D Y PATIL
COLLEGE of
ENGINEERING & TECHNOLOGY
KASABA BAWADA, KOLHAPUR.
(AN AUTONOMOUS INSTITUTE)

Approved By AICTE, New Delhi, Recognised by Govt. of Maharashtra & Affiliated to Shivaji University, Kolhapur.

D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

Accredited by NAAC with 'A' Grade

S. Y. B. Tech. Syllabus

Department of Civil Engineering

(with effect from academic year **2021-22**)

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR

Teaching and Evaluation Scheme from Year 2020-21

Second Year B. Tech. Civil Engineering

SEMESTER-III

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation scheme			
				Lecture Hours	Tutorial Hours	Practical Hours			Type	Max. Marks	Min. Marks for Passing	
1	201CEL201	BSC	Applied Mathematics	3	1	0	4	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
2	201CEL202	PCC	Mechanics of Structures	3	0	0	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
3	201CEL203	PCC	Concrete Technology	3	0	0	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
4	201CEL204	PCC	Fluid Mechanics	3	0	0	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
5	201CEL205	ESC	Building Construction and Material	3	0	0	3	100	ISE	20	20	40
									MSE	30		
									ESE	50	20	
6	201CEP206	PCC-LC	Mechanics of Structures Lab	0	0	2	1	50	ISE	25	10	
									ESE (OE)	25	10	
7	201CEP207	PCC-LC	Concrete Technology Lab	0	0	2	1	50	ISE	25	10	
									ESE (OE)	25	10	
8	201CEP208	PCC-LC	Fluid Mechanics Lab	0	0	2	1	50	ISE	25	10	
									ESE (POE)	25	10	
9	201CEP209	ESC-LC	Building Construction and Material Lab	0	0	2	1	25	ISE	25	10	
10	201CEP210	ESC	Computer Aided Drawing	0	0	2	1	25	ISE	25	10	
Summary		**Total**		**15**	**1**	**10**	**21**	**700**				
		Total Contact Hrs/week		**26**			**Total Credits**		**21**	**Total Marks**		**700**

ISE: *In Semester Evaluation* ***MSE:*** *Mid Semester Examination* ***ESE:*** *End Semester Examination* ***OE****- Oral Examination* ***POE****- Practical Oral Examination*

Note 1 : Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students.

Note 2 : ESE will be conducted for 100 marks and converted to 50 Marks

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR

Teaching and Evaluation Scheme from Year 2020-21

Second Year B. Tech. Civil Engineering

SEMESTER-IV

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme Per Week			Credits	Total Marks	Evaluation scheme			
				Lecture Hours	Tutorial Hours	Practical Hours			Type	Max. Marks	Min. Marks for Passing	
1	201CEL211	PCC	Structural Analysis	3	1	0	**4**	**100**	**ISE**	**20**	**20**	**40**
									MSE	**30**		
									ESE	**50**	**20**	
2	201CEL212	PCC	Geotechnical Engineering	3	0	0	**3**	**100**	**ISE**	**20**	**20**	**40**
									MSE	**30**		
									ESE	**50**	**20**	
3	201CEL213	ESC	Building Planning and Design	3	0	0	**3**	**100**	**ISE**	**20**	**20**	**40**
									MSE	**30**		
									ESE	**50**	**20**	
4	201CEL214	PCC	Engineering Surveying	3	0	0	**3**	**100**	**ISE**	**20**	**20**	**40**
									MSE	**30**		
									ESE	**50**	**20**	
5	201CEL215	PCC	Open Channel Hydraulics & Hydraulic Machines	3	0	0	**3**	**100**	**ISE**	**20**	**20**	**40**
									MSE	**30**		
									ESE	**50**	**20**	
6	201CEP216	PCC-LC	Geotechnical Engineering Lab	0	0	2	**1**	**50**	**ISE**	**25**	**10**	
									ESE (POE)	**25**	**10**	
7	201CEP217	ESC-LC	Building Planning and Design Lab	0	0	2	**1**	**50**	**ISE**	**25**	**10**	
									ESE (OE)	**25**	**10**	
8	201CEP218	PCC-LC	Engineering Surveying Lab	0	0	2	**1**	**50**	**ISE**	**25**	**10**	
									ESE (POE)	**25**	**10**	
9	201CEP219	PCC-LC	Open Channel Hydraulics & Hydraulic Machines Lab	0	0	2	**1**	**25**	**ISE**	**25**	**10**	
10	201CEMC 220	MC	Environmental Studies (Mandatory Course-III)	2	0	0	**0**	**50**	**ESE**	**50**	**20**	
Summary		**Total**		**17**	**1**	**8**	**20**	**725**				
		Total Contact Hrs/week		**26**			**Total Credits**		**20**	**Total Marks**		**725**

ISE: *In Semester Evaluation* ***MSE:*** *Mid Semester Examination* ***ESE:*** *End Semester Examination* ***OE****- Oral Examination* ***POE****- Practical Oral Examination*

Note 1 : Tutorials and practical shall be conducted in batches with batch strength not exceeding 20 students

Note 2 : ESE will be conducted for 100 marks and converted to 50 Marks

* Students have to undergo 4 to 6 weeks internship after IV or VI Semester during Summer vacation (Refer sheet)

Internship Guidelines

*	The students are expected to undergo 4 to 6 week internship in the industry and work on the area as specified by the industry. The work should be assigned, monitored and evaluated by the concerned industry expert, based on the report by the students.
*	The department has to assign one faculty mentor who has to communicate with industry and monitor the internship related work, periodically.
*	The weightage of the evaluation will be as under.
	Industry Expert / Supervisor: 70%
	Department and faculty: 30%
	The evaluation should include presentations and submission of reports to the department at the beginning of the subsequent semester.
*	The internship can be availed by the students during the summer vacations after completion of Semester IV or Semester VI. The credits of internship will be considered in semester VII.
*	The industry expert / supervisor is expected to assign the work worth minimum of 100 to 120 hrs. for 4 to 6 weeks duration and should monitor and evaluate periodically.
*	At the completion of the internship work the student is expected to prepare a report on the work done and get certified from the industry expert.

Course Plan

Course Title: Applied Mathematics	
Course Code: 201CEL201	**Semester: III**
Teaching Scheme: L-T-P : 3-1-0	**Credits: 4**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The course contains Differential Equations, Vector Calculus, Statistics, Laplace Transform and Integral Calculus.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 To develop mathematical skills and enhance thinking power of students.

2 To give the knowledge to the students of Applied Mathematics with an emphasis on the application of solving civil engineering problems.

3 To prepare students to formulate a mathematical model using engineering skills & interpret the solution in civil engineering and real world.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C201.1	Apply linear differential equation to solve the civil engineering problems
C201.2	Compute gradient, divergence and curl of vector differentiation
C201.3	Make use of lines of regression and curve fittings to Describe the statistical data numerically
C201.4	Solve basic problems in probability theory, including problems involving the Binomial, Poisson, and Normal distributions.
C201.5	Apply Laplace transform to solve linear differential equations
C201.6	Calculate numerical integration by numerical methods.

Prerequisite:	Methods to solve quadratic equation, synthetic division method, partial fraction formulae of derivatives, derivative and integration formulae, basic probability.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C201.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C201.2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
C201.3	3	1	-	-	2	-	-	-	-	-	-	-	-	-	3
C201.4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	3
C201.5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
C201.6	3	1	-	-	2	-	-	-	-	-	-	-	-	-	3

Course Content	Hours
Unit 1. Linear Differential Equations and Its Applications 1.1 Linear differential equations with constant coefficients. 1.2 Rules to find complementary function. 1.3 Methods to find particular integral $\left(X=e^{ax}, \sin ax/\cos ax, x^n, e^{ax}V\right)$ 1.4 Applications of linear differential equations to Cantilever, Strut, Beam.	**6**
Unit 2. Vector Differential Calculus 2.1 Differentiation of vectors. 2.2 Gradient of scalar point function. 2.3 Divergence of vector point function 2.4 Curl of a vector point function. 2.5 Irrotational, solenoidal and scalar potential function of a vector field.	**6**
Unit 3. Correlation, Regression & Curve Fitting 3.1 Introduction. 3.2 Lines of regression of bivariate data. 3.3 Fitting of curves by method of least-squares: 3.3.1 Fitting of straight lines. 3.3.2 Fitting of second degree parabolic curves.	**6**
Unit 4. Probability Distribution 4.1 Random variables. 4.2 Discrete probability distribution. 4.3 Continuous probability distribution. 4.4 Binomial distribution. 4.5 Poisson distribution. 4.6 Normal distribution.	**6**

Unit 5. Laplace Transform and its Applications 5.1 Laplace transform of elementary functions 5.2 First shifting property 5.3 Change of scale property 5.4 Multiplication by tn property 5.5 Division by t property 5.6 Introduction to Inverse Laplace transform, standard formulae. 5.7 Inverse Laplace transform by method of partial fraction 5.8 Solution of linear differential equation with constant coefficients using Laplace transform	**6**
Unit 6. Numerical Methods- Numerical Integration 6.1 Trapezoidal Rule 6.2 Simpson's 1/3 rd rule 6.3 Simpson's 3/8 th rule 6.4 Weddle's Rule	**6**

Tutorials

Sr. No.	Title	Hours
1	Linear Differential Equations	1
2	Applications Linear Differential Equations	1
3	Vector Differential Calculus	1
4	Correlation, Regression & Curve Fitting	1
5	Probability Distribution	1
6	Laplace Transform and its Applications	1
7	Inverse Laplace Transform	1
8	Numerical Integration	1
9	Fitting of first and second degree curves using SCILAB/MATLAB	1
10	Trapezoidal and Simpson's Rule using SCILAB/MATLAB	1

Text Books:

1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publication, New Delhi, 40th Edition, 2007
2	H. K. Dass, Advanced Engineering Mathematics, S. Chand, NewDelhi
3	N.P. Bali, Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publication, New Delhi,7th Edition, 2007
4	P.N. Wartikar & J.N. Wartikar, A Text Book of Applied Mathematics Vol I & II., Pune Vidyarthi Griha Prakashan, Pune

Reference Books:

1	Erwin Kreyszig, Advanced Engineering Mathematics, India Pvt, Ltd
2	B. V. Ramana, Higher Engineering Mathematics, Tata M/c Graw-Hill Publication.
3	M. K. Jain, Numerical methods for Scientific and Engineering Computation, New Age International Pvt. Ltd, New Delhi.

Course Plan

Course Title: Mechanics of Structures	
Course Code: 201CEL202	**Semester: III**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The students learned Applied Mechanics to study the external effects on the body due to action of force system in First Year. The knowledge of behaviour of structure under different loading conditions is required so that structural design can be done by the Civil Engineer. In this course, analysis of determinate structures under action of transverse loading, along with, analysis of members under direct loading is to be studied. Analysis of Industrial Trusses is also incorporated to give an idea of typical structures to the students. The Structural Mechanics will enable the student to analyze Steel and Concrete Structures used in construction.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1. To learn the fundamental concepts of stress, strain, and deformation of solids under external forces for determinate structural members
2. To learn the bending moment, shear force and the corresponding stress distribution for different types of determinate beams.
3. To understand the nature of stresses developed in simple geometries for various types of loads
4. To show the plane stress transformation with a particular coordinate system for different orientation of the plane.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C202.1	Apply the concepts and principles of stresses, strains and elastic behaviour of materials.
C202.2	Analyze the behavior of the solid bodies subjected to various types of loadings
C202.3	Apply the concepts of ILD and moving loads on determinate structures and the concept of equivalent UDL
C202.4	Evaluate the stresses, strains resulting from elastic stresses developed within the materials for different orientation of the plane.

Prerequisite:	Engineering Mechanics

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C202.1	3	2	-	-	-	-	-	-	-	-	-	-	1	-	3
C202.2	3	3	-	2	-	-	-	-	-	-	-	1	1	1	4
C202.3	2	2	-	-	-	-	-	-	-	-	-	-	-	1	4
C202.4	2	3	-	-	-	-	-	-	-	-	-	-	-	1	4

Content	Hours
Unit 1. Stresses & Strains Elasticity and plasticity – Concept of axial stresses (compression, tension), strains(linear, lateral, shear and volumetric)–Hooke's law–Stress-strain diagram of ductile and brittle materials – Elastic limit, Ultimate stress, Yielding, Modulus of elasticity – Factor of safety – Poisson's ratio and volumetric strain – Principle of superposition - Composite sections - Elastic constants and their relations – Stresses and strains due to change in temperature.	6
Unit 2. Shear force and Bending Moment Diagrams Definition of beam – Types – Concept of shear force and bending moment – S.F and B.M diagrams for determinate beams due to concentrated, uniformly distributed, uniformly varying loads, couples and combination of these loads – Point of contra flexure – Relation between S.F., B.M and intensity of loading	6
Unit 3. Rolling Loads And Influence Lines Rolling loads – Single concentrated load – Uniformly distributed load – Two concentrated loads – Curves of maximum Bending Moment diagram and Shear Force Diagram– Equivalent Uniformly Distributed Load - Influence line for statically determinate beams and arches for bending moment and shear force due to concentrated and uniformly distributed loads	6
Unit 4. Theory of Simple Bending **Flexural Stresses** : Theory of simple bending – Assumptions and Limitations – Derivation of flexure formula, Bending stress distribution in beams of different cross sections – Moment of resistance - section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections	6
Unit 5. Shear Stresses Concept of shear, complimentary shear, derivation of shear stress formula, shear stress distribution for various cross sections like rectangular, circular, triangular, I, T angle sections., maximum and average shear stress for circular and rectangular sections.	6

Unit 6. Principal Stresses and Strains Concept of principal stresses, principal strains and principal planes; Rectangular block subjected to normal stress along and across two planes, combination of normal and tangential stress also with shear stress, normal and shear stresses on an oblique plane, Mohr's circle of stress, construction of Mohr's circle	6

Text Books:

1	Punmia B. C., A. K. Jain and A. K. Jain, Mechanics of Materials - Laxmi Publications(P) Ltd, New Delhi, 2001.
2	Bhavikatti S.S., Structural Analysis -Vikas Publications House, New Delhi.

Reference Books:

1	S. B. Junnarkar and Dr. H. J. Shah, 'Mechanics of Structures Vol. I &II' - Charotar Publishing House Pvt. Ltd. - Twenty second edition
2	R.K.Bansal, 'Strength of Materials' - Laxmi Publications.
3	Timoshenko & Young, 'Elements of Strength of Materials' -Affiliated East West Press, New Delhi.
4	F.L. Singer and Andrew Pytel, 'Strength of Materials' - Harper and Row Publication.
5	Hibbeler, R. C., 'Mechanics of Materials' -Pearson Prentice Hall.
6	Beer and Johnston, 'Mechanics of Materials' - McGraw Hill Publication.
7	Gere J. M., 'Mechanics of Materials' - Thomson Books, New Delhi, 2003.
8	R.K Rajput, ' Strength of Materials' - S. Chand & Company Ltd.

Course Plan

Course Title: Concrete Technology	
Course Code: 201CEL203	**Semester: III**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

This course broadly encompasses the study of properties of ingredients of concrete, design of concrete mix, production of concrete and various concreting operations. Cementing material is the vital component of the concrete, hence study of process of manufacturing of cement, types of cement and their properties are covered in this course. Study of properties of aggregates and water also finds their due coverage in the course. Process of concrete production and concreting operations also forms an essential component of the course. In addition to the study of special purpose concretes, the course also provides the due coverage of admixtures which are added to modify the properties of concrete. Properties of concrete in plastic as well as in hardened stage find its due coverage in this course.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To study materials used in concrete production and process of concrete manufacturing and to study properties of fresh concrete.
2. To study various mechanical properties and durability of hardened concrete.
3. To study mix design of concrete by using IS Code method and ACI method.
4. To study different Non Destructive Tests (NDT) and different types of special concretes.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C203.1	Explain physical properties of ingredients of concrete and their effect on strength and durability of concrete.
C203.2	Explain the fundamentals of process of making good quality concrete and the factors affecting properties of concrete.
C203.3	Solve the problems on concrete mix proportion as per Indian standard code of practice and ACI method.
C203.4	Explain Non Destructive Testing (NDT) of in-situ concrete and different types of special concretes.

Prerequisite:	Knowledge of General Science, Chemistry, Strength of materials.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C203.1	3	-	-	-	-	-	1	-	-	-	-	1	-	-	2
C203.2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C203.3	-	3	-	-	-	-	1	1	-	-	-	-	1	1	3
C203.4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Content	Hours
Unit 1. Ingredients of Concrete **Cement:** Manufacturing process of cement, chemical composition, grades of cement, hydration, types of cement (Use of fly ash, blast furnace slag for manufacturing helping ecology), Tests for cement: fineness, standard consistency, setting time, soundness and compressive strength. **Natural and Artificial Aggregates**: classification, requirements, Tests for Coarse Aggregates**:** Specific Gravity, Gradation, Flakiness Index, Elongation Index, Impact Value, Abrasion Value, Crushing Value. Tests for Fine Aggregates: Specific Gravity, Sieve Analysis, Fineness Modulus. Alkali Aggregate Reaction, bulking of sand, Manufactured sand (IS 838-2016) **Water**: general requirements, quality of water.	8
Unit 2. Rheology of Concrete **Properties of fresh concrete:** factors affecting workability, different tests for measurement of workability. Segregation, Bleeding. Manufacturing process of concrete: batching, mixing, transportation, compaction, curing of concrete, curing methods.	4
Unit 3. Hardened concrete **Strength of concrete:** w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength. Test on hardened concrete: compressive strength, comparison of compressive strength between cube test and cylinder test, split-cylinder test, flexural strength. Relation between compressive strength and tensile strength. Elastic constants, factors affecting modulus of elasticity, Creep – meaning and factors affecting it. Shrinkage – meaning, types – plastic, drying, carbonation and factors affecting shrinkage. **Non Destructive Testing (NDT):** Schmidt's rebound hammer test, Ultrasonic pulse velocity test.	6
Unit 4. Concrete Mix Design Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria as per IS 456 - 2000, Numerical on Concrete mix design by ACI 211.1-1991,IS Code method using IS 10262-2019, Concrete Mix Design with Superplasticizer, Concrete Mix Design with Fly Ash.	8

Unit 5. Admixtures in concrete **Chemical Admixtures:** Plasticizers, Superplasticizers, Hyperplasticizers, Retarders, Accelerators, Air entraining agents, IS 9103 Specifications. **Mineral Admixtures:** Fly ash, Silica Fume, GGBFS, Rice husk ash, Metakaolin, Nano materials	4
Unit 6. Special Concretes and Durability of concrete **Special Concretes:** Light weight concrete, High density concrete, High Performance Concrete, Polymer modified concrete, concept of Fiber Reinforced Concrete, Self compacting concrete, Ready Mixed Concrete, Green Concrete, Recycled Concrete. **Durability of concrete:** Significance, Permeability and Durability relation, Chemical Attack, Sulphate attack, Attack by Seawater/ Chloride attack, Carbonation of concrete. RCPT test on concrete for durability, Carbonation Test.	6

Text Books:

1	Shetty M.S., Concrete Technology, S. Chand Publication.
2	Gambhir M.L., Concrete Technology, Tata McGraw Hill.

Reference Books:

1	A. M. Neville, J. J. Brooks, “Concrete Technology” Pearson Education India
2	A. M. Neville, “Properties of Concrete”, Pearson Education India.
3	R.S. Varshney, “Concrete Technology”, Oxford and IBH.
4	P. Kumar Mehta, “Microstructure and properties of concrete”, Prentice Hall.SP-26.

Codes:

1	IS: 10262 - 2019, Concrete Mix Proportioning - Guidelines
2	IS 456 - 2000 Plain and Reinforced Concrete - Code of Practice
3	IS 383 – 2016 Coarse and Fine Aggregate for Concrete.
4	ACI 211.1 – 91 Concrete Mix Design

Course Plan

Course Title: Fluid Mechanics	
Course Code: 201CEL204	**Semester: III**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The material in this course will provide the student with a fundamental background in the statics and dynamics of fluids, laws of fluid mechanics and energy relationships. The basic conservation laws of mass, momentum and energy are analysed in control volume and differential form. The student will learn how to choose the right formulation for fluid flow problems. The student will also learn how to analyse practical fluid flow phenomenon and apply basic principles / concepts in fluid mechanics to solve real life situations.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To study processes and science of fluid and their properties.

2 To study pressure measuring devices and pressure diagram.

3 To apply basic principles in fluid flow problems.

4 To identify the losses in pipes.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C204.1	Apply the basic properties of fluids and their behaviour to various force systems
C204.2	Apply the basic concepts and principles in fluid statics, fluid kinematics and fluid dynamics with their applications in fluid flow problems.
C204.3	Apply the principles of continuity, momentum and energy as applied to fluid in motion.
C204.4	Apply the equations to analyse problems by making proper assumptions and learn systematic engineering methods to solve practical fluid mechanics problems.

Prerequisite:	Engineering Physics, Fundamentals of Civil Engineering and Engineering Mechanics.

Course Articulation Matrix

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C204.1	3	2	-	-	1	-	-	-	-	-	-	-	-	-	3
C204.2	3	2	1	-	1	-	-	-	-	-	-	-	-	-	3
C204.3	3	2	1	-	-	-	-	-	-	-	-	1	1	-	3
C204.4	3	2	2	-	-	-	-	-	-	-	-	1	1	1	3

Course Content	Hours
Unit 1. Fluid Properties and Pressure Measurements A) Physical Properties of fluid : Specific gravity, Viscosity, Surface tension, vapour pressure and their influence on fluid at rest and in motion B) Hydrostatics: Pascal's Law, Hydrostatic Law, Measurement of pressure: Barometer, Manometers, Mechanical gauges, Modern electronic devices	5
Unit 2. Fluid Statics A) Total pressure force and center of pressure on plane and curved surfaces (Numerical examples on Dams, Water tanks, Gates) B) Floatation and Buoyancy: Stability of Floating and submerged objects, Determination of Metacentric height of floating objects, Time of oscillation C) Relative equilibrium of fluid mass	7
Unit 3. Fluid Kinematics and Similitude A) Fluid Kinematics: Types of Flow, Continuity Equation, Flow net B) Dimensional Analysis and Model studies: Buckingham Pie Theorem, Non Dimensional numbers and their significance, Distorted river models based on Froude's model law	6
Unit 4. Fluid Dynamics A) Fluid Dynamics: Euler's and Bernoulli's equations along a streamline, Momentum equation applied to forces on pipe bends B) Measurement of flow: Pitot tube, Venturimeter, Orificemeter, Orifice and mouthpiece, Rotameter, modern equipments	6
Unit 5. Boundary Layer Theory A) Boundary Layer theory : Concept , B.L. along a thin plate, Separation of B.L. and its control, flow around submerged objects, Drag and Lift, Magnus effect B) Laminar and Turbulent Flow : Reynold's Experiment, Velocity Distribution, Hazen Poisulle's Equation, Power required to transmit the flow	5
Unit 6. Losses in Pipe Flow A) Flow through Pipes : Major and Minor losses, Darcy Weisbach Equation, Moody's diagram, Pipes in series, pipes in parallel, Two reservoir problems, Pipe network, introduction to related software B) Water hammer in pipes, Controlling Devices	7

Text Book:

1	A.K. Jain -Fluid Mechanics — Khanna Pub., Delhi.
2	Modi/Seth – Hydraulic and Hydraulic Machines – Standard Book House, Delhi

Reference Books:

1	Streeter -Fluid Mechanics -McGraw-Hill International Book Co., Auckland.
2	V. T. Chaw - Flow in open channel –McGraw-Hill International Book Co., Auckland.
3	K. L. Kumar -Fluid Mechanics — Eurasia Publication House, Delhi.
4	Shames - Fluid Mechanics - McGraw-Hill International Book Co., Auckland.
5	Rangaraju -Open Channel flow– Tata McGraw-Hill Pub. Co., Delhi.
6	R.K. Bansal -Fluid Mechanics and hydraulic machine-, Laxmi Pubication

Course Plan

Course Title: Building Construction and Materials	
Course Code: 201CEL205	**Semester: III**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

This course offers an introduction to the theory and construction of basic building systems and its requirements. It gives introduction of various building components with its functions and requirements. It elaborates various building finishes.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 Acquire knowledge about different types of foundations and different types of masonry.

2 Obtain knowledge about Flooring, Roofing materials, various types of doors, windows and lintels.

3 Design various types of stairs and acquire knowledge about lifts and escalators.

4 Gain knowledge about various building finishes and services.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C205.1	Illustrate different types of foundations and types of masonry.
C205.2	Illustrate different materials used as floors and roofs.
C205.3	Choose types of doors, windows, lintels and building finishes.
C205.4	Design the suitable type of staircase.

Prerequisite:	Basic knowledge of Fundamentals of Civil Engineering and Engineering Mechanics

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C205.1	3	-	-	-	-	-	-	-	-	-	-	1	-	-	3
C205.2	3	-	-	-	-	-	-	-	-	-	-	1	1	-	3
C205.3	3	-	-	-	-	-	-	-	-	-	-	1	1	1	3
C205.4	-	3	-	-	-	-	-	-	-	-	-	1	1	1	4

Course Content	Hours
Unit 1. Introduction of Foundation and Types of Masonry Introduction, Functions and requirements of a good foundation, Types of foundations (Shallow and Deep foundation). Masonry: Introduction, Classification of Masonry, Definition of terms used in Masonry, Introduction to classification and qualities of bricks, Bonds in Brick work - English Bond and Flemish Bond. Common building stones, their properties and uses, Classification of stone masonry, load bearing walls, cavity walls and partition walls.	6
Unit 2. Roofs and Floors Types of Roofs and Roofing materials, Flat roof (RCC), Types of pitched roofs, Types of steel trusses, modern roofing materials like pre-coated sheets, sandwich sheets, Truss less roof. Types of flooring, Factors affecting selection of flooring materials, various types of tiles used as flooring material. Formwork: types, Modern techniques like Mivan Formwork, Slip Forms.	6
Unit 3. Doors and Windows Location of doors and windows, technical terms, Types of Doors, Types of Windows, Varieties of materials for doors and windows and their properties. Lintels – functions, types.	6
Unit 4. Stairs, Lifts and Escalators Technical terms in stairs, Requirements of good stair, Types of Stairs, Geometrical design of RCC Dog legged, open well and quarter turn stairs. Concept of folded stair, Lifts, Ramps and Escalators –functions and requirements	6
Unit 5. Building Finishes Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering. Concept of form finish. Pointing: Purpose and types of pointing Introduction to Paintings, types of Paints and Varnishes. Damp Proofing - Causes, Effects and Methods of Damp Proofing.	6

Unit 6. Building Services Ventilation: Definition and Purposes. Air conditioning: Purpose, classification and methods Sound Insulation: Materials and methods Acoustics: Purpose and methods	6

Text Books:

1	B.C Punmia., 'Building Construction', Laxmi Publications Ltd New Dehli. Dec 2006
2	S.P. Arora, S.P. Bindra, 'A Text Book of Building Construction' – Dhanpat Rai Publications

Reference Books:

1	P.G. Varghese, 'A Text Book on Building Materials', Prentice-Hall of India Pvt. Ltd., Publication.
2	Mohan Rai and M.P. Jain Singh, 'Advances in Building Materials and Construction' publication by CBRI, Roorkee.
3	Rangawala S.C., 'Engineering Materials', Charter Publishing House, Anand, India, 35th Edition 2008
4	Sushil Kumar, 'Engineering Materials', Standard Publication and Distributors, New Delhi.

Course Plan

Course Title : Mechanics of Structures Lab	
Course Code : 201CEP206	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks (OE): 25**

Course Description:

The experiment of Mechanics of Structures provides a broader practical approach with high equipped lab instruments and set-up. In this lab course, various experiments are conducted to explore and understand the properties of solid materials and its behaviours like tensile strength, compressive strength, hardness and impact value of different materials and stress values. These properties are understood by performing experiments on UTM, CTM, Izod and Impact Testing equipment, Hardness Testing equipment, etc. This lab course is of vital importance in analysis and design of Civil Engineering Structures. Also, it has large potential for R and D and Consultancy work.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To perform experiments which are related to Mechanics of Structures subject to understand the practical related to theories of the subject.
2. To determine strength properties of different solid materials.
3. Understanding of professional and ethical responsibility in the areas of material testing.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C206.1	Conduct experiments to explore various properties of solid materials
C206.2	Compute and analyze engineering values (e.g. stress or strain) from laboratory measurements.
C206.3	Write a technical test report

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C206.1	-	3	-	2	2	-	-	-	-	-	-	2	2	1	3
C206.2	-	3	-	2	-	-	-	1	-	-	-	2	2	1	4
C206.3	1	-	-	-	-	-	-	1	-	2	-	1	-	-	3

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	To determine the ultimate tensile strength of Mild steel and HYSD bars.	2
2	To determine the ultimate buckling strength of materials like mild steel, cast iron and copper, aluminium, and compare their strength.	4
3	Determination of compression test on Timber – along and parallel to the grains	2
4	Determination of compression test on Brick, AAC Bricks	2
5	Determination of shear strength of Mild steel- single and double shear	2
6	To determine Rockwell Hardness No. and Brinell Hardness No. of a sample	2
7	To estimate the Shock Resistance of different qualities of materials by Izod's test and Charpy test	2
8	Bending tests on simply supported beam on steel, Aluminium, Plywood, block board, timber and glass	4
9	Measurement of deflections in statically determinate beam	2
10	Demonstration of Strain gauges and Strain indicators	2

Textbooks:

1	Punmia B. C., A. K. Jain and A. K. Jain, Mechanics of Materials - Laxmi Publications (P) Ltd, New Delhi, 2001.
2	Bhavikatti S.S., Structural Analysis -Vikas Publications House, New Delhi.

Reference Books:

1	S. B. Junnarkar and Dr. H. J. Shah, 'Mechanics of Structures Vol. I andII' - Charotar Publishing House Pvt Ltd. - Twenty second edition
2	R.K.Bansal, 'Strength of Materials' - Laxmi Publications.
3	Timoshenko and Young, 'Elements of Strength of Materials' -Affiliated East West Press,New Delhi.
4	F.L. Singer and Andrew Pytel , 'Strength of Materials' - Harper and Row Publication.
5	Hibbeler, R. C., 'Mechanics of Materials' -Pearson Prentice Hall.

Course Plan

Course Title : Concrete Technology Lab	
Course Code : 201CEP207	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks (OE): 25**

Course Description:

The course includes experiments related to physical properties of concrete ingredients, properties of fresh concrete, properties of hardened concrete and durability properties of concrete. It also includes experiments based on non-destructive testing of concrete.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To study properties of concrete ingredients.
2. To understand properties of fresh concrete and mechanical properties of hardened concrete.
3. To know durability tests and non-destructive tests of concrete.

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C207.1	Execute experiments on aggregate and cement to evaluate their different engineering properties.
C207.2	Execute experiments on concrete to evaluate the properties in fresh and hardened states.
C207.3	Demonstrate non-destructive tests on concrete.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C207.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3
C207.2	1	2	-	-	-	-	-	1	-	-	-	-	1	1	3
C207.3	3	-	-	-	1	-	-	-	-	-	-	-	-	-	3

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	Sieve Analysis of Fine and Coarse Aggregates for Natural Sand and Manufactured Sand.	2
2	Determination of Specific Gravity, Water Absorption and Surface (Free) Moisture Content of Natural Aggregates and Manufactured Sand.	2
3	Flakiness Index and Elongation Index of Coarse Aggregate	2
4	Fineness of Cement and Standard Consistency of Cement	2
5	Initial and Final Setting Time of Cement, Soundness of Cement	2
6	Compressive Strength of Cement	2
7	Workability test by Slump Test	2
8	Workability test by Compacting Factor Test	2
9	Workability test by Flow Table Test	2
10	Workability test by Vee Bee Test	2
11	Concrete Mix Design with natural and manufactured sand.	2
12	Compressive Strength Test on Concrete	2
13	Non Destructive Tests on Concrete	2
14	Durability test on concrete by RCPT	2

- Minimum 12 experiments to be conducted

Text Books:

1	Shetty M.S., 'Concrete Technology – Theory and Practice', S. Chand Publication.
2	Gambhir M.L., 'Concrete Technology', Tata McGraw Hill.

Reference Books:

1	A. M. Neville, J. J. Brooks, 'Concrete Technology' Pearson Education India
2	A. M. Neville, 'Properties of Concrete', Pearson Education India.
3	R.S. Varshney, 'Concrete Technology', Oxford and IBH.
4	P. Kumar Mehta, 'Microstructure and properties of concrete', Prentice Hall.SP-26.

Codes:

1	IS: 10262 - 2019, Concrete Mix Proportioning - Guidelines
2	IS 456 - 2000 Plain and Reinforced Concrete - Code of Practice
3	IS 383 – 2016 Coarse and Fine Aggregate for Concrete.

Course Plan

Course Title : Fluid Mechanics Lab	
Course Code : 201CEP208	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks (POE): 25**

Course Description:

The course explores the principles of fluid mechanics through laboratory experiments and verifies various hydraulic phenomena on laboratory setups.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To provide students hands-on practice for measurement of viscosity, pressure and discharge by using measuring devices.
2. To develop the skill required for applying knowledge to analysis of flow in pipe.
3. To develop the skill required for applying knowledge to estimate the losses in pipe flow.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C208.1	Measure fluid flow parameters and apply to behaviour of real fluid properties
C208.2	Develop the flow pattern and draw flow net
C208.3	Calculate the different losses in pipes to be used in pipe design type of flow …

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C208.1	1	1	-	-	1	-	-	-	-	-	-	1	-	-	3
C208.2	1	-	-	-	1	-	-	-	-	-	-	1	1	-	3
C208.3	1	-	1	1	-	-	-	-	-	-	-	2	1	1	3

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	Study of Pressure Measuring Devices: Piezometer , Manometer , barometer	2
2	Measurement of Discharge, Use of water meter, rotameter.	2
3	Determination of Metacentric Height for Floating Bodies.	2
4	Verification of Bernoulli's Theorem.	2
5	Calibration of Venturimeter and orificemeter	2
6	Plotting of flow net	2
7	Determination of Hydraulic Coefficients of Orifice andmouthpiece	2
8	Reynold's Experiment	2
9	Determination of Friction Factor for pipes of different material and diameter	2
10	Determination of Minor Losses in a Given Pipe	2
11	Study of different valves by visiting manufacturing industries and installation sites	2
12	Study of Moody's Chart , commercial pipe design nomograms	2

Text Books:

1	A.K. Jain -Fluid Mechanics — Khanna Pub., Delhi.
2	Modi/Seth – Hydraulic and Hydraulic Machines -– Standard Book House, Delhi

Reference Books:

1	Streeter -Fluid Mechanics -McGraw-Hill International Book Co., Auckland.
2	V. T. Chaw - Flow in open channel –McGraw-Hill International Book Co., Auckland.
3	K. L. Kumar -Fluid Mechanics — Eurasia Publication House, Delhi.
4	Shames - Fluid Mechanics - McGraw-Hill International Book Co., Auckland.
5	Rangaraju -Open Channel flow– Tata McGraw-Hill Pub. Co., Delhi.
6	R.K.Bansal -Fluid Mechanics and hydraulic machine-, LaxmiPubication

Course Plan

Course Title : Building Construction and Materials Lab	
Course Code : 201CEP209	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks: N.A.**

Course Description:

This course aims at preparation the sketches/ detailed drawings of various building components.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 Prepare the sketches and drawing for various building components

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C209.1	Prepare sketches/ drawings for various building components
C209.2	Design and draw plan and sectional elevation of Dog legged, Open well and Quarter turn stairs.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C209.1	3	-	-	-	-	-	-	-	-	3	-	1	1	-	2
C209.2	-	3	-	-	-	-	-	-	-	3	-	1	1	1	4

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	**Sketch Book** : Lettering, Symbols, Types of lines and dimensioning as per IS 962	2
2	Doors: Flush doors, Revolving door, Collapsible door and Rolling Shutter.	2
3	Windows: Louvered window, Sliding Window, Bay window, Casement window, Dormer Window, Corner Window.	2
4	Roofs: Line Sketches of steel trusses for different spans.	2
5	Stairs: Bifurcated, Spiral, Geometrical.	2
6	Visit to observe various types of doors, windows and staircases.	2
7	**Drawing to a scale on half imperial drawing sheet.** Foundations: Isolated Footing, Combined Footing, Under Reamed Piles.(with reinforcement details)	2
8	Stone Masonry: UCR, Coursed Rubble Brick Masonry: English bond, Flemish bond	2
9	Doors: T.W. Panelled Door.	2
10	Windows: T.W. Glazed and Aluminium Window.	2
11	Stairs: Dog legged, Quarter turn and Open well.	4

Text Books:

1	V. B. Sikka, 'A Course in Civil Engineering Drawing'- S. K. Kataria and Sons
2	M. Chakraborty, 'Civil Engineering Drawing'

Reference Books:

1	P.G. Varghese, 'A Text Book on Building Materials', Prentice-Hall of India Pvt. Ltd., Publication
2	Mohan Rai and M.P. Jain Singh, 'Advances in Building Materials and Construction' publication by CBRI, Roorkee

Course Plan

Course Title : Computer Aided Drawing	
Course Code : 201CEP210	**Semester : III**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks :N.A.**

Course Description:

Students will be developing drawings based on planning principles of all types of buildings on CAD platform. Submission and working drawings are to be developed for a project

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1	To develop plans of Residential building
2	To develop working drawings for a Project
3	To develop Municipal drawing

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C210.1	Utilize CAD platform to draw building components drawings
C210.2	Draw residential building staircase plan on CAD

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C210.1	2	-	-	-	-	-	-	-	-	-	-	2	-	-	3
C210.2	2	1	2	-	-	-	-	-	-	2	-	2	1	1	3

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	Study of Auto CAD	6
2	Draw plans for Residential Buildings	6
3	Draw Elevation and sections for Residential Building	6
4	Preparation of Municipal submission drawings for a Project of Residential Building.	6

Text Books:

1	Auto CAD Fundamentals (by Autodesk)
2	Civil Engineering Drawing – M. Chakraborty

Reference Books:

1	Auto CAD – David Fray (BPB Sybex Publication)
2	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings

Course Plan

Course Title: Structural Analysis	
Course Code: 201CEL211	**Semester: IV**
Teaching Scheme: L-T-P : 3-1-0	**Credits: 4**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

Structural analysis is the determination of the effects of loads on physical structures and their components. This analysis includes the study of effects of loads on buildings, bridges, machinery, furniture, etc. Structural analysis requires fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is a key part of the engineering design of structures.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective civil engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To provide concept and knowledge of structural analysis with significance of statically determinate and indeterminate structure.
2. To Understand the terminologies and concepts of displacements, stresses, strains, stiffness etc. and their parameters in the context of determinate systems.
3. To understand the concepts of strain energy and analysis of plane truss.
4. To understand the concepts of axially and eccentrically loaded columns
5. To learn the torsion and the corresponding stress distribution for circular shafts and cylinders.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C211.1	Apply various methods of analysis of plane trusses and arches
C211.2	Apply different procedures to calculate slope and deflections for determinate structures.
C211.3	Analyze columns and struts under axial and eccentric loading
C211.4	Analyze determinate beams, circular shaft and cylinders

Prerequisite:	Mechanics of structures

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C211.1	3	2	-	1	-	-	-	-	-	-	-	1	1	1	3
C211.2	3	3	-	2	-	-	-	-	-	-	-	1	2	1	3
C211.3	3	3	-	1	-	-	-	-	-	-	-	1	1	1	4
C211.4	3	2	-	2	-	-	-	-	-	-	-	1	2	1	4

Course Content	Hours
Unit 1. Analysis of Statically Determinate Trusses and Arches **a)** Analysis of plane trusses : Concepts of redundancy, Analysis by method of joints, method of sections and graphical method **b)** Introduction – Types of Arches – Comparison between Three hinged and Two hinged Arches, Analysis of Three hinged arches - Normal Thrust and radial shear - Geometrical properties of parabolic and circular arches - Three-Hinged Structures with Support at Same and different Level, Analysis of Three-Hinged Arches by the Graphical Method	8
Unit 2. Displacement of Determinate Beams Differential equation of elastic curve, relation between moment, slope and deflection, Double integration method, Macaulay's method, Moment Area Method, Conjugate Beam Method applied to beams	8
Unit 3. Strain Energy **a) Strain Energy** – stresses and strains due to suddenly applied, gradual and impact loading. Strain energy due to direct stress, shear stress and bending stress **b) Energy Theorems :** Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's theorem-Unit Load Method - Deflections of simple beams and pin- jointed plane frames - Deflections of statically determinate bent frames.	8
Unit 4. Axially and Eccentrically Loaded Columns Theory of Columns: Concept of short and long columns, concept of critical load and buckling, formulae by Euler and Rankine, Limitation of Euler's Formula, concept of equivalent length for various end conditions, eccentrically loaded short compression members. Rankine's constant for different materials –applications (simple and built up sections)	8
Unit 5. Direct and Bending Stresses Define eccentricity, Direct and bending stresses for eccentrically loaded solid and hollow sections of rectangular and circular columns. Kern of section - Pressure distribution of dams and retaining walls, chimneys, etc. Effect of lateral force and self-weight. Resultant stress diagrams due to axial loads, uni-axial, and bi-axial bending. Concept of core of section for solid and hollow rectangular and circular sections.	8

Unit 6. Theory of Pure Torsion and Cylinders **a) Torsion of Circular Shafts :** Theory of pure torsion – derivation of torsion formulae – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Concept of mean and maximum torque - Combined bending and torsion and end thrust **b) Thin and Thick Cylinders :** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter, and volume of thin cylinders, Thick Cylinders : Lame's equation - stresses in thick cylinders due to internal and external pressures	8

Tutorials

Sr. No.	Title	Hours
1	Analysis of Statically Determinate Trusses and Arches	1
2	Analysis Trusses and Arches by the Graphical Method	1
3	Displacement of Determinate Beams : Calculation of slope and displacement by Double integration method, Macaulay's method	1
4	Displacement of Determinate Beams : Calculation of slope and displacement by Moment Area Method, Conjugate Beam Method	1
5	Energy Theorems : Deflections of simple beams and pin- jointed plane frames	1
6	Theory of Axially and Eccentrically Loaded Columns	1
7	Direct and bending stresses for eccentrically loaded solid and hollow sections of rectangular and circular columns.	1
8	Direct and bending stresses : Pressure distribution of dams and retaining walls, chimneys, etc.	1
9	Theory of Pure Torsion	1
10	Theory of Thin and Thick Cylinders	1

Text Books

1	Punmia B. C., A. K. Jain and A. K. Jain, Mechanics of Materials -Laxmi Publications(P) Ltd, New Delhi, 2001.
2	Bhavikatti S.S., Structural Analysis -Vikas Publications House, New Delhi.

Reference Books

1	S. B. Junnarkar and Dr. H. J. Shah, 'Mechanics of Structures Vol. I andII' - Charotar Publishing House Pvt Ltd. - Twenty second edition
2	R.K. Bansal, 'Strength of Materials' - Laxmi Publications.
3	Timoshenko and Young, 'Elements of Strength of Materials'- Affiliated East West Press, New Delhi.
4	F.L. Singer and Andrew Pytel , 'Strength of Materials' - Harper and Row Publication.
5	Hibbeler, R. C., 'Mechanics of Materials' -Pearson Prentice Hall.
6	Beer and Johnston, 'Mechanics of Materials' - McGraw Hill Publication.
7	Gere J. M., 'Mechanics of Materials' - Thomson Books, New Delhi, 2003.
8	R.K. Rajput, ' Strength of Materials' - S. Chand and Company Ltd.

Course Plan

Course Title: Geotechnical Engineering	
Course Code: 201CEL212	**Semester: IV**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

This course is one of the basic sub branches of Civil Engineering. It deals with the behaviour of earth material as an engineering material. The knowledge of this course is applied to the design of foundations, retaining walls, earth dams, clay liners, and geosynthetics. This course also provides lot of scope for research, as earth material available with wide variety of conditions. This course uses the principles of soil mechanics and rock mechanics for the solution of its respective engineering problems. This course is a pre-requisite for the course foundation engineering.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective civil engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To provide students necessary knowledge and skill required for soil classification and index properties determination.
2. To introduce students the concepts of permeability, soil compaction and consolidation with field control and application.
3. To impart the knowledge about stress conditions in soil and earth pressure on retaining structures for different soil states and its evaluation.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C212.1	Describe the concepts related to index and engineering properties of soil.
C212.2	Evaluate the index properties and engineering properties of soil, its relationship and explain its significance
C212.3	Determine stresses in soil and lateral earth pressure acting on retaining wall.

Prerequisite:	Fundamentals of Civil Engineering and Engineering Mechanics; Structural Analysis; Fluid Mechanics

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C212.1	3	-	-	-	-	-	-	-	-	-	-	2	-	-	2
C212.2	3	3	-	2	-	-	-	-	-	-	-	2	2	-	3
C212.3	3	3	-	-	-	-	-	-	-	-	-	2	2	-	3

Course Content	Hours
Unit 1. Properties of Soil Introduction to Soil Mechanics, Three phase soil system, Weight volume relationships, index properties of soil - w, e, n, ac, Sr, unit weight, density, relative density. functional relationships, problems on functional relationship, Formation of clay minerals, structure, Soil consistency and indices, I.S. classification of soil, plasticity chart	6
Unit 2. Permeability and Seepage Darcy's law, Factors affecting permeability, determination of permeability, Permeability of layered soils, General flow equation. Flow net and its application, Total, effective stress and pore pressure	6
Unit 3. Compaction and Consolidation **Compaction**- definition, Factors affecting compaction, SPT and MPT, field compaction equipment, Field compaction control, **Soil Improvement Techniques**- densification techniques, reinforcement techniques **consolidation**- Spring analogy, Terzaghi's theory of 1D consolidation, Cc, Cv, mv, av explanation and pre-consolidation pressure, Square root of time and logarithmic time fitting method	6
Unit 4. Shear Strength of Soil **Mohr's circle**, Mohr-coulomb failure criteria, Effective stress concept. Factors affecting shear strength, Determination of shear strength (Direct Shear Test, Unconfined Compression test, Tri-axial shear test, Vane Shear Test)- numerical, Shear strength of different types of soil, Sensitivity and thixotropy, Expansive soil	6
Unit 5. Stress Distribution in Soils and Lateral Earth Pressure **Stress Distribution in Soil**- Boussinesq theory and Westergaard's theory- Pressure distribution, pressure bulb, approximate stress distribution method. contact pressure concept, rigid and flexible approach **Earth pressure**- Rankine's theory, Active and Passive earth pressure, Coulomb's theory	7
Unit 6. Principles of Soil Dynamics Introduction to soil dynamics, Measurement of dynamic soil properties, Factors Affecting: Shear Modulus, Elastic Modulus And Elastic Constants	5

Text Books:

1	B. C. Punmia, Ashok Kumar Jain, "Soil Mechanics and Foundation Engg", Laxmi Publications Pvt Limited, 16th Edition
2	Braja M. Das, G. V. Ramana, "Principles of Soil Dynamics", Cengage Learning, 7th Edition

Reference Books:

1	Karl Terzaghi, Mesri, Ralph B. Peck, R. B. Peck, "Soil mechanics in engineering practice", Wiley, 3rd Edition
2	Joseph E. Bowles, "Foundation Analysis and Design", McGraw-Hill Education (India) Private Limited, 5th Edition
3	V. N. S. Murthy, "Soil Mechanics and Foundation Engg." CBS Publishers and Distributors, 2nd Edition
4	K.R.Arora, "Soil Mechanics and Foundation Engg.", Standard Publishers Distributors, 2nd Edition
5	Braja M. Das, Nagaratnam Sivakugan, Siva Sivakugan " Introduction to Geotechnical Engineering", Cengage Learning, 6th Edition
6	P. Purushottam Raj, "Geotechnical Engineering", Dorling Kindersley, 1st Edition

Web links:

1	NPTEL website: https://nptel.ac.in/courses/105/107/105107066/

Course Plan

Course Title: Building Planning and Design	
Course Code: 201CEL213	**Semester: IV**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The course includes classification of buildings, provisions of National Building Codes and rules, building byelaws, open area, setbacks, FAR terminology. Also it includes design and drawing of residential and public buildings

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To study General bye laws requirements for planning all types of buildings

2 To acquire knowledge of procedure to sanction a building proposal from local town planning authority.

3 To apply knowledge of residential and public building principles to develop a plan.

4 To designbuilding service requirements based on use of building.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C213.1	Understand and implement Building Bye- Laws, regulations and Planning, Design public building considering principles of planning
C213.2	Apply principles of building aesthetics in planning and draw perspective drawings
C213.3	Design building service requirements based on its use

Prerequisite:	Building constructions and materials

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C213.1	2	-	2	-	-	1	-	-	-	-	-	1	1	1	2
C213.2	2	-	1	-	-	1	-	-	-	-	-	2	1	1	3
C213.3	2	-	1	-	-	-	1	-	-	-	-	1	1	1	3

Course Content	Hours
Unit 1. Introduction Principles of Planning, Sun diagram, wind diagram, Building Byelaws. Planning of Residential Building (Row, Twin Bungalows, and Apartments) Municipal Drawings, Working Drawings, Procedure for obtaining approval, commencement, Plinth completion and Occupancy certificate. Introduction to UDCPR. Human Body figures and its application in space design. Need of Measured Drawing.	8
Unit 2. Planning of Public Building Site selection, site layout for various types of building such as: Educational buildings - (Younger age range, middle age range), Building for health –(health centers, hospitals), Assembly buildings – (recreational halls, cinema theatres, restaurants, hotels, clubs), Business and mercantile buildings –(shops, banks, markets and malls), Industrial buildings –(factories, workshops, cold storages), Office buildings- (administrative buildings, corporate office), Buildings for transportation- (Bus stations, Truck Terminal).	8
Unit 3. Perspective Drawings Elements of perspective drawings, Parallel perspective and Angular perspectives of different objects and small buildings.	4
Unit 4. Services **Plumbing system:** Various Materials for system like A-PVC, C-PVC, GI, and HDPE. Various types of traps, Fittings, Chambers, Need of Septic Tank, Concept of Plumbing and Drainage plan, introduction to rainwater harvesting. **Electrification:** Concealed and Open Wiring, Requirements and Location of various points, Concept of Earthing. **Fire resistance in building**: Fire protection precautions, confining of fire, fire hazards, Characteristics of fire resisting materials, building materials and their resistance to fire. Introduction to advanced firefighting system, concept of sprinklers, fire detectors, addressing system, refuge areas, etc.	7
Unit 5. Building Aesthetics Principles of building aesthetics like Unity, Mass-Balance, Symmetry, Contrast, Proportion, Scale, Rhythm, and Accentuation. Character of building. Introduction to new techniques of façade like structural glazing and dry cladding.	4

Unit 6. Sustainable Building Design Low Cost Housing, use of local materials, Green Building, Maintenance and Repairs. Interior Design- Scope, Materials used, Concept of Appropriate Technology like eco-tourism.	5

Text Books:

1	Shah, Kale, Patki, Building Drawing –Tata McGraw- Hill
2	Y. S. Sane, Building Design and Drawing – Allied Book Stall, Pune

Reference Books:

1	V.B. Sikka, A Course in Civil Engineering Drawing – S.K. Kataria and Sons
2	Sandeep Mantri, A to Z of Practical Building Construction and Its Management-Satya Prakashan, New Delhi
3	SP 7- National Building Code Group 1 to 10- B.I.S. New Delhi
4	Time Saver Standards
5	I.S. 962 – 1989 Code for Practice for Architectural and Building
6	Guidelines and space standard for barrier free building environment for disabled and elderly person.-1998
7	Unified Development Control and Promotion Regulations (UDCPR)
8	Building bye laws.

Course Plan

Course Title: Engineering Surveying	
Course Code: 201CEL214	**Semester: IV**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The course includes introduction to various techniques of surveying which is an important field of Civil Engineering. The course aims to give thorough knowledge to students about the use of various traditional and modern instruments in surveying. Also this course includes both traditional and modern methods of surveying.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1. To describe the functions of surveying in Civil Engineering field.
2. To study the traditional methods of surveying such as chain compass survey, simple and differential levelling, theodolite traversing, tachometry, and contouring
3. To study the modern techniques of surveying such as use of Total Station.
4. To study different methods of plane survey, geodetic survey, hydrographic survey.
5. To calculate, design and establish curves, understand, interpret and prepare plan, profile and cross-sectional drawing.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C214.1	Demonstrate basics of plane surveying and differentiate instrument used for it.
C214.2	Operate surveying equipment and analyse surveying data obtained from this equipment.
C214.3	Plan and execute different types of surveys like chain - compass survey, theodolite survey, contour survey, etc.
C214.4	Use modern instruments like Total Station in Civil Engineering projects.

Prerequisite:	Fundamentals of Civil Engineering, Geometry, Trigonometry

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C214.1	2	-	-	-	1	1	-	-	-	-	-	-	-	-	3
C214.2	2	-	-	-	1	1	-	-	-	-	-	-	-	-	3
C214.3	2	-	-	-	1	1	-	-	-	-	-	-	-	-	3
C214.4	2	-	-	-	1	1	-	-	-	-	-	-	-	1	3

Course Content	Hours
Unit 1. Compass Surveying Definition, objective and fundamental classification of surveying (Plane and Geodetic), concept of Scale, Ranging, Chaining, Offsetting and Traversing. Concept of bearing, meridian and their types, construction and use of prismatic compass, local attraction, and correction for local attraction.	5
Unit 2. Levelling and Contouring Introduction to levelling, Types of levelling, Types of benchmarks, Study and use of dumpy level, auto level, digital level and laser level in construction industry, principle axes of dumpy level, testing and permanent adjustments, reciprocal levelling, curvature and refraction corrections, distance to the visible horizon. Contouring–direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile leveling and cross-sectioning and their applications.	7
Unit 3. Theodolite Surveying Uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles, measurement of deflection angles using transit theodolite and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite. Fundamental axes of Theodolite: testing and permanent adjustments of a transit theodolite.	6
Unit 4. Theodolite Traversing Computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gales traverse table. Checks, omitted measurements, area calculation by independent co-ordinates. **Planimeter**-Introduction to digital planimeter.	6
Unit 5. Curves Introduction to horizontal and vertical curves (no numerical and derivations to be asked on vertical curves and reverse curves), different types and their applications, simple and compound circular curves, elements and setting out by linear method.	6

Unit 6. Introduction to GIS and Total Station **GIS:** Definition of GIS, History and development of GIS, Components of GIS, Hardware and software, introduction to GPS **Surveying using Total Station–** Study and use of Electronic Tacheometer (Total Station) types, functions (remote elevation measurements, remote distance measurements, area measurement).	6

Text Books:

1	N. N. Basak, 'Surveying and Leveling'- Tata McGraw Hill.
3	Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain 'Surveying, Vol. I and II' - Laxmi Publications

Reference Books:

1	T. P. Kanetkar and S.V. Kulkarni, 'Surveying and Leveling' Vol. I and Vol. II - Pune Vidyarthi Griha Prakashan.
2	S. K. Duggal, 'Surveying, Vol. I and II' - Tata Mc-Graw Hill.
3	Dr. K. R. Arora, 'Surveying Vol. I and II'- Standard Book House.
4	Subramanian, 'Surveying and Levelling' - Oxford University Press.
5	James M. Anderson, Edward M. Mikhail, 'Surveying: Theory and Practice' - Tata Mc-Graw Hill.
6	C. Venkatramaiah, 'Textbook of Surveying' - University Press.
7	John Uren and Bill Price, 'Surveying for Engineers' Palgrave Macmillan

Course Plan

Course Title: Open Channel Hydraulics and Hydraulic Machines	
Course Code: 201CEL215	**Semester: IV**
Teaching Scheme: L-T-P : 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks : 20 + 30	**ESE Marks: 50**

Course Description:

The material in this course will provide the student with a fundamental background in the open channel flow, basic principles in fluid flows. The student will learn how to choose the right formulation for fluid flow problems and mechanism of pumps and turbines. The student will also learn how to analyse practical fluid flow phenomenon and apply basic principles / concepts in fluid mechanics to solve real life situations.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 To study uniform and non-uniform flow in open channel.

2 To apply basic principles in fluid flow problems in open channel.

3 To study velocity and discharge measurement devices.

4 To study impact of jet, Pumps and turbines.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C215.1	Provide students with basic knowledge of types of open channel flows and flow parameters to analyze the flow.
C215.2	Apply the energy and momentum equations for GVF, RVF and SVF to flow of water in artificial and natural channels
C215.3	Apply the flow measurement techniques and modern methods of velocity, discharge , sediment transport of open channel flow
C215.4	Apply the performance characteristic curves and commercial manuals to choose the suitable efficient Hydraulic Machines

Prerequisite:	Fluid Mechanics - I

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C215.1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	2
C215.2	3	3	2	-	-	-	-	-	-	-	-	1	-	-	3
C215.3	2	2	1	-	2	1	-	-	-	-	-	1	-	1	3
C215.4	2	1	1	-	2	1	-	-	-	-	-	1	1	1	3

Course Content	Hours
Unit 1. Uniform Flow in Open Channel **A)** Types of Flows in Open Channel, Geometric Elements, Velocity Distribution, Measurement of Velocity- (Pitot tube, Current Meter, modern electronic equipment , Sonar method , Acoustic doppler method) **B)** Steady and Uniform Flow : Chezy's and Manning's Formula, Selection of Chezy's and Manning's coefficients ,Uniform Flow Computations, Hydraulically Efficient Section (Rectangular, Triangular, Trapezoidal) , Basic principles of Irrigation canal Design	7
Unit 2. Gradually Varied Flow (GVF) **A)** Depth Energy Relationship in Open Channel Flow: Specific Energy , critical flow computations , Flow in transitions **B)** Steady Gradually Varied Flow (GVF) : Dynamic Equation of GVF, Classification of GVF Profiles- Practical Examples, Direct Step Method of Computation of GVF Profiles (use of MS Excel)	7
Unit 3. Rapidly Varied Flow (RVF) **A)** Rapidly Varied Flow (RVF): Definition, Hydraulic Jump- Phenomenon, Conjugate Depth Relationship, Characteristics, uses, types, location and application ,Hydraulic Jump as an Energy Dissipater, Unsteady RVF: Surges in open channel- Positive and Negative Surge. **B)** Spatially Varied Flow: Introduction, Basic Principles and Assumptions.	7
Unit 4. Notches and Weirs Types, Derivation of Discharge Equation, Velocity of Approach, Francis Formula, Errors in Measurement of Discharge Sharp, Broad and Round Crested Weirs, Time of Emptying Tank with Weir. Introduction to Ogee spillway and energy dissipator	5
Unit 5. Impact of Jet Impulse Momentum Principle, Impact of Jet on Vanes- Flat, Curved (Stationary and Moving), Inlet and Outlet Velocity Triangles, Series of Flat, Curved Vanes Mounted on Wheel.	5

Unit 6. Pumps and Turbines **A)** Hydraulic Turbines: Introduction to Hydro-Power plants (Micro Hydal plants), working of Pelton, Francis and Kaplan Turbine, Specific Speed, Selection of Type of Turbine, Small scale Modern Turbines **B)** Centrifugal Pump: Working of Centrifugal Pump, Jet pump , submersible pump, turbine pump , Rotary pump ,Common Pump Troubles and Remedies, Net Positive Suction Head (NPSH). , Selection of commercial pumps	7

Text Books:

1	A.K. Jain -Fluid Mechanics — Khanna Pub., Delhi.
2	Modi/Seth – Hydraulic and Hydraulic Machines -– Standard Book House, Delhi

Reference Books:

1	Streeter -Fluid Mechanics -McGraw-Hill International Book Co., Auckland.
2	V. T. Chaw - Flow in open channel –McGraw-Hill International Book Co., Auckland.
3	K. L. Kumar -Fluid Mechanics — Eurasia Publication House, Delhi.
4	Shames - Fluid Mechanics - McGraw-Hill International Book Co., Auckland.
5	Rangaraju -Open Channel flow– Tata McGraw-Hill Pub. Co., Delhi.
6	R.K. Bansal -Fluid Mechanics and hydraulic machine-, Laxmi Pubication

Course Plan

Course Title : Geotechnical Engineering Lab	
Course Code : 201CEP216	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks (POE): 25**

Course Description:

The course explores the principles Geotechnical Engineering through the laboratory experiments on soil. This lab course for PCC geotechnical engineering. In this course student need to identify index and engineering properties of soil. The interpretation of soil results is one of the important aspect of this lab course. This lab course has wide scope in the real life engineering work. The testing of engineering material (earth material) directly deals with the economical aspect of any civil engineering project. This lab course also has potential for research and development.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective civil engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1	To evaluate index properties of soil and do soil classification
2	To determine engineering properties of soil

Course Outcomes (COs):

COs	**At the end of successful completion of course, the students will be able to…**
C216.1	Carryout experiments on different types of soil to evaluate index and engineering properties of soil
C216.2	Interpret results of soil testing and its behaviour.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C216.1	-	2	-	-	3	-	-	-	-	-	-	2	-	-	3
C216.2	-	2	-	3	-	-	-	-	-	-	-	2	2	2	4

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	To Determine the water content of the given sample	2
2	Determination of the specific gravity of the given soil	2
3	Grain size distribution of soil by the Mechanical Sieve Analysis.	2
4	Determination of the Atterberg Limits of the Soil Sample: Liquid Limit, Plastic Limits and shrinkage limit(at least two)	2
5	Determination of the field density by Core Cutter / Sand Replacement Method	2
6	To Determine Coefficient of Permeability of The Given Soil Sample By Permeability Test	2
7	To Determination of the Optimum Moisture Content and maximum dry density by Proctor Test	2
8	To determine the shear strength of the soil by the Direct Shear Test	2
9	Introduction to laboratory data and statistical analysis.- (mean, SD, validation, calibration)	4
10	Demonstration (Any 2) • Unconfined Compression Test • Triaxial shear test. • Vane shear test • One dimensional consolidation test.	4

Text Books:

1	B. C. Punmia, Ashok Kumar Jain, "Soil Mechanics and Foundation Engg", Laxmi Publications Pvt Limited, 16th Edition
2	Braja M. Das, G. V. Ramana, "Principles of Soil Dynamics", Cengage Learning, 7th Edition

Reference Books:

1	Karl Terzaghi, Mesri, Ralph B. Peck, R. B. Peck, "Soil mechanics in engineering practice", Wiley, 3rd Edition
2	Joseph E. Bowles,"Foundation Analysis and Design", McGraw-Hill Education (India) Private Limited, 5th Edition
3	V. N. S. Murthy, "Soil Mechanics and Foundation Engg." CBS Publishers and Distributors, 2nd Edition
4	K.R.Arora, "Soil Mechanics and Foundation Engg.", Standard Publishers Distributors, 2nd Edition
5	Braja M. Das, Nagaratnam Sivakugan, Siva Sivakugan " Introduction to Geotechnical Engineering", Cengage Learning, 6th Edition
6	P. Purushottam Raj, "Geotechnical Engineering", Dorling Kindersley, 1st Edition
7	Alfred Bartolucci, Karan P. Singh, Sejong Bae, "Introduction to Statistical Analysis of Laboratory Data" Wiley, 2nd Edition

Course Plan

Course Title : Building Planning and Design Lab	
Course Code : 201CEP217	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks (OE): 25**

Course Description:

The course includes functionally planning of residential and public buildings with all comfort, services and regulatory aspects.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfil the needs of society.

Course Objectives:

1 To plan Residential building

2 To develop Submission drawing and working drawings of Residential building

3 To plan a Public building

4 To draw Perspective drawing for a Residential building

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C217.1	Design and develop submission drawing and working drawings of Residential building
C217.2	Design a public building
C217.3	Draw perspective drawing for a Residential building

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C217.1	2	1	2	-	-	2	-	1	1	1	-	2	1	1	6
C217.2	2	1	2	-	-	2	-	1	2	1	-	2	1	1	6
C217.3	2	-	-	-	-	1	-	-	2	1	-	2	1	1	3

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	Line plan for Residential Building	4
2	Approval drawing and Foundation plan for Residential Building	4
3	Services drawings for Residential Building	4
4	Furniture drawings for Residential Building	4
5	Line plan for Any one type of Public Building	4
6	Two Point Perspective drawings for Residential Building	4

Text Book:

1	Shah, Kale, Patki, Building Drawing –Tata McGraw- Hill
2	Y. S. Sane, Building Design and Drawing – Allied Book Stall, Pune

Reference Books:

1	V.B. Sikka, A Course in Civil Engineering Drawing – S.K. Kataria and Sons
2	Sandeep Mantri, A to Z of Practical Building Construction and Its Management-Satya Prakashan, New Delhi
3	SP 7- National Building Code Group 1 to 10- B.I.S. New Delhi
4	Time Saver Standards
5	I.S. 962 – 1989 Code for Practice for Architectural and Building
6	Guidelines and space standard for barrier free building environment for disabled and elderly person.-1998
7	Unified Development Control and Promotion Regulations. (UDCPR)
8	Building bye laws.

Course Plan

Course Title : Engineering Surveying lab	
Course Code : 201CEP218	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks (POE): 25**

Course Description:

The course includes introduction to various techniques of surveying which is an important field of civil engineering. The course aims to give thorough knowledge to students about the use of various traditional and modern instruments in surveying. Also, both traditional and modern methods of surveying are given due weightage in course curriculum.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective civil engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to full-fill the needs of society.

Course Objectives:

1. Describe the functions of surveying in civil engineering field.
2. Apply the traditional methods of surveying such as chain compass survey, simple and differential leveling, theodolite traversing, tachometry and contouring
3. Apply the modern techniques of surveying such as use of Total station.
4. Understand and apply different methods of plane survey, geodetic survey, hydrographic survey.
5. Calculate design and establish curves, understand, interpret and prepare plan, profile and cross-sectional drawing.
6. Work as team member on surveying party to achieve common goal of accurate and timely project completion

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C218.1	Demonstrate basics of plane surveying and different instrument used for it.
C218.2	Express proficiency in handling surveying equipment's and analyse surveying data obtained from these equipment's
C218.3	Use modern instruments like Total station in civil engineering projects

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C218.1	2	-	-	-	1	1	-	-	1	1	-	-	-	-	3
C218.2	2	-	-	-	1	1	-	-	1	1	-	-	-	-	3
C218.3	2	-	-	-	1	1	-	-	1	1	-	-	1	1	3

a) LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	Measurement of magnetic bearing by Prismatic Compass.	2
2	Simple and differential levelling with at least two change points by using Auto level.	2
3	Measurement of horizontal angle by Direct method using vernier transit theodolite.	2
4	Measurement of horizontal angle by Repetition method	2
5	Setting out simple circular curve by offset from long chord.	2
6	Setting out simple circular curve by Rankines method of Deflection Angles	2
7	Introduction to GIS software: QGIS, Arc GIS	2
8	Use of GPS for property measurement.	2
9	Practical based on various special functions available in total station such as remote elevation measurements, remote distance measurements and co-ordinate stake out.	2
10	Setting out a building by given foundation plan (minimum six coordinates) using total station.	2

b) PROJECTS

1) Block contouring using Auto Level.

2) Road project using Auto level for minimum length of 1000 m. (Including fixing of alignment, profile levelling, cross-section, plotting of longitudinal section and cross-section).

3) Total Station Traversing.

Text Books:

1	N.N. Basak, Surveying and Levelling, Tata McGraw Hill.
2	Dr. B. C. Punmia, Ashok K. Jain, Arun K.Jain, Surveying, Vol. I andII, Laxmi Publications

Reference Books:

1	T. P. Kanetkar and S.V. Kulkarni 'Surveying and Leveling' Vol. I and Vol. II - Pune Vidyarthi Griha Prakashan.
2	S. K. Duggal 'Surveying, Vol. I and II' - Tata Mc-Graw Hill.
3	Dr. K. R. Arora, 'Surveying Vol. I and II'- Standard Book House.
4	Subramanian, 'Surveying and Levelling' - Oxford University Press.
5	James M. Anderson, Edward M. Mikhail, 'Surveying: Theory and Practice'- Tata Mc-Graw Hill.
6	C. Venkatramaiah, 'Textbook of Surveying' - University Press.
7	John Uren and Bill Price, 'Surveying for Engineers' Palgrave Macmillan

Course Plan

Course Title : Open Channel Hydraulics and Hydraulic Machines Lab	
Course Code : 201CEP219	**Semester : IV**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE Marks : N.A.**

Course Description:

The course explores the principles of fluid mechanics through open channel laboratory experiments and verifies various hydraulic phenomena on laboratory setups.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective civil engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 Explore the fundamental principles of mechanics through experimentation.

2 Demonstrate and analyze key hydraulic phenomena using hands-on physical devices.

3 To provide students knowledge about the working of centrifugal pump and Pelton wheel turbine.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C219.1	Apply the calibration process to notch and weir models and compare with prototype structures of weirs
C219.2	Apply the profiles of GVF and RVF to Open channel flow
C219.3	Analyze the performance and working of centrifugal pump and Pelton wheel turbine.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C219.1	1	2	-	-	-	1	-	-	-	1	-	1	1	-	3
C219.2	1	2	-	-	-	1	-	-	-	1	-	1	-	-	3
C219.3	1	2	-	--	-	1	-	-	-	1	-	2	2	1	4

LIST OF EXPERIMENTS

Experiment No	Name of Experiment	Hours
1	Demonstration of Pitot Tube , Current meter	2
2	Calibration of V-Notch / Rectangular Notch.	2
3	Plotting of a GVF profile	2
4	Hydraulic characteristics of Hydraulic Jump.	2
5	Calibration of Ogee weir and plotting of Ogee profile	2
6	Calibration of Broad crested weir	2
7	Impact of Jet.	2
8	Demonstration of performance of Pelton Turbines	2
9	Performance test on Centrifugal Pump.	2
10	Visit report of Hydropower Plant, Pump House	2
11	Visit to River gauging station, K. T. weir	2
12	Study of modern commercial pump	2

Text Books:

1	A.K. Jain -Fluid Mechanics — Khanna Pub., Delhi.
2	Modi/Seth – Hydraulic and Hydraulic Machines –– Standard Book House, Delhi

Reference Books:

1	Streeter -Fluid Mechanics -McGraw-Hill International Book Co., Auckland.
2	V. T. Chaw - Flow in open channel –McGraw-Hill International Book Co., Auckland.
3	K. L. Kumar -Fluid Mechanics — Eurasia Publication House, Delhi.
4	Shames - Fluid Mechanics - McGraw-Hill International Book Co., Auckland.
5	Rangaraju - Open Channel flow– Tata McGraw-Hill Pub. Co., Delhi.
6	R.K. Bansal- Fluid Mechanics and hydraulic machine-, Laxmi Pubication

Course Plan

Course Title: Environmental Studies	
Course Code: 201CEMC220	**Semester: IV**
Teaching Scheme: L-T-P : 2-0-0	**Credits: 0**
Evaluation Scheme: ISE + MSE Marks : - N.A.	**ESE Marks: 50**

Course Description:

Environmental Studies course enhance a student's knowledge in a variety of currently relevant topics related to environmental awareness and pollution. The course aims to identify environmental problems, come-up with suitable solutions and create awareness for a hygienic and eco-friendly environmental.

Program Specific Outcomes (PSOs):

PSO1	To design and execute cost effective Civil Engineering solutions for sustainable development.
PSO2	To develop entrepreneur skills among the graduates to fulfill the needs of society.

Course Objectives:

1 Recognize the structure and functions of ecosystems with their importance.

2 Understand the environmental and social problems with global concern.

3 Understand the importance of environmental management for its protection.

4 Acquire problem solving skills through visits to different locations, identifying the environmental problems, proposing the solution models and exhibiting to the society and government authorities.

Course Outcomes (COs):

COs	At the end of successful completion of course, the students will be able to…
C220.1	Understand the importance of ecosystem and biodiversity in view of its conservation.
C220.2	Understand the concept of hazardous waste and to promote healthier environment.
C220.3	Explain the importance of environmental management through pollution control boards.
C220.4	Propose solutions for problems related with environmental well beings through location visits and model exhibitions.

Prerequisite:	Understanding of Environmental Education course.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	BTL
C220.1	-	-	-	-	-	1	3	2	-	-	-	-	-	-	2
C220.2	-	-	-	-	-	1	2	-	-	-	-	-	-	-	2
C220.3	-	-	-	-	-	1	3	-	1	1	-	-	-	-	2
C220.4	-	-	-	-	-	2	3	1	1	1	-	-	-	-	3

Course Content	Hours
Unit 1. Ecology and Biodiversity Definition, types, importance and examples of ecology, types of community relationships: Symbiosis, predation and competition. Ecosystem: structure and functions, biotic and abiotic components, energy flows, ecological succession, food chain, food web & ecological pyramid, types of ecosystems, degradation of ecosystems and its impact. Biodiversity hotspots: Western ghats, eastern Himalayas, threats to biodiversity and conservation of biodiversity, environmental ethics.	8
Unit 2. Environment and Health Air Pollution, water pollution. E-waste, waste minimization technology, Plastic waste, Population growth of the world and reduced health content of the environment, energy crisis, biofuels, Occupational health hazards, Concept of Carbon footprint.	7
Unit 3. Environmental Management Role of Central Pollution Control Board (CPCB) and Maharashtra Pollution Control Board (MPCB) in environmental protection of India. Concept of sustainability, ISO Certification.	5
Unit 4. Field Work Visit to a local area for documentation of environmental assets-River/forest/grassland/hill/mountain OR Visit to a local polluted site-Urban/Rural/Industrial/Agricultural OR Study of common plants, insects, birds OR Study of simple ecosystems- Ponds, Lakes, Rivers, Hill slopes, etc.	5

Text Books:

1	Trivedi R.K. and P.K Goel, Introduction to Air Pollution, Tech-science Publications.
2	Mhaskar A.K, Matter Hazardous, Techno-Science Publication.

Reference Books:

1	Bharucha, Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India
2	Hawkins R.E., Encyclopaedia of Indian Natural History, Bombay Natural History Society, Bombay
3	Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I &II, Environmental Media.
4	Miller T.G. Jr., Environmental Science, Wadsworth Publications Co.
5	Sharma B.K., Environmental Chemistry, Gokel Publ. House, Meerut.