STRUCTURAL GEOLOGY & ELEMENTS OF SEISMOLOGY**	**9 Periods**

Attitude of beds Dip and Strike - Uses of Clinometer compass – Outcrops – Geological maps – their uses – Structural features – Folds, Faults and Joints – their engineering significance. - Earthquakes – Causes and effects, Seismic waves and seismographs, Elastic rebound theory, Mercelli's scale of intensity, Magnitude - Richter's scale and Earthquake Zones in India -Engineering Considerations.

UNIT – V	**GEOLOGICAL INVESTIGATIONS FOR ENGINEERING STRUCTURES AND GEOHAZARDS**	**9 Periods**

Geological investigations pertaining to the constructions of Dam and Reservoir, Tunnels and Road cuttings, Geophysical investigations - Seismic and electrical resistivity methods and data interpretation. Landslides – causes and prevention – Sea erosion and coastal protection, Tsunami – causes and mitigation. Case studies from India.

Contact Periods: **Lecture: 45 Period** **Tutorial: 0 Period** **Practical: 0 Period** **Total: 45 Periods**

TEXT BOOKS:

1	*Parbin Singh, "**Engineering and General Geology**", Katson Publication House, 2015.*
2	*Varghese, P.C., "**Engineering Geology for Civil Engineering"** PHI Learning Private Limited,New Delhi, 2012.*

REFERENCES:

1	*F.G.Bell. "**Fundamentals of Engineering Geology"**, B.S. Publications. Hyderabad 2011.*
2	*N. Chenna Kesavulu. "**Textbook of Engineering Geology"**, Macmillan India Ltd., 2009.*
3	*A.B.Roy , "**Fundamentals of Geology**", Narosa Publication,2010.*
4	*S.M.Mathur, "**Elements of Geology**", PHI learning private limited New Delhi 2011.*
5	*Bangar.K.M, "**Principles of Engineering Geology**", Standard Publishers& Distributors,1705- B, Naisarak, Delhi,2010.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Know the internal structure of earth and its relation to volcanism and the various geological agents.	K2
CO2	Identify the properties and uses of Minerals.	K1
CO3	Identify the formation and Engineering properties of rocks.	K2
CO4	Apply fundamental knowledge in structural geology like fault, fold and Joints	K3
CO5	Use all the geological knowledge in design and construction of major civil engineering structures, in addition to mitigating geological hazards such as earthquakes, landslides and Tsunami that affect civil engineering structures.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	-	-	-	-	-	1	-	-	-	-	-	1	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	-	-	-	-	1	-	-	-	3	-	-	1	2	-
CO4	-	1	-	3	-	1	1	2	-	3	1	1	1	2	-
CO5	-	1	1	3	1	2	2	2	-	1	1	1	1	2	-
22CES 308	2	1	1	3	1	1	1	2	-	3	1	1	1	2	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1,1.3.1,1.2.2,1.4.1,2.1.2,3.1.1,7.1.1,7.1.2
CO2	1.3.1,1.2.1,2.1.2,2.2.2,3.1.1,7.1.1,7.1.2
CO3	1.2.1,2.1.2, 2.2.2,3.1.1, 3.1.5, 6.1.1,6.2.2,7.1.1, 7.1.2
CO4	1.3.1,2.1.2,3.1.5 ,6.1.1,6.2.2,7.1.1,7.1.2,7.2.2,9.1.1
CO5	1.3.1,1.4.1,2.1.2,3.1.1,6.1.1,6.2.2,7.1.1, , 7.1.2,7.2.2,9.1.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50					100
CAT2	40	40	20				100
Individual Assessment 1/ Case Study 1/ Seminar 1/ Project1	40	40	20				100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	40	40	20				100
ESE	40	40	20				100

22CPC301	MECHANICS OF SOLIDS I	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
ENGINEERING MECHANICS	PC	3	0	0	3

Course Objectives	To understand the concepts and the behavior of Engineering materials under the action of axial, bending and twisting forces in order to evaluate the strength of the materials.

UNIT – I	**STRESS, STRAIN AND DEFORMATION OF SOLIDS**	**9 Periods**

Introduction – Mechanical properties of materials – Hooke's law – Stress Strain Diagram for Mild Steel, TOR Steel, Concrete – Principle of superposition - Deformation of simple, compound bars and bars of Varying sections – Elastic constants - Volumetric strains – Thermal Stresses and Strains - Strain Energy due to Axial Force – Resilience – Stresses due to Impact and Suddenly Applied Load. Stresses and deformation in thin cylindricalshell due to internal pressure.

UNIT – II	**SHEAR FORCE AND BENDING MOMENT IN BEAMS**	**9 Periods**

Beams and Bending – supports and loads - Shear Force and Bending Moment Diagrams for determinate beams – Relationship between Rate of Loading, Shear Force, Bending Moment – Point of Contra Flexure.

UNIT – III	**BENDING AND SHEAR STRESSES IN BEAMS**	**9 Periods**

Theory of Simple Bending – Analysis of Beams for Stresses - Stress Distribution at a Cross Section due to Bending Moment and Shear Force for determinate beams - Flitched Beams – Combined Direct and Bending Stresses – Condition for No Tension in a section – Strain Energy due to Flexure, Transverse Shear – Shear Stress Distribution.

UNIT – IV	**TORSION**	**9 Periods**

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Strain Energy due to Torsion – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – Leaf Springs – springs in series and parallel.

UNIT – V	**COMPLEX STRESSES AND TRUSS**	**9 Periods**

State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress–Principal Strains and Direction – Mohr's circle method.

Analysis of pin jointed plane determinate trusses by method of joints and method of sections – Analysis of space truss by tension coefficient method.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOKS:

1	*Rajput R.K. "**Strength of Materials (Mechanics of Solids"**, S.Chand & company Ltd., New Delhi, 7th edition, 2018.*
2	*Rattan S.S., "**Strength of Materials**", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.*

REFERENCES:

1	*Singh. D.K., "**Strength of Materials**", Ane Books Pvt Ltd., New Delhi, 2021.*
2	*Egor P Popov, "**Engineering Mechanics of Solids**", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.*
3	*Beer. F.P. & Johnston. E.R. "**Mechanics of Materials**", Tata McGraw Hill, 8th Edition, New Delhi 2019.*
4	*Vazirani. V.N, Ratwani. M.M, Duggal .S.K **"Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1"**, Khanna Publishers, New Delhi 2014.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe the fundamental concepts of stress, strain and their deformations under axial loads.	K2
CO2	Draw shearforceandbending momentdiagrams for different loadings on the determinate beams	K3
CO3	Sketch the distribution of stresses for various cross sections subjected to transverse loadings.	K3
CO4	Apply elastic theory of torsion in designing of shafts and helical springs.	K3
CO5	Analyse the determinate trusses and 2D stress elements.	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping														
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	0	0	0	0	0	0	0	0	0	3	3	2
CO2	3	2	1	1	0	0	0	0	0	0	0	0	3	3	2
CO3	3	3	1	1	0	0	0	0	0	0	0	0	3	3	2
CO4	3	3	1	0	0	0	0	0	0	0	0	0	3	3	2
CO5	3	2	1	1	0	0	0	0	0	0	0	0	3	3	2
22CPC 301	3	3	1	1	0	0	0	0	0	0	0	0	3	3	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.2.1, 1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,3.1.1,3.1.3,3.2.1,3.4.1
CO2	1.1.1, 1.2.1, 1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.4.1,2.4.4,3.1.1,3.1.3,3.2.1,3.4.1,4.3.3
CO3	1.1.1, 1.2.1, 1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.3,3.2.1,3.4.1,4.3.3
CO4	1.1.1, 1.2.1, 1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,2.4.4,3.1.1,3.1.3,3.2.1,3.4.1
CO5	1.1.1, 1.2.1, 1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.3,2.3.1,2.3.2,2.4.1,,3.1.1,3.1.3,3.2.1,3.4.1,4.3.3

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	80					100
CAT2	20	80					100
Individual Assessment 1/ Case Study 1/ Seminar 1 / Project1	10	90					100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	10	90					100
ESE	20	80					100

22CPC302	CONSTRUCTION MATERIALS AND TECHNOLOGY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	2	0	2	3

Course Objectives	To learn the properties, applications and testing procedures of construction materials and the construction practices for different types of structural elements.

UNIT – I	**CONSTRUCTION MATERIALS**	**6+6 periods**

Properties, composition, types and tests : Stones – Bricks – Hollow blocks - Concrete- Timber – Wood products – Structural steel and high tensile steel – Ferrous and non ferrous metal – Glass – Polymer products – Green materials.

UNIT – II	**MASONRY AND PLASTERING**	**6+6 periods**

Stone masonry – Brick masonry – Composite masonry – Types of wall – Arches and Lintels. Plastering - Materials and Methods of plastering – Types of plastering – Tools for plastering – Preparation and uses of cement mortar–Defects in plastering–pointing.

UNIT – III	**FLOORING AND ROOFING**	**6+6 periods**

Floors – Requirements of good floor – Floor finishing materials – Classifications – Terrazzo flooring – Cement concrete flooring–Suitability of floors for various applications. Damp Proof Course– Causes and effect of dampness – Materials and Methods of damp proofing – Anti-termite treatment.

Roofs– Roofing materials – Requirements – Types – Pitched roof – Flat roof – Flat and Ribbed slab.

Ramps and Escalators.

UNIT – IV	**DOORS,WINDOWS AND PAINTING**	**6+6 periods**

Doors and Windows– Types – Fixtures and Fastening – Ventilators.

Painting – Paints and painting – Classification of paints – Painting on new and old surfaces of steel, timber and masonry wall –Defects in painting.

UNIT – V	**CONSTRUCTION PRACTICES**	**6+6 periods**

Centering and shuttering – Formwork – Scaffolding – Plumbing Services.

Market forms of steel – Fabrication and erection of steel trusses – Frames – Launching girders. Housing Modernization – Construction of tall structures – Lift modernization – Automation in construction – Introduction to sustainable practices – Concept of carbon footprint.

Contact Periods: **Lecture: 30 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 60 Periods**

TEXT BOOKS:

1	*Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, **"Building construction"**, Laxmi Publications Pvt.Ltd., 2016.*
2	*Bindra.S.P and Arora.S.P, **"Building construction"**,Dhanpat Rai Publication Pvt.Ltd.,2010.*

REFERENCES:

1	*Edward Allen, Joseph Iano,**"Fundamentals of Building Construction : Materials and Methods"**, Wiley Publishers,2014.*
2	*Maden Mehta, **"Building Construction"**, Pearson Education Publishers, 2016.*
3	*Varghese P.C ,**"Building Construction"**, Prentice Hall of India,2012.*
4	*Rangwala, **"Building construction"**, Charotar Publishing House Pvt.Ltd., 2016.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Select the suitable materials for building construction	K2
CO2	Acquire knowledge on different masonry and plastering works.	K2
CO3	Select the suitable type of floors, roofs, stairs and dampness preventing methods for practical applications.	K2
CO4	Apply knowledge for selection of doors, windows paints and materials for buildings.	K2
CO5	Know the different construction practices existing in construction field.	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping															
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	1	0	3	3	3	2	2	0	3	2	2	2
CO2	3	1	1	1	0	3	3	3	2	2	0	3	2	1	2
CO3	3	1	1	1	0	3	3	3	2	2	0	3	2	1	2
CO4	3	1	1	1	0	3	3	3	2	2	0	3	2	1	2
CO5	3	2	1	1	1	3	3	3	3	2	0	3	2	1	2
22CPC302	3	2	1	1	1	3	3	3	3	2	0	3	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 12.1, 12.2, 12.3
CO2	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 12.1, 12.2, 12.3
CO3	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 12.1, 12.2, 12.3
CO4	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 12.1, 12.2, 12.3
CO5	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 12.1, 12.2, 12.3

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Rememberin g (K1) %**	**Understandin g (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluatin g (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	60					100
CAT2	40	60					100
Individual Assessment 1/ Case Study 1/ Seminar 1 / Project1	40	60					100
Individual Assessment 2/ Case Study 2/ Seminar 2 / Project 2	40	60					100
ESE	40	60					100

22CPC303	SURVEYING	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	To understand the basic principle and concepts of different surveying methods to calculate various measurements using survey instruments.

UNIT – I	**INTRODUCTION, CHAIN SURVEYING AND COMPASS SURVEYING**	**9 Periods**

Definition- Principles - Classification – Field and Office work – Scales – Conventional Signs.

Chain Survey - Instruments – Ranging – Types - Obstacles in Chaining – Chain and Tape corrections –Setting out Perpendiculars.

Prismatic Compass – Surveyor's Compass – Working and use of compass - Bearing – Systems and Conversions – Computation of angles from bearing - Local Attraction - Magnetic Declination – Dip – Traversing – Adjustment of error.

UNIT – II	**LEVELLING AND CONTOURING**	**9 Periods**

Basic Terms - Types of Level – Fundamental Axes - Levelling staff – Bench Marks – Temporary and Permanent Adjustments – Types of Levelling - Curvature and Refraction correction – Reciprocal Levelling – Calculation of Areas and Volumes.

Contouring – Characteristics and Uses of Contours – Methods of contouring.

UNIT – III	**THEODOLITE SURVEYING AND TACHEOMETRIC SURVEYING**	**9 Periods**

Theodolite – types – Terms - Temporary and Permanent Adjustments – Measurement of Horizontal Angles by Repetition and Reiteration – Closing Error and Distribution – Omitted measurements. Tacheometric surveying –- Stadia method - fixed hair method - Determination of constants of the tacheometer - use of anallactic lens - distance and elevation formula for inclined sights with vertical and normal holding staff – movable hair method - Tangential method - subtense bar method.

UNIT – IV	**CURVES AND HYDROGRAPHIC SURVEYING**	**9 Periods**

Simple curves – elements - Setting out of curves - Linear and angular methods - Compound and Reverse curves - elements.

Shore line survey–Sounding–Equipments–Locating Sounding-Reduction.

UNIT – V	**TRIANGULATION AND MODERN SURVEYING INSTRUMENTS**	**9 Periods**

Vertical and horizontal control - Triangulation-classification – Intervisibility - Triangulation Figures – Strength of figure -Signals and Towers - Base line measurements - Satellite stations and reduction to centre.

Trigonometrical Levelling - Geodetical observations - Curvature correction - Refraction correction – Axis signal correction – Difference in elevation.

Total Station – Principle – classification - working. Applications of Drone Surveying.

GPS - Developments – Basic Concepts – Segments – Applications.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOKS :

1	*Punmia B.C, Ashok K Jain, Arun K Jain.* ***"Surveying, Vol. I &II"****, Lakshmi Publications, 2017.*
2	*Kanetkar.T.P,and Kulkarni.S.V,* ***"Surveying and Levelling, Vol. I & II"****, Pune Vidyarthi Griha Prakashan,2014.*

REFERENCES :

1	*Basak N.N,* ***"Surveying and Levelling"****, Tata McGraw-Hill, Publishing Company, 2nd edition,2014.*
2	*BhavikattiS.S,****"Surveying and Levelling,Vol.I&II"****, I.K. International Pvt. Ltd., 2010.*
3	*Duggal S.K.* ***"Surveying,Vol.I&II"****, Tata McGraw-Hill Publishing Company,2017.*
4	*Charles D Ghilani, Paul R Wolf.,* ***"Elementary Surveying"****, Prentice Hall,2012.*
5	*Chandra A.M.,****"Plane Surveying"****, New Age International Pvt. Ltd, 2015.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Calculate linear and angular measurements using compass and chain.	K2
CO2	Interpret level data using different types of levelling techniques and plot contour map by various contouring methods.	K2
CO3	Determine the horizontal distances, vertical distances and area by using theodolite and tacheometer.	K3
CO4	Set out the curves using survey instruments and apply the principles of hydrographic surveying.	K3
CO5	Execute triangulation method, Trigonometric levelling and apply modern surveying principles and techniques.	K2

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	3	3	-	-	-	-	-	-	2	1	2	2
CO2	2	3	-	3	3	-	-	-	-	-	-	2	-	2	2
CO3	3	3	-	3	3	-	-	-	-	-	-	2	-	2	2
CO4	3	3	-	3	3	-	-	-	-	-	-	2	1	2	2
CO5	3	3	-	3	3	-	-	-	-	-	-	2	1	2	2
22CPC303	3	3	-	3	3	-	-	-	-	-	-	2	1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.2, 1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2, 2.2.3, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	1.1.2, 1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2, 2.2.3, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO3	1.1.2, 1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2, 2.2.3, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO4	1.1.2, 1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2, 2.2.3, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO5	1.1.2, 1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2, 2.2.3, 2.4.1, 2.4.2, 2.4.3, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1,4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Rememberin g (K1) %	Understandin g (K2) %	Applying (K3) %	Analyzin g (K4) %	Evaluatin g (K5) %	Creatin g (K6) %	Total %
CAT1	40	40	20	-	-	-	100
CAT2	40	40	20	-	-	-	100
Individual Assessment 1/ Case Study 1/ Seminar 1/ Project1	40	40	20	-	-	-	100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	40	40	20	-	-	-	100
ESE	40	40	20	-	-	-	100

22CES309	MATERIALS TESTING LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	To deal with experimental determination and evaluation of mechanical characteristics and behaviour of construction materials and to familiarize experimental procedures and common measurement instruments, equipment and devices.

LIST OF EXPERIMENTS

1. Mechanical properties of mild steel rod as per IS Code 1608 (2005)
2. Mechanical properties of tor steel rod as per IS Code 1786 (2008)
3. Weight per running metre of steel rod
4. Tension and compression test on springs.
5. Test on Bricks: Visual observation, Compression test, Water absorption test and Efflorescence test as per IS 3495-1 to 4 (1992)
6. Hardness test on different metals.
7. Deflection test on simply supported beams (for different metals).
8. Deflection test on cantilever beams (for different metals).
9. Bending test on rolled steel joist
10. Flexure test on tiles
11. Charpy and Izod Impact Test
12. Compression test on Hallow/Concrete Blocks

Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Determinethetensilestrength ofmaterials	K3
CO2	Obtain bending properties of structural materials	K3
CO3	Determinethehardness propertiesofthematerials	K3
CO4	Predict the compressive strength of the materials	K3
CO5	Obtaintheimpact andtorsionalstrengthofthematerials	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-
CO2	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-
CO3	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-
CO4	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-
CO5	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-
22CES309	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1 ,3.1.4,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1
CO2	1.3.1,1.4.1 ,3.1.4,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1
CO3	1.3.1,1.4.1 ,3.1.4,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1
CO4	1.3.1,1.4.1 ,3.1.4,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1
CO5	1.3.1,1.4.1 ,3.1.4,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1

22CPC304	SURVEY LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	To deal with different surveying methods and measure the distances, areas using different surveying instruments and also to enable setting out of foundation and curves.

LIST OF EXPERIMENTS

1. Chain Surveying – Open and Closed Traversing
2. Compass Surveying – Intersection method
3. Compass Surveying - Traversing
4. Plane table surveying –Introduction- Intersection method
5. Levelling –Differential Levelling and Fly Levelling
6. Measurement of horizontal angles by Repetition and Reiteration methods.
7. Height and Distance – Single Plane method and Double Plane method.
8. Tacheometric Surveying – Stadia, Tangential method and Subtense bar method
9. Total Station Surveying.
10. Setting out of foundation and Curves

Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Effectively handlethesurveyinginstrumentslikeChain,Compass,planetable,Dumpy level and Theodolite.	K3
CO2	Accurately measuredistances,areas,anglesandlevels using survey instruments.	K3
CO3	Calculate the levels and distances in the field for various works.	K3
CO4	Setout foundations and curves for various Civil Engineering projects.	K3
CO5	Handle and measure using advanced surveying instruments like Total Station.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	-	1	2	-	-	-	-	-	-	-	-	1	1	-
CO2	2	-	1	2	1	-	-	-	-	-	-	-	1	1	-
CO3	2	-	1	2	1	-	-	-	-	-	-	-	1	1	-
CO4	2	-	1	2	1	-	-	-	-	-	-	-	1	1	-
CO5	2	-	1	2	1	-	-	-	-	-	-	-	1	1	-
22CPC304	2	-	1	2	1	-	-	-	-	-	-	-	1	1	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1,1.3.1,1.4.1 ,3.1.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1.4.3.1
CO2	1.2.1,1.3.1,1.4.1 ,3.1.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1.4.3.1,5.1.1
CO3	1.2.1,1.3.1,1.4.1 ,3.1.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1.4.3.1,5.1.1
CO4	1.2.1,1.3.1,1.4.1 ,3.1.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1.4.3.1,5.1.1
CO5	1.2.1,1.3.1,1.4.1 ,3.1.1,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1.4.3.1,5.1.1

22CES410	APPLIED HYDRAULICS AND FLUIDMACHINERY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
MECHANICS OF FLUIDS	ES	3	0	0	3

Course Objectives	To understand the performance of pumps and turbines, open channel hydraulics with different types of flow, dimensional analysis and impulse momentum principle for the performance of hydraulics machines.

UNIT – I	OPENCHANNELFLOW	9 Periods

Uniform flow - Velocity measurement - Manning's and Chezy's formula – Roughness coefficients - Critical depth and critical velocity - Most economical sections - Wide open channel - Specific energy curve - Critical flow - Dynamic equations of gradually varied flow - Assumptions - Characteristics of flow profiles - Draw down and back water curves - Hydraulic jump - Types – Energy dissipation.

UNIT – II	DIMENSIONALANALYSIS	9 Periods

Units and Dimensions – Dimensional Homogeneity -Rayleigh's and Buckingham methods – Non-dimensional numbers – Model study and Similitude–scale effects and distorted model – Applications of models study.

UNIT – III	MOMENTUMPRINCIPLE	9 Periods

Impulse momentum Principle and equation - Impact of Jet – force exerted by a jet on normal, inclined and curved surfaces for stationary and moving vanes- Angular momentum principle - Inlet and outlet velocity triangles – Applications of impulse momentum principle.

UNIT – IV	TURBINES	9 Periods

Turbines – Classification – Impulse and Reaction Turbines – Tangential flow, radial flow and axial flow turbines-work done and efficiency - draft tube and cavitation - Selection of Turbines-operating characteristic curves of turbines- Specific speed- Runaway Speed.

UNIT – V	PUMPS	9 Periods

Pumps– Classifications of pumps –Centrifugal pump –Work done and Efficiency – Priming - Net positive Suction Head - Cavitation in Pumps - multistage Pumps. Reciprocating pump -Work done and Efficiency - negative slip - air vessels - indicator diagram–Working of Jet Pump and submersible pump.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOK

1	*P.N.Modi and S.N.Seth, **"Hydraulics and Fluid Mechanics, Including Hydraulic Machines"**, Standard Book House, NewDelhi, 2015.*
2	*R.K.Bansal, **"Fluid Mechanics and Hydraulic Machines"**, Laxmi Publications (P) Ltd., NewDelhi,2018.*

REFERENCES

1	*Subramanya K.,**"Flow In Open channels"**, Tata McGraw-Hill Publishing Company,2015.*
2	*S.Ramamurtham and R.Narayanan, **"Hydraulics Fluid Mechanics and Fluid Machines"** Dhanpat Rai Publishing Company(P) Limited, 2014.*
3	*R.K.Rajput,**"A Text Book of Fluid Mechanics and Hydraulic Machines"**, S.Chand and Company, NewDelhi, 2015.*
4	*D.S.Kumar, **"Fluid Mechanics and Fluid Power Engineering"**, S.K.Kataria & Sons, NewDelhi,2012.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	GaininsightknowledgeonOpenchannelhydraulics andtosolvepracticalproblems.	K2,K3
CO2	Apply the concepts of dimensional analysis for fluid flow problems	K3
CO3	Apply the impulsemomentumprincipleforthedeterminationofhydrodynamicforces.	K3
CO4	Analyze the performance of turbines and design of turbines.	K3
CO5	Analyze the performance of pumps and design of pumps.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping														
COs / POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	0	1	0	0	0	0	0	0	0	0	0	2	1
CO2	2	1	0	1	0	0	0	0	0	0	0	0	0	2	1
CO3	2	1	0	1	0	0	0	0	0	0	0	0	0	2	1
CO4	2	1	1	3	0	0	0	0	0	0	0	0	0	2	1
CO5	2	1	1	3	0	0	0	0	0	0	0	0	0	2	1
22CES 410	2	1	1	3	0	0	0	0	0	0	0	0	0	2	1
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.3.1, 2.4.1, 4.1.2
CO2	1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.3.1, 2.4.1, 4.1.2
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.3.1, 4.1.2
CO4	1.1.1, 1.3.1,2.1.2,2.1.3, 2.3.2, 3.2.2, 3.4.2, 4.1.1, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.3
CO5	1.1.1, 1.3.1, 2.1.2, 2.1.3, 2.3.2, 3.2.2, 3.4.2, 4.1.1, 4.1.3, 4.1.4, 4.2.1, 4.3.1, 4.3.3

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	50	30				100
CAT2	20	50	30				100
Individual Assessment 1/ Case Study 1/ Seminar 1 / Project1	20	50	30				100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	20	50	30				100
ESE	20	50	30				100

22CPC405	MECHANICS OF SOLIDS II	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
MECHANICS OF SOLIDS I	PC	3	0	0	3

Course Objectives	To study the different methods used for beam deflection analysis, analysis of Indeterminate beams, unsymmetrical bending, columns, theory of elastic failures and stress in thick cylinders.

UNIT – I	**DEFLECTION OF BEAMS**	**9 Periods**

Differential Equation for elastic curve – Double Integration Method – Macaulay's Method – Moment Area Method – Conjugate Beam Method – Stepped beams

UNIT – II	**STATICALLY INDETERMINATE BEAMS**	**9 Periods**

Propped Cantilever Beams – Fixed Beams – Method of Consistent Deformation – Continuous Beams – Theorem of Three Moments – Calculation of reactions, Bending Moments and Shear Force – Shear Force and Bending Moment Diagrams (for all Types of Loadings, Couple).

UNIT – III	**INDETERMINATE TRUSSES AND COLUMNS**	**9 Periods**

Analysis of Plane trusses with maximum two redundant members – Trusses with lack of fit – Temperature effects. Members Subjected to Axial Load – eccentric load – Slenderness Ratio – End Conditions – Buckling Load for Columns - Euler's Theory – Assumptions and Limitations – Rankine - Gordon Formula – Empirical Formula – Straight Line Formula – Columns Subjected to Eccentric Loading .

UNIT – IV	**UNSYMMETRICAL BENDING AND SHEAR CENTRE**	**9 Periods**

Stresses due to Unsymmetrical Bending of Beams for Symmetrical Sections – Moment of Inertia – Product of Inertia – Principal Moment of Inertia - Shear Centre - Definition – Shear Centre for Sections Symmetrical about One Axis

UNIT – V	**THICK CYLINDERS AND THEORIES OF ELASTIC FAILURE**	**9 Periods**

Lame's Equation – Hoop Stress and Radial Stress Distribution – Compound Cylinders – Wire Wound Cylinders – Shrink Fit.

Theories of Elastic Failure – Factor of Safety – Graphical Representation of Theories for Two Dimensional Stress System.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical:0 Periods Total:45 Periods**

TEXT BOOKS:

1	*Vaidyanathan.R, Perumal. P and Lingeswari.S, **"Mechanics of Solids and Structures, Volume I**", Laxmi Publications Pvt Ltd, Chennai, 2017.*
2	*L.S.Negi, "**Strength of Materials**", Tata McGraw Hill Education Pvt.Ltd, 2010.*

REFERENCES:

1	*Robert L. Mott, **"Applied Strength of Materials"**, PHI Learning Pvt Ltd., New Delhi,2009*
2	*Ferdin and Beer, E.Russell Johnston and John Dewolf, **"Mechanics of Materials"**, McGraw Hill Education, 2015.*
3	*L.S. Srinath, **"Strength of Materials",** Macmillan Publishers India,2000.*
4	*Bansal RK **"Strength of Materials"**, Laxmi Publications, New Delhi,2010.*
5	*Jhunarkar.S.B. and Shah.H.J, **"Mechanics of Structures",** Vol. I, Charotar Publishing House, New Delhi,2016.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	To impart knowledge on deflection of beams in various situations using different methods.	K3
CO2	To identify the behaviour of statically indeterminate beams	K3
CO3	To recognize the behaviour of columns with different end conditions.	K3
CO4	To develop and understand the concepts of unsymmetrical bending of beams and shear centre.	K3
CO5	To understand the theory thick cylinders and the theory of elastic failures.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	2	1	1	-	-	-	1	-	-	-	1	1	-
CO2	3	3	2	2	-	-	-	-	1	-	-	-	-	2	-
CO3	3	2	2	1	1	-	-	-	1	-	-	-	1	-	-
CO4	3	1	2	1	-	-	-	-	1	-	-	-	1	1	-
CO5	3	1	2	-	-	1	-	-	1	-	-	-	-	1	-
22CPC405	3	2	2	1	1	1	-	-	1	-	-	-	1	1	-
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.3.3, 4.3.4, 5.2.1, 5.2.2, 6.1.1, 9.1.2
CO2	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.3.3, 4.3.4, 5.1.1, 5.2.1, 9.1.2
CO3	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.3, 2.4.4, 3.1.1, 3.1.3, 3.2.3, 3.4.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 9.1.2
CO4	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.3.1, 2.4.1, 3.1.1, 3.1.3, 3.1.5, 3.2.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 9.1.2
CO5	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.3.2, 2.4.4, 3.1.1, 3.1.3, 3.1.5, 3.1.6, 3.2.1, 3.2.3, 3.3.1, 3.4.1, 4.1.1, 4.1.2, 4.2.1, 4.3.2, 4.3.3, 4.3.4, 5.2.1, 5.3.1, 9.1.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	40	30				100
CAT2	20	40	40				100
Individual Assessment 1/ Case Study 1/ Seminar 1/ Project1	30	40	30				100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	20	40	40				100
ESE	30	40	30				100

22CPC406	CONCRETE TECHNOLOGY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
CONSTRUCTION MATERIALS AND TECHNOLOGY	PC	3	0	0	3

Course Objectives	To understand about various concrete making materials, the properties of fresh and hardened concrete, special concrete and mixdesignforconcrete.

UNIT – I	INGREDIENTSOFCONCRETE	9 periods

Cement – constituents - Hydration – Tests on cement – Types of cement – Aggregates – properties and uses – Classification of aggregates – Properties and test on aggregates – gradation – Quality of water – Admixtures – Chemical Admixtures and mineral admixtures.

UNIT – II	CONCRETING OPERATIONS	9 periods

Concreting operations: Batching, mixing, transportation, placing, compaction, curing and finishing of concrete. Forms for Concreting: Different types of formworks for beams, slabs, columns, material used for formwork, requirement of good form work. Stripping time for removal of formworks as per IS456 – 2000 provision for different structural members. Water Proofing: Importance and need of water proofing. Methods of water proofing and materials used for water proofing. Joints in Concrete Construction: Types of joints, joining old and new concrete. Methods of joining, materials used for filling joints.

UNIT – III	PROPERTIESOFCONCRETE	9 periods

Properties of fresh concrete – Workability – Segregation – Bleeding – Test for fresh concrete properties – Properties of hardened concrete – Strength – Stress – Strain characteristics – Modulus of Elasticity – Shrinkage – Creep – Thermal properties – Permeability – Test for hardened concrete properties – Introduction to micro structural properties of concrete - Non-Destructive Test.

UNIT – IV	MIX DESIGN AND QUALITYCONTROLOFCONCRETE	9 periods

Quality Control - Frequency of sampling – Statistical analysis of test results – standard deviation – Coefficient of variation – Characteristic strength – Acceptance and rejection Criteria – Importance ofwater cement ratio – Importance of cover to concrete. Nominal mixes – Design Mixes – factors influencing the design mix – Mix Design by ACI method, ARE method and DOE method.

UNIT – V	SPECIALCONCRETES AND CONCRETING METHODS	9 periods

High Performance Concrete – Lightweight Concrete – Self Compacting Concrete – Polymer Concrete – Fibre Reinforced Concrete - 3D printing of concrete.

Special Concreting Methods: Pumped Concrete, Ready mix Concrete, Under-water Concrete, Hot and Cold weather Concreting, Precast Concrete, Pre-placed Concrete.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOKS:

1	*Shetty M.S and Jain A.K, **"Concrete Technology - Theory and Practice"**, S.Chand & Company, New Delhi, 2018.*
2	*Santha kumar A.R ,**"Concrete Technology"**,S.Chand Publishers, 2018.*

REFERENCES:

1	*Gambhir M.L, **"Concrete Technology - Theory and Practice"**, Tata Mc-Graw Hill Company,2013.*
2	*IS 10262 –2019, Concrete Mix Proportioning – Guidelines.*
3	*ACI 211.1-91, Standard Practicefor Selecting Proportions for Normal, Heavy weight and Mass Concrete, American Concrete Institute.*
4	*NevilleA.M **"Properties of Concrete"**, Pearson Education India,,2012*
5	*Povindar K. Mehta, Paulo J. M. Monteiro, **"Concrete: Microstructure, Properties, and Materials"**, Mc-Graw Hill Company, 2014.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the properties and role of ingredients like cement, aggregate, admixtures in concrete.	K2
CO2	Choose the suitable formwork and methods of concrete production for construction.	K2
CO3	Infer the behavior of fresh and hardened concrete.	K2
CO4	Proportion the concrete using various mix design concepts.	K2
CO5	Select appropriate type of concrete for specific requirements.	K2

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	0	3	3	3	2	3	0	3	2	3	2
CO2	3	1	1	1	0	3	3	3	3	3	0	3	2	3	2
CO3	3	1	1	1	0	3	3	3	2	2	0	3	2	2	1
CO4	3	1	1	1	0	3	3	3	2	3	1	3	2	2	1
CO5	3	2	1	1	1	3	3	3	2	2	1	3	2	3	2
22CPC406	3	2	1	1	1	3	3	3	3	3	1	3	2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 11.2, 12.1, 12.2, 12.3
CO2	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 11.2, 12.1, 12.2, 12.3
CO3	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 11.2, 12.1, 12.2, 12.3
CO4	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 11.2, 12.1, 12.2, 12.3
CO5	1.2, 1.3, 1.4, 2.1, 2.2, 2.4, 3.1, 3.2, 3.4, 4.1, 4.3, 6.1, 6.2, 7.1, 7.2, 8.1, 8.2, 9.1, 9.2, 10.1, 10.2, 10.3, 11.2, 12.1, 12.2, 12.3

ASSESSMENT PATTERN – THEORY (Times New Roman, Size 11)

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
Individual Assessment 1/ Case Study 1/ Seminar 1/ Project1	40	60					100
Individual Assessment 2/ Case Study 2/ Seminar 2/ Project 2	40	60					100
ESE	40	60					100

22CPC407	DESIGN OF REINFORCED CONCRETE ELEMENTS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
MECHANICS OF SOLIDS I	PC	3	0	0	3

Course Objectives	Understand the behavior and design of reinforced concrete components and systems subjected to gravity loads according to INDIAN STANDARD building code requirements

UNIT – I	REINFORCEDCONCRETEMATERIALS	9 Periods

Introduction to R.C structures – Review of basic material properties - Concrete and Reinforcing steel - Objectives of structural Design- Stages in RCC structural design process for a building- Types of load on structures and load combinations –Load transfer in framed structures - Design philosophies – Basic design concepts –working stress, ultimate load and limit state methods – Analysis: Moment of resistance for Rectangular beams.

UNIT – II	LIMIT STATE DESIGN OF BEAMS	9 Periods

Design of singly and doubly reinforced rectangular and flanged beams - Design of beams for bending, shear and torsion - bond and anchorage – deflection.

UNIT – III	LIMIT STATE DESIGN OF SLABS& STAIRS	9 Periods

Behaviour of one way and two way slabs – Design and detailing of one way and two way rectangular slabs subjected to uniformly distributed load - Design of lintel - lintel cum sunshade – Stairs - Loads on Staircase – Design of Dog legged staircase.

UNIT – IV	LIMIT STATE DESIGN OF COLUMNS	9 Periods

Classification of columns - Axial, uniaxial and biaxial bending - Braced and unbraced columns - Orientation of columns in buildings - Design of columns – Use of interaction charts.

UNIT – V	LIMIT STATE DESIGN OF FOOTINGS	9 Periods

Behaviour of concentric and eccentric footing - Design of axially loaded square and rectangular pad and sloped isolated footing – Design of wall footing.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOKS:

1	*Pillai, S. U.andMenon, D,**"Reinforced Concrete Design"**, Tata McGraw Hill, 2021*
2	*SubramanianN, **"Design of Reinforced Concrete Structures"**, Oxford University Press, 2014.*

REFERENCES:

1	*VargheseP.C, **"Limit State Design of Reinforced Concrete"**, Prentice hall of India Pvt.Ltd., 2008*
2	*Dayaratnam P., **"Design of Reinforced Concrete Structures"**, Oxford & IBH publishing Co. Pvt.Ltd.,2018.*
3	*Shah V.L and Karve S.R, **"Limit State Theory and Design of Reinforced Concrete"**, Structures Publications, 2018.*
4	*Krishnaraju N, **"Design of Reinforced Concrete Structures"**, CBS Publishers and Distributors PvtLtd, 2019.*
5	IS: 456-2000 (R2016), "***Plain and Reinforced Concrete - Code of practice"***.
6	SP: 16-1980, "***Design Aids for Reinforced Concrete to IS 456:(1978)"***.
7	IS: 875-2015, "***Code of Practice for design loads for buildings and structures***".
8	SP: 34-1987, "***Handbook on Concrete Reinforcement and Detailing***".

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Apply theconceptsofworkingstress method andlimitstatemethods and estimate the design loads on various structural elements.	K2
CO2	Analyse and Designthe beams using Limit State Method.	K3
CO3	Designofrectangularslabsandstaircasesbylimitstatemethod and prepare detailing drawing.	K3
CO4	Designthecolumnssubjectedtobothaxialandeccentricloads	K3
CO5	Designloadedwallandisolatedfootings.	K3

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	--	2	--	--	--	1	--	--	--	--	--
CO2	2	2	1	1	--	2	--	--	1	1	--	--	--	2	2
CO3	2	2	1	1	--	2	--	--	1	1	--	--	--	2	2
CO4	2	2	1	1	--	2	--	--	1	1	--	--	--	2	2
CO5	2	2	1	1	--	2	--	--	1	1	--	--	--	2	2
22CPC 407	2	2	1	1	--	2	--	--	1	1	--	--	--	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.2.1, 1.4.1, 2.1.3, 3.1.4, 3.2.3, 4.1.1, 4.1.2, 6.2.1, 10.1.1, 10.3.1
CO2	1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.4, 3.1.4, 3.2.3, 3.4.2, 4.1.2, 6.2.1, 9.3.1, 10.1.1, 10.3.1
CO3	1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.4, 3.1.4, 3.2.3, 3.4.2, 4.1.2, 6.2.1, 9.3.1, 10.1.1, 10.3.1
CO4	1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.4, 3.1.4, 3.2.3, 3.4.2, 4.1.2, 6.2.1, 9.3.1, 10.1.1, 10.3.1
CO5	1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.4, 3.1.4, 3.2.3, 3.4.2, 4.1.2, 6.2.1, 9.3.1, 10.1.1, 10.3.1

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	25	50	25	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	25	50	25	-	-	100
ESE	30	30	40	-	-	-	100

22CPC408	WATER SUPPLY ENGINEERING	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	To conversant with sources of water, demand of water, characteristics of water and Conveyance of Water.To expose the students to understand the design of water Treatment processes and distribution of water supply

UNIT – I	QUANTITY OF WATER AND SOURCES OF WATER	9 Periods

Introduction of Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater –Impounding Reservoir – Development and selection of source – Source Water quality.

UNIT – II	QUALITY OF WATER AND TRANSPORTATION	9 Periods

Quality of water - sampling - Characterization – Significance -analysis of water - water borne diseases - quality standards of water as per IS 10500. Intakes - types - intake tower - Transportation of water - types of conduits - Hydraulics of pipe flow - design - materials of pressure pipes - pipe corrosion - Theories, effect and prevention- Laying, jointing and testing of pipe lines. Pumps - Types of pumps - pumping stations.

UNIT – III	WATER TREATMENT	9 Periods

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators, flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier –Rapid and slow sand filters - Disinfection - Residue Management –Construction, Operation and Maintenance of treatment units- Recent advances.

UNIT – IV	ADVANCED WATER TREATMENT	9 Periods

Water softening - Desalination - R.O. Plant - demineralization – Adsorption - Ion exchange - Membrane Systems - RO Reject Management - Iron and Manganese removal –Fluoridation and Defluoridation - Construction , Operation and Maintenance of treatment units – Recent advances.

UNIT – V	WATER DISTRIBUTION SYSTEM	9 Periods

Distribution of water - requirements of good distribution system - method of distribution system - layouts of distribution system - Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Analysis of distribution networks - Computer applications – Appurtenances – Leak detection. Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**

TEXT BOOKS:

1	*Garg. S. K., "**Water Supply Engineering**", Khanna Publishers, Delhi, 2014.*
2	*Punmia B.C, Jain A.K and Jain A.K, "**Water Supply Engineering**" Laxmi Publications, New Delhi 2014.*

REFERENCES :

1	*Dr. P.N. Modi., "**Water Supply Engineering Volume**" Rajson Publications, New Delhi, 2018.*
2	*D. Lal&A.K. Upadhyay, "**Water Supply and Waste Water Engineering**" S. K. Kataria& Sons, 2013*
3	*Mackenzie L Davis., "**Water and Waste Water Engineering Design Principles and Practice**", McGraw Hill book education, 2010.*
4	*NPTEL "**Water and Waste Water Engineering**" by Dr.P.Bose , IIT Kanpur.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Know the principles of water supply and characteristics of water.	K1, K2
CO2	Attain knowledge on quality of water and its conveyance.	K1, K2
CO3	Acquire knowledgeon various water treatment units.	K1, K2
CO4	Get clear knowledge about advanced water treatments	K1, K2
CO5	Know the distribution and supply of water	K1, K2

COURSE ARTICULATION MATRIX:

	a) CO and PO Mapping														
COs/ POs	**PO 1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1				1	2						1	2	2
CO2	2	2	1			1	2						2	2	2
CO3	2	1	2			1	2						2	2	2
CO4	1	2	2			1	2						2	2	2
CO5	1	1	1			1	2						2	2	2
22CPC408	2	2	2			1	2						2	2	2
	1 – Slight, 2 – Moderate, 3 – Substantial														
	b) CO and Key Performance Indicators Mapping														
CO1	1.2.1, 1.3.1,1.4.1, 2.1.3,2.4.3,6.1.1,7.1.1,7.1.2,7.2.2														
CO2	1.2.1, 1.3.1,1.4.1, 2.1.3,2.2.3, 2.3.1, 2.4.3,3.1.4, 3.1.6,3.3.1, 6.1.1, 7.1.1,7.1.2,7.2.2														
CO3	1.2.1, 1.3.1,1.4.1, 2.1.3,2.4.3,, 3.1.4, 3.1.6,3.3.1,3.2.3, 6.1.1, 7.1.1,7.1.2,7.2.2														
CO4	1.2.1, 1.3.1,1.4.1, 2.1.3,2.2.3, 2.3.1, 2.4.3, 3.1.4, 3.1.6, 3.2.3,3.3.1, 5.1.1, 6.1.1, 7.1.1,7.1.2,7.2.2														
CO5	1.2.1, 1.3.1,1.4.1, 2.1.3,2.4.3, 3.1.4, 3.1.6,3.3.1, 6.1.1, 7.2.2, 7.1.1,7.1.2,7.2.2														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	60					100
CAT2	40	60					100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	40	60					100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	40	60					100
ESE	40	60					100

22CMC4Z2	CONSTITUTION OF INDIA (Common to all Branches)	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

Course Objectives	The objective of the course is to familiarize the students on the role,powers and functions of Indian government. Also understand the recent acts in India.	
UNIT- I	**INTRODUCTION ANDEMERGENCY PROVISIONS**	**9 Periods**
Historical Background: The Company rule, The Crown rule - Constituent Assembly: Composition, Objectives - Preamble and Salient features of the Indian Constitution - Fundamental Rights, Fundamental Duties, Directive Principles of state policy, Emergency Provisions - National Emergency, President Rule, Financial Emergency.		
UNIT- II	**SYSTEM OF GOVERNMENT**	**9 Periods**
Parliamentary system: merits, demerits, reasons for adopting parliamentary system – Federal system: Evaluation of federal features –Centre-State relations: Legislative, Administrative and Financial relations – Local Government: Panchayati Raj and urban local government.		
UNIT- III	**UNION AND STATE GOVERNMENT**	**9 Periods**
President of India: Election, Powers and functions - Prime Minister and Cabinet: Structure and functions – Governor: Powers and functions - Chief Minister and Council of Ministers: Functions.		
UNIT- IV	**ORGANS OF GOVERNANCE AND RECENT ACTS**	**9 Periods**
Parliament: LokSabha and RajyaSabha, Composition and powers - State Legislative Assembly and Legislative Council: Composition and powers - Judicial System in India: Structure and features - Supreme Court and High Court: Composition, Jurisdiction, Recent acts in significance-RTI, Citizenship act, POCSO Act.		
UNIT- V	**POLITICAL DYNAMICS**	**9 Periods**
Political parties: Party system, Recognition of National and State parties – Elections: Electoral system and reforms – Pressure groups – National Integration: Obstacles, National Integration Council – Foreign Policy: Principles and Objectives.		
Contact Periods: **Lecture: 45 Period Tutorial: 0 Period Practical: 0 Period Total: 45 Periods**		

TEXT BOOKS:

1	*National portal of India, "**The Constitution of India"** (Full Text), https://legislative.gov.in/constitution-of-india*
2	*Dr.B.R.Ambedkar, "**The Constitution of India",** Sudhir Prakashan, 2020.*

REFERENCES:

1	*Durga Das Basu, "**Introduction to the Constitution of India**, LexisNexis, 2022*
2	*P.M.Bakshi, "**The Constitution of India"**, LexisNexis, 2020*
3	*Subash C Kashyap, "**Our Parliament"**, National Book Trust, 2021*
4	*Subash C Kashyap, "**Our Political System**", National Book Trust, 2011*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Know the evolution of Indian Constitution and its basic premises.	K1
CO2	Explain the system of governance in India.	K2
CO3	Describe the structure of Union and State Governments	K2
CO4	Obtain the knowledgeof functions of Legislature and Judiciary	K1
CO5	Know the political system of India	K1

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	-	-	-	-	-	1	-	1	1	-	-	-	-	-	1
CO3	-	-	-	-	-	2	-	1	1	-	-	-	-	-	1
CO4	-	-	-	-	-	1	-	1	2	-	-	-	-	-	1
CO5	-	-	-	-	-	2	-	2	1	-	-	-	-	-	-
22CMC4Z 2	-	-	-	-	-	1	-	1	1	-	-	-	-	-	1
1 – Slight, 2 – Moderate, 3 – Substantial															
b) CO and Key Performance Indicators Mapping															
CO1	6.1.1,6.2.1,8.1.1,8.2.1,8.2.2,9.1.2														
CO2	6.1.1,6.2.1,8.1.1,8.2.1,8.2.2,9.1.2														
CO3	6.1.1,6.2.1,8.1.1,8.2.1,8.2.2														
CO4	6.1.1,6.2.2,9.1.2,9.2.1														
CO5	6.2.2,8.1.1,8.2.2,9.1.2,9.2.1														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Rememberin g (K1) %**	**Understandin g (K2) %**	**Applyin g (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creatin g (K6) %**	**Total %**
CAT1	50	50	-	-	-	-	100
CAT2	50	50		-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-			-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-			-	100
ESE	50	50	-	-	-	-	100

22CES411	FLUID MECHANICS AND MACHINERY LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
MECHANICS OF FLUIDS	ES	0	0	3	1.5

Course Objectives	* To impart knowledge in solving problems occurring in a pipes due to losses, the verification of Bernoulli's theorem and its applications and conducting performance tests on different types of pumps and turbines.

LIST OF EXPERIMENTS:

1. Determination of Darcy's friction factor.
2. Verification of Bernoulli's Theorem.
3. Calibration of Venturimeter and Orifice meter.
4. Flow over V-Notch.
5. Flow through Mouthpiece.
6. Determination of velocity through Pitot tube.
7. Determination of Meta centric height.
8. Performance Study of Roto dynamic pumps:Centrifugal pump, Submersible pump and Jet pump.
9. Performance Study of Positive displacement pumps:Reciprocating pump, Gear oil pump and Single screw pump.
10. Load test on Pelton wheel, Francis turbine and Kaplan Turbine.

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Obtain the knowledge on conducting different type of experiments.	K2
CO2	Solve different problems in pipes due to losses.	K3
CO3	Verify the Bernoulli's theorem and its applications.	K3
CO4	Do performance tests on different types of pumps.	K3
CO5	Do performance tests on different types of turbines.	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1
CO2	2	2	0	2	1	0	1	0	0	0	0	0	0	2	1
CO3	1	2	0	2	0	0	0	0	0	0	0	0	0	2	1
CO4	0	1	0	2	1	0	1	0	0	0	0	0	0	2	1
CO5	0	1	0	2	1	0	1	0	0	0	0	0	0	2	1
22CES 411	2	2	0	2	1	0	1	0	0	0	0	0	0	2	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	2.3.2, 2.4.2
CO2	1.1.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.2, 4.1.3, 4.1.4, 4.3.1, 5.2.1, 5.3.2, 7.1.1
CO3	1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.4.2, 4.1.3, 4.1.4, 4.2.1, 4.3.1
CO4	2.1.2, 2.1.3, 2.3.1, 2.4.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.2.1, 5.3.2, 7.1.1
CO5	2.1.2, 2.1.3, 2.3.1, 2.4.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 5.2.1, 5.3.2, 7.1.1

22CES412	ENGINEERING EXPLORATION	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

Course Objectives	The objective of the course is to provide an introduction to the engineering field. It is designed to help the student to learn about engineering and how it is useful in our everyday life.	
UNIT- I	**INTRODUCTION**	**(15)**
Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes.		
UNIT- II	**ENGINEERING DESIGN**	**(15)**
Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements, Problem definition, Idea generation through brain storming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement.		
UNIT- III	**ENGINEERING DISCIPLINES**	**(15)**
Civil Engineering: Loads on Structures, Analysis of Structural elements, Design and detailing of Structural elements. Testing and selection of construction materials. Analysis of water quality and checking its suitability for construction and drinking purposes. Preparation of site layout using advanced Survey instruments. Modeling of Hydraulic elements.		
Contact Periods: **Lecture: 0 Periods Tutorial: 0 Practical: 45 Periods Total: 45 Periods**		

REFERENCES:

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser: "**Engineering Fundamentals: Design, Principles and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	*Saeed Moaveni, "**Engineering Fundamentals: An Introduction to Engineering**", Cengage learning, Fourth Edition, 2011.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain technological and engineering development , change and impacts of engineering	K2
CO2	Complete initial steps (Define a problem list criteria and constrains , Brainstorm potential solutions and document ideas) in engineering designs	K3
CO3	Communicate possible solutions through drawings and prepare project report.	K3
CO4	Draw sketches to a Design problem.	K3
CO5	Apply the concept of engineering fundamentals in Civil, Mechanical, Electrical and Computer Engineering.	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	0	0	0	0	0	0	0	0	0	0	2	-
CO2	3	2	1	0	0	0	0	0	0	0	0	0	0	1	1
CO3	3	2	1	0	0	0	0	0	0	0	0	0	0	2	-
CO4	3	2	1	0	0	0	0	0	0	0	0	0	0	1	-
CO5	3	2	1	0	0	0	0	0	0	0	0	0	0	1	1
22CES412	3	2	1	0	0	0	0	0	0	0	0	0	0	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.2, 1.2.1, 1.3.1, 2.2.4, 6.1.1, 7.1.1, 7.2.1
CO2	2.1.1, 2.2.3, 3.1.1, 3.1.2, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 4.1.1, 4.1.2, 4.2.2
CO3	2.1.3, 3.2.1, 3.2.2, 3.2.3, 3.4.2, 4.3.2, 4.3.3, 4.3.4, 9.2.1, 9.3.1, 10.1.3, 10.2.2, 10.3.2, 11.3.2
CO4	3.1.3, 5.1.1, 5.2.2
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 4.3.1, 7.2.2, 8.2.2, 9.1.2, 10.1.1, 11.3.2

22CPC409	ENVIRONMENTAL ENGINEERING LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	To Impart knowledge in sampling and analysis of procedures of water and waste water samples to identify the water and waste water characteristics.

LIST OF EXPERIMENTS

1. Sampling and preservation methods for water and wastewater (Demonstration only).
2. Determination of pH & Electrical Conductivity.
3. Determination of Turbidity.
4. Determination of Chlorides.
5. a) Determination of Total Hardness.
   b) Determination of Calcium Hardness.
6. a) Determination of Alkalinity.
   b) Determination of Acidity.
7. Determination of Sulphates.
8. Determination of Iron & Fluoride.
9. Estimation of Residual Chlorine.
10. Estimation of Solids.
    a) Determination of Total Suspended solids.
    b) Determination of Dissolved solids.
    c) Determination of Fixed and Volatile solids.
    d) Determination of Total solids.
11. Determination of Optimum Coagulant Dosage.
12. Determination of Dissolved Oxygen.
13. Determination of BOD.
14. Determination of COD.
15. Demonstrations of water quality parameters for construction purpose.

Contact Periods: **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**

COURSE OUTCOMES: On completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Interpret thesamplingandpreservation methodsofwaterandwastewater	K2
CO2	Correlate the physical properties of water and waste water.	K3
CO3	Correlate the chemical properties of water and waste water.	K3
CO4	Categorize thebiologicalproperties ofwaterand wastewater.	K3
CO5	Categorizethe Micro-biologicalproperties ofwaterandwastewater.	K3

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping														
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	0	1	1	2	1	2	0	0	0	2	0	0	0	1	0
CO2	2	2	1	2	0	2	1	0	0	0	0	0	0	1	0
CO3	2	1	1	2	0	2	2	0	0	0	0	0	0	1	0
CO4	2	1	1	2	0	2	2	0	0	0	0	0	0	1	0
CO5	1	1	1	2	0	2	1	0	0	0	0	0	0	1	0
22CPC 409	2	1	1	2	1	2	2	0	0	2	0	0	0	1	0
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	2.2.4, 3.1.5, 4.1.1,4.1.2, 4.3.1, 4.3.2, 4.3.4, 6.1.1, 10.1.1, 10.1.3
CO2	1.2.1,1.3.1,1.4.1,2.1.3,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,3.1.4,3.1.5,3.1.6,4.1.14.1.2,4.1.3,4.1.4,4.3.2,7.1.2
CO3	1.2.1,1.3.1,2.1.2,2.2.3,2.2.4,2.4.3,3.1.4,3.1.5,3.2.1,3.2.3, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.3.2,6.1.1,7.2.2
CO4	1.2.1,1.3.1,2.1.2,2.4.3,3.1.4,3.1.5,3.2.1,3.2.3,4.1.1,4.1.2,4.1.3,4.2.1,4.3.3,6.1.1,7.1.2,7.2.2
CO5	1.3.1,2.2.3,2.4.3,3.1.5,4.1.1,4.1.2,4.1.3,4.2.1,7.1.2