Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

S.Y.B. Tech. Structural Engineering

2020 Pattern

Curriculum

(With effect from Academic Year 2020-2021)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

SANJIVANI RURAL EDUCATON SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON

(An Autonomous Institute Affiliated to SPPU, Pune)

DECLARATION

We, the Board of Studies Structural Engineering, hereby declare that we have designed the Curriculum of B.Tech. (Structural Engineering) of Pattern 2020 w.e.f. A.Y. 2021-22 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

14/8/24

BOS Chairman

14/8

(Dean Academics)

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
Approved

(Director)

Sanjivani Rural Education Society's
Kopargaon
Sanjivani College of Engineering

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute) Affiliated to Savitribai Phule Pune University.
At Sahajanandnagar, Post Shingnapur-423603, Ta:: Kopargaon, Dist.: Ahmednagar (MS)
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Department of Structural Engineering

Semester-III

Cat	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CA				
PC	ST201	Mechanics of Fluids	3	-	-	3	30	50	20	-	-	-	100
PC	ST202	Mechanics of Solids	4	-	-	4	30	50	20	-	-	-	100
PC	ST203	Civil Engineering Materials	3	-	-	3	30	50	20	-	-	-	100
PC	ST204	Architectural Planning and Drawing	3	-	-	3	30	50	20	-	-	-	100
HS	HS205	Universal Human Values and Ethics.	3	-	-	3	30	50	20	-	-	-	100
PC	ST206	Mechanics of Fluids Lab.	-	-	2	1	-	-	-	50	-	-	50
PC	ST207	Mechanics of Solids Lab.	-	-	2	1	-	-	-	50	-	-	50
PC	ST208	Civil Engineering Materials Lab	-	-	2	1	-	-	-	50	-	-	50
PC	ST209	Architectural Planning and Drawing Lab	-	-	2	1	-	-	-	-	-	50	50
MLC	MLC210	Mandatory learning Course-III-(Constitution of India)	2	-	-	Pass/Fail	-	-	-	-	-	-	-
		Total	18	-	8	**20**	150	250	100	150	-	50	**700**

*Oral will be based on term-work submitted

Semester-IV

Cat	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PC	BS202	Engineering Mathematics-III	3	1	-	4	30	50	20	-	-	-	100
PC	ST211	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	100
PC	ST212	Geotechnical Engineering	3	-	-	3	30	50	20	-	-	-	100
PC	ST213	Infrastructure Engineering	3	-	-	3	30	50	20	-	-	-	100
PC	ST214	Analysis of Determinate Structures	3	-	-	3	30	50	20	-	-	-	100
PC	ST215	Computer Aided Drawings Lab	-	-	2	1	-	-	-	-	50	-	50
PC	ST216	Geotechnical Engineering Lab	-	-	2	1	-	-	-	50	-	-	50
PC	ST217	Object Oriented Programming Lab	-	-	2	1	-	-	-	-	-	25	25
PRJ	ST218	Seminar	-	-	4	2	-	-	-	25	-	25	50
PRJ	ST219	Sports	-	-	2	1	-	-	-	-	25	-	25
MLC	MLC220	Mandatory Learning Course-IV (Innovation)	2	-	-	Pass/Fail	-	-	-	-	-	-	-
		Total	18	1	10	**22**	150	250	100	75	50	75	**700**

Semester	**III**
Course Category	**Professional Core (PC)**
Course Code	**ST201**
Course Title	**Mechanics of Fluids**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks**
	Insem. Evaluation: 30 Marks
	Endsem. Evaluation: 50 Marks

Prerequisite Course: Physics, Engineering Mechanics

Course Objectives:

1	To study the fluid properties and fluid statics.
2	To study the fluid kinematics
3	To study the fluid dynamics.
4	To study the boundary layer theory.
5	To study the laminar and turbulent flow through pipes.
6	To the flow through pipes.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the use of different fluid properties and concepts of fluid statics, Buoyancy and floatation and it's applications.	2	Understand
CO2	Understand the concepts of fluid kinematics with reference to continuity equation.	2	Understand
CO3	Understand the concepts of fluid dynamics with reference to Bernoulli's theorem and it's applications.	3	Apply
CO4	Understand the phenomenon of boundary layer and to use the concept for finding boundary layer thickness, displacement thickness, and momentum thickness.	3	Apply
CO5	Categorize the different types of flow such as Laminar and Turbulent through pipe.	4	Analyse
CO6	Determine the major and minor losses in the pipe line.	4	Analyse

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Fluid Properties:** Definition of fluid and fluid mechanics, classification of fluids, mass density, specific weight, specific volume, relative density, viscosity, Newton's law of viscosity, Dynamic and kinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapor pressure. **Fluid Statics:** Basic equations of fluid statics, Manometers, center of pressure on plane horizontal, vertical, inclined and curved surfaces, practical applications. Buoyancy and floatation principle of floatation and buoyancy, stability of floating and submerged bodies.	6	CO1
II	**Fluid Kinematics:** Eulerian and Lagrangian approach, velocity and acceleration and their components in Cartesian co-ordinates, classification of flows, stream line, stream tube, path line, streak line, control volume, equation of continuity for 3D flow in Cartesian co-ordinates, components of rotation, velocity potential, stream function and flow net.	6	CO2
III	**Fluid Dynamics:** Forces acting on fluid mass in motion, Euler's equation of motion along a stream line, Bernoulli's equation and it's limitations, modified Bernoulli's equation, concept of HGL, TEL, Applications of Bernoulli's equation, Venturimeter, Orifice meter, Rotameter, Pitot tube.	6	CO3
IV	**Boundary Layer Theory:** Concept, development of boundary layer on flat plate, factors affecting the growth, boundary layer thickness, displacement thickness, momentum and energy thickness, laminar , sub-layer, local and mean drag coefficient, hydro dynamically smooth and rough boundary, boundary layer separation and methods to control separation.	6	CO4
V	**Laminar and Turbulent Flow through Pipe:** Characteristics of laminar flow, laminar flow through a circular pipe, characteristics of turbulent flow, instantaneous velocity, temporal mean velocity, scale of turbulence and intensity of turbulence, Prandtl's mixing of length theory, velocity distribution equation, variation of friction factor for laminar and turbulent	6	CO5

Unit No.	Topic	Hrs.	COs
	flow, resistance to flow in smooth and rough pipes, friction factor, Moody's diagram.		
VI	**Flow through Pipes:** Energy losses in pipe flow, equation of major and minor losses in pipe, flow through pipes in simple and compound pipe, pipes in series, parallel, Dupit's equation, pipe network, introduction to siphon (No numerical)	6	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	R. K. Rajput	A text book of fluid mechanics and hydraulic machines	6th Ed.	1998	S.Chandand Company Ltd. New Delhi
2	R. K. Bansal	A text book of fluid mechanics and hydraulic machines	Rev. Ed.	2008	Laxmi Publications, New Delhi

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Streeter, Wylie and Bedford	Fluid mechanics	2nd Ed.	1959	McGraw-Hill
2	Modi, P. N., and Seth, S. M	Hydraulics and fluid Mechanics including Hydraulic Machine	9th Ed.	1998	Standard book house, New Delhi

E-Resources:

Sr. No.	Link
1	https://nptel.ac.in/courses/112/104/112104118/
2	https://nptel.ac.in/courses/105/103/105103192/
3	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/

Semester	**III**
Course Category	**Professional Core (PC)**
Course Code	**ST202**
Course Title	**Mechanics of Solids**
Credits	**4**
Teaching Scheme	**Lectures: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Engineering Mechanics, Mathematics

Course Objectives:

1	To introduce fundamental concepts of solid mechanics
2	To introduce the shear force and bending moments induced in a beam
3	To study the bending and shearing stresses developed in a beam
4	To study the shafts subjected to torsion
5	To study the principal stresses and strains
6	To study the types of column and stresses developed in columns

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Recall the basic concepts of mechanics of deformable bodies	1	Remembering
CO2	Calculate the internal forces developed due to external loads	2	Understanding
CO3	Apply basic concept of pure bending to determine stresses in beams, columns, shafts	3	Applying
CO4	Analyze beams, columns, shafts for shear, bending, torsion etc.	4	Analyzing
CO5	Calculate the principal stresses and strains in deformable bodies	2	Understanding
CO6	Classify different column and to find out stresses in it.	3	Applying

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	---	---	---	---	---	---	---	---	---	---	---	---	---
CO2	3	---	---	---	---	---	---	---	---	---	---	---	---	---
CO3	3	2	---	---	---	---	---	---	---	---	---	---	---	---
CO4	---	3	---	2	---	---	---	---	---	---	---	---	---	---
CO5	3	2	---	3	---	---	---	---	---	---	---	---	---	---
CO6	2	---	2	---	---	---	---	---	---	---	---	---	---	---

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Simple Stresses and Strain:** Introduction, difference between mechanics of rigid bodies and mechanics of deformable bodies. Concept of stress and strain, types of stresses and strains. Stress-strain diagram for elastic, plastic and brittle material, Hooke's law, elastic constants and relation between them, Generalized Hooke's law, Principle of superposition - bars of varying sections and of different materials Thermal stresses. Concepts and Numerical on stresses in determinate and indeterminate structures.	8	CO1
II	**Shear Force and Bending Moment Diagram:** Shear force and bending moment at a section. Relation between shear force, bending moment and intensity of loading, Shear force and bending moment diagrams for beams subjected to point loads, uniformly distributed loads, uniformly varying loads and couples (Only simply supported and Cantilever beams)	8	CO2
III	**Bending and Shear Stresses:** Theory of pure bending, Assumptions, derivation of flexural formula, Bending stress distribution diagrams. Moment of Resistance. Concept of shear, complimentary shear, derivation of shear stress formula, shear stress distribution diagrams for various sections, maximum and average shear stress for rectangular, triangular and circular sections (No derivation, formula only), Concepts of shear centre, shear connectors and shear flow.	8	CO3
IV	**Torsion:** Torsion of circular shafts, Theory of torsion, Assumptions, Derivation of Torsional formula, Power Transmitted by shafts, Stresses, strain and deformations in determinate shafts of hollow, solid, homogeneous cross-sections subjected to twisting moments.	8	CO4
V	**Principal Stresses and Strains:** Concepts of Principal planes and stresses, Normal and Shear stresses on an oblique plane, Magnitude and Orientation of Principal stresses, Maximum shear stresses, Theories of failure.	8	CO5
VI	**Axially and Eccentrically Loaded Columns:** Axially loaded columns, Critical and Buckling load, Safe load, Assumptions and Euler's formula for buckling load with hinged support, Limitations of Euler's formula, equivalent length for various end conditions, Rankine's formula. Direct and bending stresses for columns subjected to eccentric load. Uniaxial and bi-axial bending. Core of section for different sections.	8	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	R. Subramanian	Strength of Materials	3rd Ed.	2016	Oxford University Press
2	Dr. R.K. Bansal	Strength of Materials	6th Ed.	2018	Laxmi Publications
3	S.S. Rattan	Strength of Materials	3rd Ed.	2017	McGraw Hill Education

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Gere and Timoshenko	Mechanics of Materials	2nd Ed.	2004	CBS Publications

2	Ferdinand P. Beer, E. Russel Johnston Jr., John Dewolf and David Mazurek, Sanghi	Mechanics of Materials	7th Ed.	2017	McGraw Hill Education India Private Limited
3	R. C. Hibbeler	Mechanics of Materials	9th Ed.	2018	Pearson Education

E-Resources:

Sr. No.	Link
1	https://nptel.ac.in/courses/105/105/105105108/
2	https://nptel.ac.in/courses/112/107/112107147/
3	https://nptel.ac.in/courses/112/107/112107146/

Semester	**III**
Course Category	**Professional Core (PC)**
Course Code	**ST203**
Course Title	**Civil Engineering Materials**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks**
	Insem. Evaluation: 30 Marks
	Endsem. Evaluation: 50 Marks

Prerequisite Course: Nil

Course Objectives:

1	To study different types of building components and their materials.
2	To study the building occupants to access the areas.
3	To know the properties of various ingredients of concrete
4	To learn the behaviour and properties of fresh concrete and hardened concrete
5	To learn and develop the concrete mix design.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Recognize different building components and material required for it.	1	Remembering
CO2	Define the types of flooring, doors and windows.	2	Understanding
CO3	To describe the vertical circulation and protective coatings	2	Understanding
CO4	Determine the various ingredients of concrete.	1	Remembering
CO5	Analyse and examine the various types of concrete and their Properties.	4	Analyzing
CO6	Calculate required grade of concrete	2	Understanding

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to building construction**– Definition, types of building, Building components, substructure and superstructure requirements. Superstructure: Concept and advantages of a framed structure, RCC framed structures. Substructure – shallow and deep foundations and their suitability, Failure of foundation and its causes, Foundation in black cotton soil. **Masonry**– Stone masonry, types of stone masonry. Brick masonry: characteristic of good building bricks, IS specification and tests, classification of bricks: silica, refractory, fire and fly ash bricks. Brick work, types of bonds: English, Flemish. **Block Masonry –** Cellular lightweight concrete blocks, hollow blocks, concrete blocks.	6	CO1
II	**Flooring, Doors and Windows building Materials –** Functional requirement of flooring, types of floor finishes and their suitability, construction details for concrete, tiles and stone flooring. Types of flooring. **Doors and Windows** – Types of doors, Types of windows.	6	CO2
III	**Vertical Circulation and Protective Coatings** **Vertical Circulation** – Consideration in planning, design considerations, Staircase: types, and details of ramps. Ladders, lifts, and escalator. Types of staircase: straight stairs, open well stairs, quarter turn stairs, half turn stairs, turning stairs, dog-legged stairs, circular stairs, geometrical stairs, bifurcated stairs, and spiral stairs **Protective Coatings -**Mortar preparation and types, painting and varnishing, types and application, white washing distempering, oil paints.	6	CO3
IV	**Ingredients and admixture of Concrete** **Ingredients of concrete**: -Manufacturing of Portland cement, Chemical composition, chemistry of cement, Hydration, Classification and types of cement, Tests on cement. Aggregate: - Classification, Mechanical and Physical properties, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate. **Admixtures:** Functions, Classification, Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents.	6	CO4
V	**Properties of Fresh Concrete and hardened concrete** **Fresh Concrete Properties:** -Workability-Definition, Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete. **Hardened concrete Properties**: – General, Factors affecting strength, Micro cracking and stress strain relationship, Relation between tensile and compressive strength.	6	CO5
VI	**Concrete Mix Design:** Factor affecting concrete mix design, Types of Mixes, Methods of Mix Design:	6	CO6

	IS code method and DOE method, Demonstration and application of concrete mix design software.		

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	B.C.Punmia.	Building Construction	11th Ed.	2016	Laxmi Publications
2	S.P Bindra and S P Arora	Building Construction	05th Ed	2009	Dhanpat Rai Publications
3	M. S. Shetty	Concrete Technology	10th Ed	2020	S. Chand Publications.

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. K. Duggal	Building Materials	4th Ed.	2014	New Age International Publishers
2	A. M. Neville and J. J. Brooks	Concrete Technology	2nd Ed.	2009	Pearson Education
3	A.R.Santhakumar	Concrete Technology	2nd Ed.	2018	Oxford University Press

E-Resources:

Sr. No.	Link
1	https://nptel.ac.in/courses/105/106/105106206/
2	https://nptel.ac.in/courses/105/102/105102088/

Semester	**III**
Course Category	**Professional Elective (PE)**
Course Code	**ST204**
Course Title	**Architectural Planning and Drawing**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: NIL

Course Objectives:

1	To understand necessity of Town planning, principles of planning, principles of architecture and byelaws.
2	Develop capability to prepare drawings of residential buildings
3	Develop capability to prepare drawings of nonresidential buildings
4	To study the planning for building services such as noise and acoustics, ventilation, lighting, plumbing work and safety practices

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes(COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Gain a broad understanding of principles planning and designing of buildings.	3	Understand
CO2	Analyze the available primary or secondary data and plan different types of structures considering futuristic need of an area.	3	Analyse
CO3	Understanding the approach and process of planning of residential buildings.	3	Understand
CO4	Understanding the approach and process of planning of non-residential buildings.	3	Understand
CO5	Develop capability to prepare drawings of residential/Non residential buildings.	3	Apply
CO6	Design effectively various types of buildings according to their utility with reference to different codes.	3	Apply

Mapping of Cos with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Town planning and legal aspects** a) **Town planning:** Necessity and evolution of town planning in India. Development plan and its importance, Objectives and Contents of DP, Introduction to different zones of land in town planning, Requirements of various zones, Height zoning and Density zoning. b) **Legal Aspects**: co-op Housing societies in apartments. Ownership of land, Role of Plan sanctioning authority, 7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, Concept of TDR, List of documents to be submitted to local authority, Procedure for seeking Commencement and Occupancy Certificate, Various NOCs required.	6	CO1
II	**Architectural Planning and Building bye laws:** a) History of architecture, built environment, principles of Architecture, relation between form and function, utility, aesthetics. b) Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), concept of V.P.R. Marginal distances, building line: control line, height regulations, room sizes and Area calculations, Rules for ventilation, lighting and Parking of vehicles.	6	CO2
III	**Planning of Residential Building:** **a)** Functional requirements of Bungalows, Twin bungalows, Row houses, Ownership flats, and Apartments. **b)** Developed Plan, Elevation and Sectional Elevation of above mentioned categories.	6	CO4
IV	**Planning of Public Buildings** **a)** Functional requirements and planning of industrial buildings, commercial buildings, School, Colleges , Hostel, Auditorium, Restaurant/ Hotel building, Primary Health Center/ Hospital, Shopping complex, Sports complex, Vegetable market, Post office, Bank buildings etc. . **b)** Dimensioned line plans of above public buildings.	6	CO5
V	**Building Drawing and Introduction to Software:**	6	CO3

Unit No.	Topic	Hrs.	COs
	a) Introduction to Architectural drawing: i) Line plan, ii) Developed Plan, iii) Elevation, iv) Section, Key plan-Site plan) Elements of perspective drawings. **b)** Introduction to software- i) AutoCAD ii) 3D max iii) Revit.		
VI	**Building Services** a) Noise and Acoustics b) c) Lighting d) Plumbing e) Other services	6	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M. G. Shah, C. M. Kale and S. Y. Patki	Building Drawings with an integrated Approach to Built-Environment.	5th Ed.	2017	Tata McGraw Hill.
2	Dr. S. V. Deodhar	Building science and planning	5th Ed.	1972	Khanna Publishers
3	David V. Chadderton	Building Services Engineering	6th Ed	2012	Routledge

References Books:(Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Frederick Merrit	Building Design and construction	6th Ed.	2019	McGraw-Hill
2	Callender	Times Saver standards of Architectural Design Data	Rev. Ed.	1973	Tata McGraw-Hill
3	IS	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings	--	1989	IS

E-Resources: (NA)

Sr. No.	Link
1	**https://onlinecourses.nptel.ac.in/noc21_ar08/ (NPTL)**
2	**https://onlinecourses.nptel.ac.in/noc21_ar07 (NPTL)**
3	**https://onlinecourses.swayam2.ac.in/cec21_ar02**
4	**http://www.grihaindia.org/**
5	**http://new.usgbc.org/**
6	**http://www.hcd.ca.gov/hpd/green_build.pdf**
7	**http://ncict.net/Examples/Examples1.aspx**

Semester	**III**
Course Category	**Humanities and Social Sciences (HS)**
Course Code	**HS205**
Course Title	**Universal Human Values and Ethics**
Credits	**3**
Teaching Scheme	**3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **In semester Evaluation: 30 Marks** **End semester Evaluation: 50 Marks**

Course Objectives:

1	To study the Values, Morals and Ethics; Concept and need of value education.
2	To study the human being as the coexistence of self and the body
3	To study the holistic approach for the human being to live in harmony at different levels.
4	To study the professional ethics and Humanistic education and universal human order
5	To study the engineering ethics.
6	To study the global issues such as cross cultural, environmental, bio, computer etc.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Recognize the concept of self-exploration as the process of value education.	2	Knowledge
CO2	Describe the human being as the coexistence of self and body	2	Comprehension
CO3	Identify the values in human relationship.	2	Comprehension
CO4	Recognize the professional ethics and its competence.	2	Comprehension
CO5	Write ethical practices in engineering profession and moral issues	3	Application
CO6	Identify the importance of various ethical practices in the wake of global realities	4	Analyze

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	Introduction to Value Education: Values, Morals and Ethics; Concept and need of value education; Self-exploration as the process for value education; Guidelines for value education; Basic human aspirations and their fulfillment	6	CO1
II	Harmony in Human Being : Human being as the coexistence of self and the body; Discrimination between the needs of the self and the body; The body as an instrument; Harmony in the self; Harmony of the self with the body	6	CO2
III	Harmony in the family, Society and Nature: Harmony in the family- The basic unit of human interaction; Values in the human to human relationship; Harmony in the society; Vision for the universal human order; Harmony in the nature; Realizing existence as coexistence at all levels	6	CO3
IV	Professional Ethics : Natural acceptance of human values; Definitiveness of ethical human conduct; Humanistic education and universal human order; Competence in professional ethics; Transition towards value-based life and profession	6	CO4
V	Engineering Ethics and Social Experimentation : Need of engineering ethics; Senses of engineering ethics; Variety of moral issues; Moral autonomy; Utilitarianism; Engineering as experimentation; Engineers as responsible experimenters; Codes of ethics	6	CO5
VI	Global Issues: Globalization and multi-national corporations; Cross-cultural issues; Business ethics; Environmental ethics; Computer ethics; Bio-ethics; Ethics in research; Intellectual property rights and plagiarism	6	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	R. R. Gaur, R. Sangal,and G. P. Bagaria	A Foundation Course in Human Values and Professional Ethics.	Reprint	2010	Excel Books Pvt. Ltd.
2	R. S. Naagarazan	A Textbook on Professional Ethics and Human Values	1st	2020	New Age Int, (P) Ltd. publishers

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	B. P. Banerjee	Foundations of Ethics in Management	1st	2005	Excel Books Pvt. Ltd
2	M. K. Gandhi	The Story of my Experiments with Truth	**2020th Ed.**	2020	Discovery Publisher

E-Resources:

Sr. No.	Link
1	http://uhv.org.in/
2	https://nptel.ac.in/courses/109/104/109104068/

Semester	**III**
Course Category	**Professional Core (PC)**
Course Code	**ST206**
Course Title	**Mechanics of Fluids Lab**
Credits	**1**
Teaching Scheme	**Laboratory: 2 hrs./week**
Evaluation Scheme	**Term work: --, Oral: 50**

Prerequisite Course: **Physics, Engineering Mechanics**

Course Objectives:

1	To study the fluid properties and fluid statics.
2	To study the fluid kinematics
3	To study the fluid dynamics.
4	To study the boundary layer theory.
5	To study the laminar and turbulent flow through pipes.
6	To the flow through pipes.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the use of different fluid properties and concepts of fluid statics, Buoyancy and floatation and it's applications.	2	Understand
CO2	Understand the concepts of fluid kinematics with reference to continuity equation.	2	Understand
CO3	Understand the concepts of fluid dynamics with reference to Bernoulli's theorem and it's applications.	3	Apply
CO4	Understand the phenomenon of boundary layer and to use the concept for finding boundary layer thickness, displacement thickness, and momentum thickness.	3	Apply
CO5	Categorize the different types of flow such as Laminar and Turbulent through pipe.	4	Analyze
CO6	Determine the major and minor losses in the pipe line.	4	Analyze

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	--	--	--	--	--	--	--	--	--	--	--	3	--
CO2	2	--	--	2	2	--	--	--	--	--	--	--	--	2
CO3	2	--	--	2	2	--	--	--	--	--	--	--	2	--

CO4	1	--	--	2	2	--	--	--	--	--	--	--	1	2
CO5	1	2	--	2	--	--	--	--	--	--	--	--	2	1
CO6	1	2	--	2	--	--	--	--	--	--	--	--	2	--

Course Contents

Expt. No.	Topic	Hrs.	COs
1	Measurement of viscosity by Redwood Viscometer.	2	1,2
2	Verification of Bernoulli's theorem.	2	3
3	Calibration of Venturimeter/ Orificemeter.	2	3
4	Determination of friction factor for a pipe.	2	1
5	Determination of stability of floating bodies using ship model	2	1
6	Determination of pressure using different pressure measuring devices.	2	1
7	Determination of minor losses in pipe.	2	5,6
8	Determination of Reynold's number using Reynold's apparatus.	2	4,5

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	R. K. Rajput	A text book of fluid mechanics and hydraulic machines	6th Ed.	1998	S.Chandand Company Ltd. New Delhi
2	R. K. Bansal	A text book of fluid mechanics and hydraulic machines	Rev. Ed.	2008	Laxmi Publications, New Delhi

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Streeter, Wylie and Bedford	Fluid mechanics	2nd Ed.	1959	McGraw-Hill
2	Modi, P. N., and Seth, S. M	Hydraulics and fluid Mechanics including Hydraulic Machine	9th Ed.	1998	Standard book house, New Delhi

E-Resources:

Sr. No.	Link
1	https://nptel.ac.in/courses/112/104/112104118/
2	https://nptel.ac.in/courses/105/103/105103192/
3	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/

Semester	**III**
Course Category	**Professional Core (PC)**
Course Code	**ST207**
Course Title	**Mechanics of Solids Lab.**
Credits	**1**
Teaching Scheme	**Lectures: 2 hrs./week**
Evaluation Scheme	**Oral Evaluation: 50 Marks**

Prerequisite Course: **Engineering Mechanics, Mathematics**

Course Objectives:

1	To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	determine yield strength and toughness of various metals	2	Understanding
CO2	determine crushing strength and flexural strength of various metals	2	Understanding
CO3	determine flexural strength and quality of flooring tiles	2	Understanding
CO4	determine crushing strength and quality of bricks	2	Understanding

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	---	---	---	---	---	---	---	---	---	---	---	---	---
CO2	2	---	---	---	---	---	---	---	---	---	---	---	---	---
CO3	3	---	---	---	---	---	---	---	---	---	---	---	---	---
CO4	---	3	---	2	---	---	---	---	---	---	---	---	---	---

List of Experiments

Sr. No.	Topic	COs
A	**Tests on Metals**	CO1
	1. Tension test on mild steel and TMT steel.	
	2. Shear test on mild steel (Single and Double Shear)	
	3. Impact test on Mild steel, Copper, Brass and Aluminum (Izod and Charpy test)	
B	**Tests on Timber**	CO2

Sr. No.	Topic	COs
	1. Compression Test on Timber	
	2. Bending Test on Timber	
C	**Tests on Tiles**	CO3
	1. Flexural Strength of Flooring Tiles.	
	2. Abrasion Strength of Flooring Tiles.	
D	**Test on Bricks**	CO4
	1. Water Absorption of Bricks.	
	2. Compressive Strength of Bricks.	
	3. Efflorescence Test on Bricks.	

Assignment:

Draw Mohr's circle for a given Stress-Strain condition by using any suitable software.

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	N. Subramanian	Building Materials	1st Ed.	2019	Oxford University Press
2	Dr. A.K.Misra	Building Materials and Construction	1st Ed.	2017	S Chand Publication
3	Parbin Singh	Civil Engineering Materials	Reprint 2013 Ed.	2013	S K Kataria and Sons

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S.K. Duggal	Building Materials	5th Ed.	2019	New Age Publishers
2	Marios Soutsos and Peter Domone	Construction Materials	5th Ed.	2017	CRC Press
3	Theodore Marotta	Basic Construction Materials	6th Ed.	2001	Pearson

E-Resources: (Maximum 3)

Sr. No.	Link
1	http://sm-nitk.vlabs.ac.in/#
2	https://virtlabs.tech/strength-materials/
3	https://www.youtube.com/c/AnimeEdu/playlists

Semester	**III**
Course Category	**Professional Core (PC)**
Course Code	**ST208**
Course Title	**Civil Engineering Materials**
Credits	**1**
Teaching Scheme	**Practical: 2 hrs./week**
Evaluation Scheme	**Oral Examination: 50 Marks**

Prerequisite Course: Nil

Course Objectives:

1	To study the different laboratory test on cement.
2	To learn the properties of fresh concrete and hardened concrete
3	To study concrete mix design.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	To be aware of different test on cement and aggregate.	2	Understanding
CO2	To identify various ingredients of concrete and carried out fresh and hardened test of concrete in the field.	2	Understanding
CO3	Design concrete mix of desired grade	4	Analysis

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	---	---	1	1	---	1	---	1	---	---	---	3	2
CO2	3	---	---	--	2	---	---	---	---	---	---	---	2	3
CO3	---	---	3	---	---	2	---	---	1	---	2	---	3	3

List of Experiments

Sr. No.	Title	COs
A	**Tests on Cement** 1. Fineness of cement and Fineness of fly ash 2. Standard consistency of cement 3. Initial and final setting time and soundness of cement. 4. Compressive strength of cement.	1,2
B	**Test on Aggregates** 1. Fineness modulus of fine and coarse aggregate by sieve analysis. 2. Moisture content, silt content, density and Specific gravity of fine aggregate	1,2

Sr. No.	Title	COs
	3. Moisture content, water absorption, density and Specific gravity of coarse aggregate.	
C	**Test on Concrete** 1. Workability of concrete by slump test, flow table test, compaction factor, concrete 2. Compressive strength, Flexural strength and spilt tensile test of concrete. 3. Compressive strength test of concrete by Rebound hammer 4. Concrete mix design by IS code method.	2,3

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M. S. Shetty	Concrete Technology	10th Ed	2020	S. Chand Publications.
2	O. Subramanian	Building Materials	1st Ed.	2019	Oxford University Press
3	Parbin Singh	Civil Engineering Materials	Reprint 2013 Ed.	2013	S K Kataria and Sons

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S.K. Duggal	Building Materials	5th Ed.	2019	New Age Publishers
2	Marios Soutsos and Peter Domone	Construction Materials	5th Ed.	2017	CRC Press
3	Theodore Marotta	Basic Construction Materials	6th Ed.	2001	Pearson

E-Resources: (Maximum 3)

Sr. No.	Link
1	http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Civilomarwadians/labs/exp1/simulation.html
2	https://www.youtube.com/c/AnimeEdu/playlists

Semester	**III**
Course Category	**Professional Elective (PE)**
Course Code	**ST209**
Course Title	**Architectural Planning and Drawing using Auto CAD**
Credits	**1**
Teaching Scheme	**Practical: 2 hrs./week**
Evaluation Scheme	**Practical exam: 50 Marks**

Prerequisite Course: **Engineering Graphics**

Course Objectives:

1	To understand necessity of Town planning, principles of planning, principles of architecture and byelaws.
2	To study the planning for building services such as noise and acoustics, ventilation, lighting, plumbing work and safety practices
3	To develop the plan, elevation and section of load bearing and framed structures.
4	To produce graduate civil engineers who can excel in post graduate programs.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes(COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Identify the need of owner/clients, able to design the layout plan, and also water supply-Drainage layout	3	Understand
CO2	Design effectively Residential buildings according to their utility with reference to different codes.	3	Apply
CO3	Design effectively Elevation and Section of Residential and nonresidential building.	3	Apply
CO4	Design Perspective drawing of building components.	3	Apply
CO5	Identify the effectiveness of different rules and regulations of competent authority for planning of residential and public building.	3	Understand

Mapping of Cos with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

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

Course Contents

Practical No.	Topic	Hrs.	COs
I	Students shall prepare working drawings of any type of building from the list. (Individual project to be planned and manually drafted to suitable scale): Layout/ Site plan indicating water supply and drainage line (with area statement).	2	CO1
II	c) Floor Plan/ Typical floor plan (with construction notes, schedule of openings)	2	CO2
III	Elevation and Sectional Elevation (preferably to be drawn on same sheet).	4	CO3
IV	Perspective drawing of a small building element.	2	CO4
V	Report file: It shall consist of data given for the project, DC. Rules and information about software used to draw plan, elevation and section.	2	CO5

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	M. G. Shah, C. M. Kale and S. Y. Patki	Building Drawings with an integrated Approach to Built-Environment.	5th Ed.	2017	Tata McGraw Hill.
2	Dr. S. V. Deodhar	Building science and planning	5th Ed.	1972	Khanna Publishers
3	David V. Chadderton	Building Services Engineering	6th Ed	2012	Routledge

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Frederick Merrit	Building Design and construction	6th Ed.	2019	McGraw-Hill
2	Callender	Times Saver standards of Architectural Design Data	Rev. Ed.	1973	Tata McGraw-Hill
3	Code	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings	--	1989	IS

E-Resources:

Sr. No.	Link
1	**https://onlinecourses.nptel.ac.in/noc21_ar08/ (NPTL)**
2	**https://onlinecourses.nptel.ac.in/noc21_ar07 (NPTL)**
3	**https://onlinecourses.swayam2.ac.in/cec21_ar02**

Semester	**III**
Course Category	**MLC**
Course Code	**ST210**
Course Title	**Constitution of India**
Credits	**2**
Teaching Scheme	**Lectures: 02 hrs./week**
Evaluation Scheme	**Pass/Fail**

Course Objectives:

1	To study the historical background, salient features and preamble of Indian constitution
2	To study the provision of fundamental right in the Indian constitution
3	To study the directive principle of state policy and fundamental duties
4	To study the system of government through parliamentary and federal system
5	To understand the formation, structure and legislative framework of central government
6	To understand the formation, structure and legislative framework of state government

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes(COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe background, salient features of constitution of India	1	Remembering
CO2	Explain the system of government, its structure and legislative framework also can interpret the fundamental rights and duties	2	Understand
CO3	Apply the fundamental rights and duties in their life	3	Determine

Mapping of Cos with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1								
CO2						2								
CO3						2								

Course Contents

Practical No.	Topic	Hrs.	COs
I	**Introduction to Constitution of India** a. Historical background b. Salient features c. Preamble of constitution	07	CO1
II	**Fundamental rights** a. Features of fundamental rights b. Basic rights 1. Right to equality; 2. Right to freedom; 3. Right against exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6. Right to property; 7. Right to constitutional remedies	05	CO1
III	(A) Directive principle of state policy: a. Features of directive principle b. Classification of directive principle c. Criticism of directive principle	05	CO2

Practical No.	Topic	Hrs.	COs
	d. Utility of directive principle e. Conflict between Fundamental rights and directive principle (B) Fundamental duties: a. List of fundamental duties b. Features of fundamental duties c. Criticism of fundamental duties d. Significance of fundamental duties e. Swaran Singh Committee Recommendations		
IV	**System of Government** a. Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system b. Federal system: Federal features of constitution, unitary features of constitution c. Centre and state relation: Legislative relation, administrative relations and financial relation. d. Emergency provision: National emergency, Financial emergency and criticism of emergency provision	05	CO2
V	**Central government** a. President: Election of president, powers and functions of president, and Veto power of president b. Vice-president: Election of vice-president, powers and functions of vice-president c. Prime minister: Appointment of PM, powers and functions of PM, relationship with president d. Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees e. Parliament: Organization of parliament, composition of the two houses , duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament. f. Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court	05	CO3
	State government a. Governor: Appointment of governor, powers and functions of governor, constitutional position b. Chief minister: Appointment of CM, powers and functions of CM, relationship with governor c. State council of ministers: Appointment of ministers, responsibility of ministers, cabinet. d. High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC e. Sub-ordinate court: Structure and jurisdiction, LokAdalats, Family court, Gram Nyayalayas	05	CO3

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	M Laxmikanth	Indian Polity for Civil Service Examination.	Fifth Edition		Mc GrawHill Education
2	Durga Das Basu	Introduction to the Constitution of India	22nd Edition		Lexis Nexis,

Semester	**IV**
Course Category	**Basic Science (BS)**
Course Code	**BS 202**
Course Title	**Engineering Mathematics III**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Computer Fundamentals**

Course Objectives:

1	To make students familiarize with concepts and techniques of vector calculus, probability and differential calculus.
2	The intent is to furnish them with the techniques to understand engineering mathematics and its applications that would develop logical thinking power, useful in their disciplines.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Describe** the basics of vector algebra, **apply** it to calculate directional derivative, divergence and curl of vector function	**3**	**Apply**
CO2	**Understand** the concept, vector integration, **apply** it to solve engineering problems using Green's theorem, Stoke's theorem, Gauss's theorem	**3**	**Apply**
CO3	**Analyze** solution of ordinary differential equations **using** iterative, interpolation methods	**4**	**Analyze**
CO4	**Apply** integral transform technique to **solve** equations involved in engineering applications**.**	**3**	**Apply**
CO5	**Analyze** data, **find** mean, correlation, regression of a statistical data, calculate probability using different distributions.	**4**	**Analyze**
CO6	**Apply** partial differential equation and **solve** practical problems in engineering	**3**	**Apply**

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Vector Differentiation:** Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function $\emptyset$, Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	6	CO1
II	**Vector Integration:** Line integral, Green's theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem, Equation of Stream line. objects in inheritance hierarchy, abstract classes, polymorphism.	6	CO2
III	**Numerical Methods:** Interpolation with unequal intervals: Lagrange's formulae, Interpolation using Newton's forward and backward difference formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Numerical Differentiation: Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first order equations.	6	CO3
IV	**Fourier Transformation:** Dirichlet's Condition, Definition of Fourier transform, Properties of Fourier transform, Fourier Cosine transform, Fourier sine transform, Inverse Fourier transform.	6	CO4
V	**Basic Statistics and Probability:** Measures of Central tendency, Moments, Skewness and Kurtosis, Correlation and regression, Definitions of probability, Bay's theorem, Distribution function, Binomial, Poisson and normal distributions	6	CO5
VI	**Applications of Partial Differential Equations:** Separation of variables; solutions of one dimensional diffusion equation; first and second order one-dimensional wave equation and two dimensional Laplace equations	6	CO6

Text Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	B. S. Grewal	Higher Engineering Mathematics	4th	2012	Khanna Publishers
2	Scott Miller, Donald Childers	Probability and Random Processes	2nd	2012	Elsevier
3	R. K. Jain and S. R. K. Iyengar	Advanced Engineering Mathematics	4th	2014	Narosa Publishing House

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	K.A. Stroud & D. S. Booth	Advanced Engineering Mathematics	5th Ed	2011	Industrial Press
2	P. C. Matthews	Vector Calculus	2nd Ed	2012	Springer
3	Erwin Kreyszig	Advanced Engineering Mathematics, Wiley, 9/e, 2013	9th Ed	2013	Wiley
4	T. Veerarajan	Probability Statistics and random processes	3rd Ed	2008	Tata McGraw Hill

Semester	**IV**
Course Category	**Professional Core (PC)**
Course Code	**ST211**
Course Title	**Object Oriented Programming**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Computer Fundamentals & Programming**

Course Objectives:

1	To introduce basics of the Object Oriented Programming.
2	To develop simple programming application using objects and classes in C++ programming.
3	To learn use of Constructors and Destructors in program.
4	To learn polymorphism principle of OOP.
5	To develop C++ classes using inheritance principle of OOP.
6	To learn use of memory allocation, exception handling and template features of OOP.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Introduce basics of the Object Oriented Programming.	2	Understanding
CO2	Develop simple programming application using objects and classes in C++ programming.	3	Apply
CO3	Learn use of Constructors and Destructors in program.	2	Understanding
CO4	Learn polymorphism principle of OOP.	2	Understanding
CO5	Develop C++ classes using inheritance principle of OOP.	3	Apply
CO6	Learn use of memory allocation, exception handling and template features of OOP.	2	Understanding

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to Object Oriented Programming**		
	Introduction to Procedure Oriented Programming, Introduction to Object Oriented Programming, POP vs OOP, Need of OOP, Benefits of OOP, Applications of OOP **Basic Concepts of OOP:** Classes, Objects, Data abstraction, Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing **Beginning with C++:** Introduction, C++ Programming basics, Program Development Process, Data types, Tokens, Constants, Enumerations, Expressions, Type casting (implicit and explicit), Arrays	6	CO1
II	**Classes and Objects**		
	Structures, Specifying class, Creating object, Defining member functions, Class scope and accessing class members, Simple C++ program with class & objects, Memory allocation for objects, Arrays in classes, Arrays of objects, Classes- private, protected, public members **Functions:** Introduction, function prototype, parameter passing, Inline function, friend function, friend class, static function	6	CO2
III	**Constructors and Destructors**		
	Constructors: Introduction, Types- Default, parameterized, copy constructor, Multiple constructors in a class, Constructors with default arguments, Example **Destructors:** Introduction, Example **Control Structures:** Introduction, Types- Sequence, Selection and Loop control structure	6	CO3
IV	**Polymorphism**		
	Introduction: Concept, Relationship among objects in inheritance hierarchy, Types – Static (Function overloading, Operator Overloading) and Dynamic (Function Overriding/Use of Virtual Function), Pure Virtual Function **Operator Overloading:** Concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Binary Operators using friends, Rules for operator overloading, Type conversions	6	CO4
V	**Inheritance**		
	Introduction, benefits of Inheritance, Base class, Derived Class, Making the private members inheritable, Types of Inheritance – Single, Multiple, Multilevel, Hierarchical and Hybrid, Ambiguity resolution, Visibility of inherited members, Function Overriding, Virtual Base classes, Abstract classes, Polymorphic class Hierarchy, Constructors and destructors in derived classes. **Dynamic Memory Allocation:** Introduction, Static Vs Dynamic Memory Allocation, Dynamic memory allocation and de-allocation in	6	CO5

Unit No.	Topic	Hrs.	COs
	C++ using new and delete operator		
VI	**Templates and Exception Handling**		
	Standard Template Library (STL): Introduction to STL, Components of STL- Containers, algorithms and iterators, Benefits of STL **Templates:** Introduction, Function Templates, Class Templates, Function and Class Templates with multiple parameters, Default parameters **Exception Handling:** Fundamentals, try-throw-catch mechanism, Example-Divide by Zero, re-throwing an exception, Catch all block, multiple catch block.	6	CO6

Text Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	E. Balagurusamy	Object Oriented Programming with C++	6th Ed.		McGraw Hill Edition
2	Bjarne Stroustrup	The C++ Programming language	3rd Ed.	2013	Pearson Education
3	Deitel	C++ How to Program	4th Ed	2015	Pearson Education.
4	Robert Lafore	Object-Oriented Programming in C++	4th Ed	2001	Sams Publishing

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Matt Weisfelda	The Object-Oriented Thought Process	3rd Ed.	2021	Pearson Education
2	Cox Brad, Andrew J. Novobilski	Object–Oriented Programming: An Evolutionary Approach‖	2nd Ed.	1991	Addison–Wesley

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://faculty.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf
2	https://www.udemy.com/course
3	https://www.coursera.org/courses?query=object%20oriented%20programming

Semester	**IV**
Course Category	**Professional Core (PC)**
Course Code	**ST212**
Course Title	**Geotechnical Engineering**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Engineering Mechanics**

Course Objectives:

1	To study the various phase diagrams and derive various phase relationships of the soil.
2	To study various methods for determination of permeability of soils
3	To study the compaction curve for soil.
4	To find the stress distribution and shear strength in soil.
5	To study the earth pressure and stability of slopes.
6	To study the methods of soil exploration and bearing capacity.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the various types of soil, their classifications, phase diagrams and index properties of the soil.	2	Understand
CO2	Determine the coefficient of permeability and seepage velocity of soils using different laboratory and field tests. Also, students will be able to draw flow net diagram.	3	Determine
CO3	Understand the compaction curve in soil with respect to optimum moisture content and dry density using Proctor tests	2	Understand
CO4	Estimate the stresses and shear strength in soil using analytical and experimental methods.	2	Estimate
CO5	Calculate earth pressure on vertical wall using Rankine's and Coulomb's theory. Also students will be able to calculate factor of safety against the failure along slopes.	3	Calculate
CO6	Determine Safe Bearing capacity of soil using SPT, Cone penetration test and in-situ vane shear test.	3	Determine

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

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

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Properties of soil:** Introduction–Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Properties of soil -Moisture content, Specific gravity, Unit weight, plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Classification of Soils- Indian standard soil system.	06	1
II	**Permeability and Seepage:** Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils, Seepage forces, Quick Sand Condition, Capillary Phenomena, and General flow equation. Flow Net, properties and application, Flow Net construction for flow under sheet pile and earthen dam.	06	2
III	**Compaction of Soil:** Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship. Zero air voids	06	3

Unit No.	Topic	Hrs.	COs
	line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils.		
IV	**Stress distribution and shear strength in soils:** Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory. Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory.	06	4
V	**a) Lateral Earth Pressure:** Earth pressure on vertical wall, earth pressure with movement of wall, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory. b) **Stability of Slopes**: Slope classification, slope failure, modes of failure. Finite and Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.	06	5
VI	**Soil Exploration and Bearing Capacity:** Objectives and methods of explorations-Sampling and its design features, SPT, Cone penetration test and in-situ vane shear test, Bearing Capacity	06	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Gopal Ranjan and A S Rao	Basic and Applied Soil Mechanics	2nd Ed.	2000	New Age International Publisher, New Delhi
2	B. C. Punmia	Soil Mechanics and Foundation Engineering	17th Ed.	2020	Laxmi Publishing Co
3	B. J. Kasmalkar	Geotechnical Engineering	2nd Ed.	1991	Pune Vidyarthi Griha Prakashan
4	P.C.Varghese	Foundation Engineering	9th Ed.	2012	Asoke K. Ghosh, PHI Learning Private Limited

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	V. N. S. Murthy	Soil Mechanics and Foundation Engineering	3rd Ed.	2018	**C.** B.S. Publications
2	J.E. Bowles	Foundation Analysis and Design	5th Ed.	2001	McGraw-Hill Book Company
3	W C Teng	Foundation Design	1st Ed	1962	Prentice Hall PTR, 1962

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce11/
2	https://nptel.ac.in/courses/105/106/105106142/
3	https://nptel.ac.in/courses/105/103/105103097/

Semester	**IV**
Course Category	**Professional Core (PC)**
Course Code	**ST213**
Course Title	**Infrastructure Engineering**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Civil Engineering Materials**

Course Objectives:

1	To introduce the students to the various infrastructure elements.
2	To learn the requirements of harbors and concept of underground and underwater construction.
3	To study the high-rise structures and infrastructural development in flyovers and bridges.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the basic information of infrastructure Engineering and infrastructure development in India.	2	Understand
CO2	Understand the basic structural component, design aspects and loading conditions of water and earth retaining structures.	2	Understand
CO3	Understand the concept of tunneling and methods of tunneling in rock and soft ground.	2	Understand
CO4	Understand the structural components and design aspects of offshore Structures.	2	Understand
CO5	Understand the Specification and standards of Bridge and Flyovers.	2	Understand
CO6	Understand advancements in high-rise structure and working method of cooling tower and transmission tower.	2	Understand

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Infrastructure Development** Definitions of infrastructure, Scope of infrastructure Engineering, Infrastructure organizations and Systems, Overview of Infrastructure development in India such as Metrorail, Bullet train, Monorail, Airport, Runways, Taxiways and Aprons.	6	CO1
II	**Water and Earth Retaining Structures** **Dams:** Types of Dam, Site selection of dam, Structural components, Design aspects, loading, Case study. **Retaining Walls:** Types of retaining walls, Structural components, design aspects, Loading, Case study. **Water Tanks:** Types of Water tanks, Structural components, design aspects, Loading, Case study.	6	CO2
III	**Tunneling** Definition, classification of tunnel, criteria for selection of size and shapes, Shapes of tunnel, surveys, shaft, Tunneling methods in rock and soft ground, methods of tunneling, Tunnel Boring Machines (TBM), modern developments in tunnel drainage and ventilation. Case study.	6	CO3
IV	**Offshore Structures** Introduction and types of offshore structures such as Fixed Platforms, Compliant tower, Floating Structures. Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Structural components of Ports, Docks, Wharves, Types of Fenders. Case study.	6	CO4
V	**Bridges and Flyovers** Introduction, structural component of bridges, selection of site, types of bridges, discharge, waterway, spans, afflux, standards, specifications, loads and forces, Maintenance of Bridges, Economic Span of Bridge. Case study **Flyovers**	6	CO5

Unit No.	Topic	Hrs.	COs
	Introduction, structural component of flyovers. Case study		
VI	**High-Rise Structures** Definition of a tall building, main components of a tall building, Types of loads used for high-rise structure, Introduction and types foundation used for high rise structure.Introduction and component part of transmission power plant and chimney, Introduction types and working of cooling tower.Case study.	6	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S.C Sharma	Construction Equipment & its Management	01st Ed	2014	Khanna Publication.
2	R. Srinivasan	Harbour, Dock & Tunnel Engineering	28th Ed	2016	Charotar Publishing.
3	S.C.Rangwala	Bridge Engineering	16th Ed	2017	Charotar Publishing House Pvt.Ltd.
4	S.C.Saxena	Tunnel Engineering	2nd Ed	2015	Dhanpat Rai Publications Pvt Ltd.

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	R.L.Peurifoy,C.J. Schexnayder and A. Shapira	Construction Planning Equipment and Methods	9th Ed.	2018	Tata McGraw Hill
2	Harry G. Poulos	Tall Building Foundation Design	01st Ed	2017	CRC Press Taylor & Francis Group
3	Hasmukh P. Oza & Gautam H. Oza	Dock & Harbour Engineering	8th Ed.	2016	Charoter Book Stall

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://infracon.nic.in
2	https://www.india.gov.in/infrastructure

Semester	**IV**
Course Category	**Professional Core (PC)**
Course Code	**ST214**
Course Title	**Analysis of Determinate Structures**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Engineering Mechanics, Mechanics of Solids

Course Objectives:

1	To study the fundamental concepts of structural analysis and different methods such as Macaulay's method, Moment area method and conjugate beam method to determine deflection of determinate beams.
2	To study the Castigliano's first theorem to determine deflection of determinate beams and frames.
3	To apply the Castigliano's first theorem to determine deflection of determinate trusses.
4	To draw influence line diagrams for beams.
5	To draw influence line diagrams for trusses.
6	To analyse three hinged arches and cables.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Use Macaulay's method, Moment area method and conjugate beam method to find deflections of determinate beams.	3	Use
CO2	Apply the Castigliano's first theorem to find the deflection of determinate beams and frames.	3	Apply
CO3	Apply the Castigliano's first theorem to find deflection of determinate trusses.	3	Apply
CO4	Sketch/draw the influence line diagrams for beams under moving load.	3	Sketch/draw
CO5	Sketch/draw the influence line diagrams for trusses under moving load.	3	Sketch/draw
CO6	Analyse three hinged arches for horizontal thrust, radial shear and normal thrust and analyze cables.	4	Analyse

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Slope and Deflection of Beams:** a) Introduction, Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy. b) Slope and deflection of determinate beams by Macaulay's method, moment area method and conjugate beam method.	6	CO1
II	**Energy Methods:** Strain energy: Castigliano's first theorem, Virtual work method. Application to determine slope and deflection of determinate beams and frames using energy methods.	6	CO2
III	**Analysis of Determinate Trusses:** Joint displacement of determinate trusses by Castigliano's first theorem.	6	CO3
IV	**Influence Line Diagram for Beams:** Basic concept, Muller-Breslau's principle, influence line diagram for reaction, shear and moment of simply supported and overhanging beams, application of influence line diagram to determine reaction, shear and moment in beams.	6	CO4
V	**Influence Line Diagram for Trusses:** Influence line diagram for axial force in trusses, application of influence line diagram to determine the axial forces in the members of plane determinate trusses subjected to moving loads, concentrated load and uniformly distributed load.	6	CO5
VI	**Analysis of Arches and Cables** **Analysis of Three Hinged:** Types of arches, analysis of parabolic arch with supports at same and different levels, semi-circular arches with support at same level, determination of horizontal thrust, radial shear and normal thrust for parabolic and circular arch. **Analysis of Cables:** Simple suspension cables, different geometries of	6	CO6

	cable, minimum and maximum tension in the cable supported at same and different levels.		

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. S. Bhavikatti	Structural Analysis Vol-1	4th Ed.	2010	Vikas publishing House Pvt. Ltd.
2	S.B.Junnarkar and Advi	Mechanics of Structure"', Vol. I & II,	2nd Ed.	1957	Charotar publication
3	S. Ramamrutham and N. Narayan	Theory of Structures	9th Ed.	2014	Dhanpat Rai, New Delhi.
4	B.C.Punmia, Ashokkumar jain and Arunkumar Jain	Theory of Structures	13th Ed.	2017	Laxmi Publication

References Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	R.C. Hibbeler	Structural Analysis	6th Ed.	2006	Pearson Education
2	C. K. Wang	Intermediate Structural Analysis		1983	McGraw Hill Education
3	C. S. Reddy	Basic Structural Analysis	3rd Ed.	2010	Tata McGraw Hill
4	Devadas Menon	Structural Analysis	2nd Ed.	2018	Narosa Publishing House, New Delhi
5	S.P. Timoshenko and D.H. Young	Theory of Structures	2nd Ed.	1965	Tata McGraw Hill

E-Resources: (Maximum 3)

Sr. No.	Link
1	http://nptel.iitm.ac.in
2	https://onlinecourses.nptel.ac.in
3	https://www.udemy.com/course/staadpro-cs/

Semester	**IV**
Course Category	**Professional Core(PC)**
Course Code	**ST215**
Course Title	Computer Aided Drawings Lab.
Credits	**1**
Teaching Scheme	**Practical: 2 hrs./week**
Evaluation Scheme	**Practical exam: 50 Marks**

Prerequisite Course: **Engineering Graphics and Architectural Planning and Drawing**

Course Objectives:

1	To develop the plan, elevation and section of framed structures.
2	Able to develop working and Submission Building drawing
3	Able to draw the layout of Water treatment plant (WTP)
4	Able to understand and draw the components of Airport/layout of Air port
5	Able to understand and draw the components of Harbour

Mapping of Cos with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3				2			3			-	3
CO2	3	--	3	--	--	--	--	--	--	3	--	--	-	3
CO3	3	--	3	--	--	--	--	--	--	3	--	--	-	3
CO4	3	--	3	--	--	--	--	--	--	3	--	--	-	3
CO5	3	--	--	--	-	3	--	--	--	--	--	3	-	2

Course Contents

Practical No.	Topic	Hrs.	COs
I	1) Submission Drawing/Working drawing of Residential Building a. Floor Plan/ Typical floor plan of residential building b. Elevation c. Sectional Elevation d. Foundation Plan e. Block Plan & Site plan f. (Construction notes, Schedule of openings, Area statement).	6	CO1 and CO2
II	layout of Water Treatment plant (WTP) (Line Plan with different components)	2	CO3
III	Layout of Air port (Line Plan with different components)	2	CO4
IV	Lay out of Harbour (Line Plan with different components)	2	CO5

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M. G. Shah, C. M. Kale and S. Y. Patki	Building Drawings with an integrated Approach to Built-Environment.	5th Ed.	2017	Tata McGraw Hill.
2	Dr. S. V. Deodhar	Building science and planning	5th Ed.	1972	Khanna Publishers
3	David V. Chadderton	Building Services Engineering	6th Ed	2012	Routledge
4	R. Srinivasan	Harbour, Dock & Tunnel Engineering	28th Ed	2016	Charotar Publishing.
5	S.K.Garg	Water Supply Engineering	34th Edn	2010	Khanna Publishers

References Books:(Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Frederick Merrit	Building Design and construction	6th Ed.	2019	McGraw-Hill
2	Callender	Times Saver standards of Architectural Design Data	Rev. Ed.	1973	Tata McGraw-Hill
3	IS	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings	--	1989	IS
4	Hasmukh P. Oza & Gautam H. Oza	Dock & Harbour Engineering	8th Ed.	2016	Charoter Book Stall
5	Rangwala	Water Supply And Sanitary Engineering including environmental engineering	--	2014	Charoter Book Stall

E-Resources:

Sr. No.	Link
1	**https://onlinecourses.nptel.ac.in/noc21_ar08/ (NPTL)**
2	**https://onlinecourses.nptel.ac.in/noc21_ar07 (NPTL)**
3	**https://onlinecourses.swayam2.ac.in/cec21_ar02**

Semester	**IV**
Course Category	**Professional Core (PC)**
Course Code	**ST216**
Course Title	**Geotechnical Engineering Lab**
Credits	**1**
Teaching Scheme	**Lectures: 2 hrs./week**
Evaluation Scheme	**Oral Exam: 50 Marks**

Prerequisite Course: **Engineering Mechanics**

Course Objectives:

1	To study the experimental methods for determination of index properties of soil.
2	To investigate index properties of soil using experimental methods.
3	To study the analytical and graphical methods to interpret the soil properties.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the various experimental methods used for estimation of index properties of soil.	2	Understand
CO2	Determine the index properties of soil sample using various laboratory test.	3	Determine
CO3	Analyze the earth pressure, shear strength of soil using analytical and graphical methods.	4	Analyze

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	1	2	2	1	1	1	1	1	3	2
CO2	3	2	2	3	1	1	2	1	1	1	1	1	3	2
CO3	3	1	1	2	3	1	1	1	1	1	1	1	2	3

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

The term work shall consist of a journal giving details of at least 9 out of 11 of the following experiments. Assignments - Sr. No 12 and 13 are compulsory.

Pr. No.	Topic	Hrs.	COs
1	Water content determination by any two methods a) Oven drying method, b) Infrared moisture method, c) calcium carbide method	2	CO1
2	Specific gravity determination by Pycnometer /density bottle.	2	CO1
3	Sieve analysis, particle size determination and IS classification as per I.S. Codes.	2	CO1
4	Determination of Consistency limits and their use in soil classification	2	CO1

Pr. No.	Topic	Hrs.	COs
	as per I.S. Codes.		
5	Field density test by a) Core cutter b) Sand Replacement and c) Clod method	2	CO1
6	Determination of coefficient of permeability by a) Constant head and b) Variable head method.	2	CO1
7	Direct shear test.	2	CO1
8	Unconfined compression test.	2	CO1
9	Vane Shear test.	2	CO1
10	Standard Proctor test / Modified Proctor test.	2	CO1
11	Triaxial test	2	CO1
12	SPT Test	2	CO1
13	Bore log Test	2	CO1
12	Collection of sample soil investigation report for any construction project and write report about interpretation of index properties of soil.	2	CO2
13	Assignments on the following topics: a) Rebhann's and Cullman's graphical method for determination of earth pressure. b) Solution of problems on shear strength parameters using graph. c) Flow net construction for sheet pile or earthen dam.	2	CO3

Note: Performance based oral examination on the above Term Work

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Gopal Ranjan and A S Rao	Basic and Applied Soil Mechanics	2nd Ed.	2000	New Age International Publisher, New Delhi
2	B. C. Punmia	Soil Mechanics and Foundation Engineering	17th Ed.	2020	Laxmi Publishing Co
3	B. J. Kasmalkar	Geotechnical Engineering	2nd Ed.	1991	Pune Vidyarthi Griha Prakashan
4	P.C.Varghese	Foundation Engineering	9th Ed.	2012	PHI Learning Private Ltd.

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	V. N. S. Murthy	Soil Mechanics and Foundation Engineering	3rd Ed.	2018	**D.** B.S. Publications
2	J.E. Bowles	Foundation Analysis and Design	5th Ed.	2001	McGraw-Hill Book Company
3	W C Teng	Foundation Design	1st Ed	1962	PrenticeHall 1962

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce11/

2	https://nptel.ac.in/courses/105/106/105106142/
3	https://nptel.ac.in/courses/105/103/105103097/

Semester	**IV**
Course Category	**Professional Core (PC)**
Course Code	**ST217**
Course Title	**Object Oriented Programming Lab**
Credits	**1**
Teaching Scheme	**Practical: 2 hrs./week**
Evaluation Scheme	**OR: --**
	Term Work: 25 Marks

Prerequisite Course: Computer Fundamentals, Computer Basics

Course Objectives:

1	To develop programs by applying concepts of constructors, friend function, inline functions and data abstraction.
2	To apply OOP principles polymorphism and inheritance to solve problems.
3	To use C++ features templates, exceptions and dynamic memory allocation for solution of various problems.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Develop programs by applying concepts of constructors, friend function, inline functions and data abstraction.	3	Apply
CO2	Apply OOP principles polymorphism and inheritance to solve problems.	3	Apply
CO3	Use C++ features templates, exceptions and dynamic memory allocation for solution of various problems.	3	Apply

Mapping of Cos with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	--	3	--	3	--	--	2	3	1	--	2	--	2
CO2	3	--	2	--	1	--	--	2	3	1	--	2	--	2
CO3	3	--	2	--	2	--	--	2	3	1	--	2	--	2

Course Contents

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. Encourage students for the use coding standards such as appropriate use of Hungarian notation, proper Indentation and comments. Use of open source software is encouraged. Instructor may also assign one real life application in the form of a mini-project. Based on the concepts learned

Suggested List of Assignments			
Sr. No.	**ASSIGNMENTS**	**No. of Hours**	**COs**
1	Write a menu driven program with class, object and different types of constructors.	2 Hrs.	CO1
2	Write a program to demonstrate use of Friend function/inline function.	2 Hrs.	CO1
3	Write a program to demonstrate compile time polymorphism (Operator Overloading/ Function Overloading)	2 Hrs.	CO2
4	Write a program to demonstrate run time polymorphism (Virtual Function Concept).	2 Hrs.	CO2
5	Write a program to demonstrate Inheritance Concept.	2 Hrs.	CO2
6	Write a program to demonstrate Memory allocation in C++.	2 Hrs.	CO3
7	Write a program to demonstrate use of exception handling in C++.	2 Hrs.	CO3
8	Write a program to demonstrate use of Template in C++.	2 Hrs.	CO3

Text Books: (Maximum 3)

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	E. Balagurusamy	Object Oriented Programming with C++	6th Ed.		McGraw Hill Edition
2	Bjarne Stroustrup	The C++ Programming language	3rd Ed.	2013	Pearson Education
3	Deitel	C++ How to Program	4th Ed	2015	Pearson Education.
4	Robert Lafore	Object-Oriented Programming in C++	4th Ed	2001	Sams Publishing
1	Matt Weisfelda	The Object-Oriented Thought Process	3rd Ed.	2021	Pearson Education
2	Cox Brad, Andrew J. Novobilski	Object–Oriented Programming: An Evolutionary Approach‖	2nd Ed.	1991	Addison–Wesley

Semester	**IV**
Course Category	**Seminar/Mini Project (PRJ)**
Course Code	**ST**218
Course Title	**Seminar**
Credits	**2**
Teaching Scheme	**Practical: 4 hrs./week**
Evaluation Scheme	**Oral Exam: 25 Marks**
	Term-work: 25 Marks

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Analyse a current topic of professional interest and present it before an audience/ present it in terms of patent.	2	Understanding
CO2	Identify an engineering problem, analyse it and prepare a work plan to solve it.	2	Understanding

Course Guidelines:

Oral examination shall be conducted based on a Seminar report prepared by each individual. The seminar report should contain the following. (**In case of a seminar on an engineering topic**)

1. Introduction of the topic, its relevance to the construction industry, need for the study, aims and subjunctives, limitations.
2. Literature review from books, journals, conference proceedings, published reports / articles / documents from minimum 8 references.
3. Theoretical chapter on the topic of study, advantages and limitations.
4. Photographs from web search / experiments done / projects visited / organizations visited for studying documents / procedures/ systems / materials/ equipment/ technologies used.
5. Ongoing research areas, information, about commercial vendors, information on benefit – cost aspects.
6. Concluding remarks with respect to commercial/ practical and social applications.
7. References in standard format.

For Patent (Mini Project)

1. Introduction of the topic (Idea)
2. Idea behind the development of patent.
3. Purpose of the patented idea.
4. Use of the model/instrument developed.
5. Detailed Drawings.
6. Patent documents which are filed on the portal of IP india.

Note:- In order to arouse the interest of students and engage them in active learning, mini projects / complex problems may be given in groups of maximum 4 students, covering different aspects involved in structural engineering so as to also enable the students to submit separate individual reports as required above.

A) Guidelines on mini project:

Mini Project: A short report on any significant and innovative topic in structural engineering domain that is observed during the course as a part of curriculum. As a part of this students are required to write a short report named as a mini project under the guidance of supervisor.

Benefits to the Students: The basic purpose of writing a mini project is to allow students to explore the breadth of research that is performed during the U.G. course.

Expected outcomes of mini project: It is up to the student and the supervisor to choose the title/topic for mini project from any significant and innovative topic in structural engineering. The expected outcomes of the mini project must be in the form of either research paper or I.P.R.

B) Guidelines for report writing:
The report must include following contents

1. Introduction of the topic (Idea)
2. Idea behind the development of patent.
3. Purpose of the patented idea.
4. Use of the model/instrument developed.
5. Detailed Drawings.
6. Patent documents which are filed on the portal of IP india.

MLC: (MC219): Mandatory Course –IV

Innovation - Project based – Science and Technology, Social, Design & Innovation

Teaching Scheme	Examination Scheme
Lectures: 02 Hrs. / week	**Audit Course**

Course Objectives:

Sr. No	Course Objectives
1	To develop strategic thinking to solve social problems
2	Understand the role of innovation and technical change in enterprise and national level economic performance
3	Understand the technological, human, economic, organizational, social and other dimensions of innovation
4	Understand the effective management of technological innovation requires the integration of people, processes and technology
5	Recognize opportunities for the commercialization of innovation

Course Outcomes: Students will able to:

COs No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Understand the role of innovation and technical change in enterprise and national level economic performance	2	Understanding
CO2	Develop strategic thinking to solve social problems	3	Applying
CO3	Recognize opportunities for the commercialization of innovation	3	Applying

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

COURSE CONTENTS

Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student, which may result in development ofa working system, a prototype, or a device or material, etc. They are expected to come up with novel and useful ideas on social problems. Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this

(a) Exposure to social problems (which are amenable to technological solutions)

(b) Design & Innovation (to address above problems)

After this student, be encouraged to undertake technology projects of social relevance

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

T.Y.B. Tech. Structural Engineering

2020 Pattern

Curriculum

(With effect from Academic Year 2022-2023)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

SANJIVANI RURAL EDUCATON SOCIETY'S
SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
(An Autonomous Institute Affiliated to SPPU, Pune)

DECLARATION

We, the Board of Studies Structural Engineering, hereby declare that we have designed the Curriculum of B.Tech. (Structural Engineering) of Pattern 2020 w.e.f. A.Y. 2021-22 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

14/8/24

BOS Chairman

14/8/24

(Dean Academics)

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
Approved

(Director)

Sanjivani Rural Education Society's
Kopargaon
Sanjivani College of Engineering

Semester-V

Cat	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PC	ST301	Analysis of Indeterminate Structures	03	-	-	03	30	50	20	-	-	-	100
PC	ST302	Design of Steel Structures	04	-	-	04	30	50	20	-	-	-	100
PC	ST303	Foundation Engineering	03	-	-	03	30	50	20	-	-	-	100
PC	ST304	Construction Planning and Management	03	-	-	03	30	50	20	-	-	-	100
PE	ST305	Professional Elective-I	03	-	-	03	30	50	20	-	-	-	100
PC	ST306	Surveying	02			02	15	25	10	-	-	-	50
PC	ST307	Surveying Lab	-	-	02	01	-	-	-	-	50	-	50
PC	ST308	Structural Analysis and Design using STAAD Pro.	-	-	04	02	-	-	-	-	50	50	100
MLC	MLC309	Mandatory Learning Course-V (Sports)	1	-	-	Pass/Fail	-	-	-	-	-	-	-
		Total	19	-	06	**21**	165	275	110	50	100	-	**700**

Semester-VI

Cat	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PC	ST311	Design of Reinforced Concrete Structures	03	-	-	03	30	50	20	-	-	-	100
PC	ST312	Design of Industrial Structures	03	-	-	03	30	50	20	-	-	-	100
PC	ST313	Finite Element Method	03	-	-	03	30	50	20	-	-	-	100
PC	ST314	Fundamentals of Earthquake Engineering	02	-	-	02	15	25	10	-	-	-	50
HS	HS315	Corporate readiness-II	02	-	-	02	-	-	50	-	-	-	50
PRJ	PR316	IPR and EDP	02	-	-	02	-	30	20	-	-	-	50
PE	ST317	Professional Elective-II	03	-	-	03	30	50	20	-	-	-	100
PC	ST318	Design of Reinforced Concrete Structures Lab	-	-	02	01	-	-	-	50	-	-	50
PC	ST319	Design of Industrial Structures Lab	-	-	02	01	-	-	-	50	-	-	50
PRJ	ST320	Creational Activity (Sports)	-	-	02	01	-	-	-	-	50	-	50
MLC	MLC321	Mandatory Learning Course-VI	1	-	-	Pass/Fail	-	-	-	-	-	-	-
		Total	19	-	06	**21**	135	255	160	100	50	00	**700**

Semester	**V**
Course Category	**Professional Core (PC)**
Course Code	**ST301**
Course Title	**Analysis of Indeterminate Structures**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Engineering Mechanics, Mechanics of Solids, Analysis of Determinate Structures.

Course Objectives:

1	To impart the knowledge of analysis of indeterminate structures using slope deflection method.
2	To impart the knowledge of analysis of indeterminate structures using moment distribution method and it's applications to beams and portal frame.
3	To make the students aware about the matrix methods of analysis
4	To apply the force method for the analysis of indeterminate trusses.
5	To impart the knowledge of analysis of indeterminate arches.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply slope deflection method for analysis of beams and frames.	4	Analyse
CO2	Use moment distribution method for the analysis of beams and frames.	4	Analyse
CO3	Analyse beams and frames using stiffness matrix method.	4	Analyse
CO4	Analyse beams and frames using flexibility matrix method.	4	Analyse
CO5	Apply the force method for the analysis of indeterminate trusses.	4	Analyse
CO6	Analyse two hinged arches.	4	Analyse

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
	Displacement Methods		
I	a) Introduction to structural analysis, Different methods used for analysis of structures viz. Displacement Methods and Force Methods. b) Slope-deflection method of analysis: Slope-deflection equations, equilibrium equation of Slope deflection method, application to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram. c) Sway analysis of rigid jointed rectangular single bay single storey portal frames using moment distribution method (Involving not more than three unknowns). c) One exercise using any computer software.	6	CO1
II	a) Moment distribution method of analysis: Stiffness factor, carry over factor, distribution factor, application to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram. b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using moment distribution method (Involving not more than three unknowns). c) One exercise using any computer software.	6	CO2
III	a) Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix, application to trusses by member approach. Application to beams by structure approach only, (Involving not more than three unknowns). b) Application to rigid jointed rectangular single bay single storey portal frames by structure approach only (Involving not more than three unknowns). c) One exercise using any computer software.	6	CO3
	Force Methods of Analysis		
IV	a) Fundamental concepts of flexibility method of analysis, formulation of flexibility matrix, application to pin jointed plane trusses (Involving not more than three unknowns). b) Application to beams and rigid jointed rectangular single bay single storey portal frames (Involving not more than three unknowns). c) One exercise using any computer software.	6	CO4
V	a) Force method or Flexibility method of analysis, Application to indeterminate trusses. Basic formulation of force method for trusses. Externally indeterminate trusses, Internally indeterminate trusses, Trusses with lack of fit, Temperature effects in indeterminate trusses.	6	CO5

Unit No.	Topic	Hrs.	COs
	Displacement Methods		
	b) One exercise using any computer software.		
VI	a) Two hinged arches, Horizontal thrust at support, Radial shear, Normal Thrust and bending moment at a cross section using method of least work (Force Method). Bending moment diagram for concentrated load and uniformly distributed load, Parabolic and semi-circular arches. b) One exercise using any computer software.	6	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S.B.Junnarkar and Advi	Mechanics of Structure"', Vol. I & II,	2nd Ed.	1957	Charotar publication
2	W. Weaver and J. M. Gere	Matrix Analysis of Framed Structures	3rd edition		CBS Publisher, New Delhi
3	C.S. Reddy	Basic Structural Analysis	3rd edition	2017	Tata McGraw Hill

References Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	R.C. Hibbeler	Structural Analysis	6th Ed.	2006	Pearson Education
2	C. K. Wang	Intermediate Structural Analysis		1983	McGraw Hill Education
3	S.P. Timoshenko and D.H. Young	Theory of Structures	2nd Ed.	1965	Tata McGraw Hill

E-Resources: (Maximum 3)

Sr. No.	Link
1	http://nptel.iitm.ac.in
2	https://onlinecourses.nptel.ac.in
3	https://www.udemy.com/course/staadpro-cs/

Semester	**V**
Course Category	**Professional Core (PC)**
Course Code	**ST 302**
Course Title	**Design of Steel Structures**
Credits	**4**
Teaching Scheme	**Lectures: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Mechanics of Solid**

Course Objectives:

1	To inculcate in the students, the understanding of structural steel and general structural behaviour of steel structural elements, design philosophy.
2	To make the students familiar with relevant Codes, design aids for their effective use in steel structural design.
3	To impart the students, the ability to analyze, design and detail of different structural steel elements and connections according to relevant codes and design aids.
4	To competent enough to analysis and design of steel structures and able to provide the good quality control during the steel construction.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Assimilate about the structural steel as a material, structural behaviour of steel, structural elements, design philosophies for design of steel structure and design different types of connections with detailing as per IS 800-2007.	3	Apply
CO2	Analyze and design tension members with detailing as per IS 800-2007.	4	Analysis
CO3	Analyze and design compression members with detailing as per IS 800-2007.	4	Analysis
CO4	Analyze and design Beams with detailing as per IS 800-2007.	4	Analysis
CO5	Analyze and design column base with detailing as per IS 800-2007 and study earthquake resistant design of steel structure	4	Analysis
CO6	Able to evaluate the loads acting on industrial roof trusses and study different PEB structures.	4	Analysis

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

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

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to steel structures:** Structural Steel types, properties, advantages and limitations of a steel as a structural material, forms of structural steel-hot formed steel, cold formed steel. Basic structural design- design consideration, codes, specification & design aids, and failure criteria of steel. **Design Approach:** Concept of elastic analysis, plastic analysis as applicable to steel structures, classification of steel structure on the basis of moment resistance behaviour, basic concept of working stress method, limit state design philosophy in detail as applicable in steel structure. **Design of Connections:** Design of Bolted connections, Bolt grade and types of Bolts, Design of staggered bolting, Welding, Types of welding, design of welded Connection	08	1
II	**Design of Tension Member**: Types of Tension Member, factors affecting strength of tension member, Design of tension member using single and double angle sections. Design of connection with gusset plate by bolting and welding.	08	2
III	**Design of Compression Member**: Possible failure modes, classification of cross section, section used for compression members, effective length, single angle strut, lacing & battening, column splicing for axial load only. Connections with gusset plate by bolts and welds. Design of axially loaded column using beam sections (I-sections). Introduction to tubular compression members.	08	3
IV	**Design of flexural member**: Behaviour of beams in bending, Design of laterally supported beams, Concept of low and high shear, check for web buckling and web crippling. Design of laterally unsupported beams using single rolled steel section with and without flange plate, Apply appropriate checks. Introduction to Plate girder and Gantry Girder, Component parts and Uses (Only concepts-No Numerical).	08	4
V	**Design of Column Bases:** Type of bases, design of Slab Base and Gusseted base for axial and eccentric loading. **Design of Composite Steel –concrete Structure:** Composite Columns, Composite Beam and Composite Construction Systems for Buildings**.** (Numerical examples are not expected only Concept)	08	5
VI	**Design of roof truss:** Types of industrial trusses, Uses, Components parts, Assessment of dead load, live load and wind load using relevant I.S. codes. Introduction to light gauge structures, Introduction to trusses using box or hollow sections, Introduction to Pre-Engineering Building (PEB) structures.	08	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M.L.Gambhir	Fundamental of Structural Steel Design	2nd	2017	McGraw Hill Education India
2	S.K.Duggal	Limit State: Design of Steel Structures	3rd	2019	McGraw Hill Education India
3	S.S. Bhavikatti	Design of Steel Structures (By Limit State Method as per IS 800-2007)	5th	2019	Dreamtech Press

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Dr. Ramchandra and Virendra Gehlot	Design of Steel Structure Vol I and II	13th	2015	**Std.Book House**
2	N.Subramanian	Design of Steel Structures: Limit State	4th	2018	Oxford University press India
3	Negi. L.S.	Design of Steel Structures	2nd	1995	Tata McGraw Hill India,

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105/106/105106112/

Semester	**V**
Course Category	**Professional Core (PC)**
Course Code	**ST303**
Course Title	**Foundation Engineering**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Geotechnical Engineering**

Course Objectives:

1	To study methods of subsurface investigation and criteria for selection of foundation.
2	To determine the bearing capacity of soil using strength and settlement criteria.
3	To analyze and design shallow foundation (isolated, combined, raft) based on settlement and strength criteria.
4	To study the pile foundation with respect to installation, load carrying capacity, in-situ tests.
5	To estimate the primary and secondary consolidation settlement and pre-consolidation pressure.
6	To study foundation on collapsible soil , expansive soil and sanitary landfills.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Identify methods of subsurface investigation and criteria for selection of foundation..	2	Understand
CO2	Calculate the bearing capacity of soil using strength and settlement criteria.	3	Determine
CO3	Analyze and design shallow foundation (isolated, combined, raft) based on settlement and strength criteria.	4	Analyze
CO4	Distinguish the pile foundation with respect to installation, load carrying capacity, in-situ tests.	2	Understand
CO5	Estimate the primary and secondary consolidation settlement and pre-consolidation pressure.	2	Understand
CO6	Identify foundation on collapsible soil , expansive soil and sanitary landfills.	2	Understand

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1	1	1	1	1	1	-	2
CO2	3	2	1	2	1	1	2	1	1	1	1	1	-	2
CO3	3	2	2	2	1	1	1	1	1	1	1	1	-	2
CO4	3	2	1	2	1	1	1	1	1	1	1	1	-	2
CO5	3	2	1	2	1	1	1	1	1	1	1	1	-	2

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO6	3	2	2	2	1	2	2	1	1	1	1	1	-	2

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Selection of foundation and Subsurface Investigations for Foundations:** Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation based on soil condition, spacing/depth of boreholes, disturbed/undisturbed soil sampling, geophysical exploration, electrical resistivity method, preparation of borehole logs and final report.	06	1
II	**Bearing Capacity:** Rankine's analysis, types of bearing capacity failures, Terzaghi, Meyerhof, Skempton and IS Methods, Effect of water table on bearing capacity, plate load test, static cone test and standard penetration test, Permissible total and differential settlement.	06	2
III	**Shallow foundations-** safe bearing pressure, settlement of footing, design of combined footings, eccentrically loaded footings. I S Code of practice for Design of Raft Foundation-Conventional and Elastic method.	06	3
IV	**Pile foundations-** Introduction, load transfer mechanism, types of piles and their function, pile driving equipment, factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test (IS 2911). Pile group: carrying capacity, efficiency and settlement. Negative skin friction, Concept of Pile Cap. Combined Pile Raft Foundation: Factors affecting, Design issues / Philosophy	06	4
V	**Consolidation of soils**; Spring Analogy, consolidation of laterally confined soil, Estimation of primary Consolidation Settlement, Time rate of consolidation; Consolidation test and determination of void ratio, volume change, Coefficient of consolidation, coefficient of permeability, Estimation of pre-consolidation pressure; secondary consolidation	06	5
VI	Designs of Foundation 1. Design problems on pile foundations 2. Design problems on shallow foundations 3. Design problems on combined raft foundation	06	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	B. J.	Geotechnical Engineering	2nd Ed.	1991	Pune Vidyarthi

	Kasmalkar				Griha Prakashan
2	P.C.Varghese	Foundation Engineering	9th Ed.	2012	Asoke K. Ghosh, PHI Learning Private Limited
3	Manjriker Gunaratne	The Foundation Engineering Handbook	1st Edition	2006	CRC Press, Taylor and Francis Group

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	V. N. S. Murthy	Soil Mechanics and Foundation Engineering	3rd Ed.	2018	**C.** B.S. Publications
2	J.E. Bowles	Foundation Analysis and Design	5th Ed.	2001	McGraw-Hill Book Company
3	W C Teng	Foundation Design	1st Ed	1962	Prentice Hall PTR, 1962

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105105176
2	https://nptel.ac.in/courses/105108069
3	https://nptel.ac.in/courses/105/103/105103097/

Semester	**V**
Course Category	**Professional core (PC)**
Course Code	**ST304**
Course Title	**Construction Planning and Management:**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Architectural Planning and Drawing**

Course Objectives:

1	To understand Significance of Construction Management.
2	Develop capability to use planning tool for scheduling and controlling the project. Understand way of minimization of total project cost, time and also effective utilization of resources.
3	Develop capability to use optimum material and check suitable type of machinery for project site.
4	Develop the ability of student to plan Quality and Safety for the Construction Site.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes(COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Demonstrate theoretical aspects of project management techniques to achieve project goals.	1	Knowledge
CO2	Develop capability to use powerful coordinating tool for planning (CPM, PERT, BAR chart) scheduling and controlling of projects also they will able to understand way of minimization of total project cost and time also effective utilization of resources	3	Apply
CO3	Develop capability to solve as well as minimize the defects for improving the quality of construction.	3	Apply
CO4	Develop capability to plan material procurement and management.	2	Understand

CO5	Develop capability to plan Quality and Safety Checklist for the Construction Site	2	Understand
CO6	Develop capability to check suitable type of machinery for their project site.	3	Apply

Mapping of COs with POs

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	-	-	-	-	-	--	3
CO2	3	3	3	-	-	3	3	-	-	-	-	2	--	3
CO3	3	3	3	-	3	3	3	-	-	3	-	-	--	3
CO4	3	-	3	-	-	3	3	2	-	3	-	-	--	3
CO5	3	2	3	-	-	3	3	2	-	3	-	-	--	3
CO6	3	2	3	-	3	3	3	2	3	3	-	-	--	3

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to Project Management: Si**gnificance, Objectives, Functions, Principles of Management, hierarchy of organization, Categories of Project, Project Failure, Project- Life cycle**.** Significance, Functions, Resources and Stages in construction.	6	1
II	**Project planning:** Work Break down structure, Bar charts, Detailed Bar chart for a Construction Project, CPM and PERT analysis, Line of balance method. Resources leveling.	6	2
III	**Construction Quality:** Quality Control, Quality Assurance, Quality Plan, Deming Cycles, Juran and Philip Crosby Principles on Quality, Quality Inspection.	6	3
IV	**Material Management:** Objectives, Material Procurement Procedures Material requirement raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping Inventory Control - ABC analysis, EOQ (Economical Order Quantity)	6	4
V	**Equipment Management:** Classification, selection, Equipment of major projects: Excavating Machines (Shovels, draglines, Bulldozer, Scrapper), Drilling and blasting, Transporting and Handling equipment Cranes, Hoists, Conveyor belts, Dumpers, Cableways. Concrete equipments: Mixers, vibrators, batch mixing plants, Calculation of Unit rate for Excavating Equipment and Concreting Equipment.	6	5
VI	**Construction safety:** Importance of safety, safety measures, accident cost and its prevention, Safety measures in Excavation, Drilling Blasting, Hot Bituminous work, scaffolding, ladder, form work.	6	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Sitangshu Khatua	Project Management and Appraisal	5th Ed.	2011	Oxford University
2	Srinath L	CPM and PERT	3rd Ed.	2002	East-West Press Pvt. Ltd New Delhi
3	B. Sengupta and H. Guha	Construction Management and Planning,		1995	Tata McGraw Hill Publishing Company, New Delhi CBS Publishers & Distributors Pvt. Ltd

References Books :(Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	R L Peurifoy	Construction Planning, Equipment, and Methods	**09**	**2021**	Tata McGraw-Hill, New Delhi, 2021 edition.
2	SC Sharma,SV Deodhar	Construction Engineering And Management,	1St	**2019**	Khanna Publishing House,
3	Harvey Maylor	Project Management	3rd	**2014**	Pearson

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105/102/105102199/

Semester	**V**
Course Category	**Professional Elective-I**
Course Code	**ST305-A**
Course Title	**Advanced Surveying**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Surveying

Course Objectives:

1	To learn the basic techniques in geodetic surveying and study the topographical maps.
2	To study hydrographic surveying and trigonometric levelling.
3	To learns the modern surveying techniques.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the basic techniques of triangulation and trilateration in geodetic surveying.	2	Understand
CO2	Understand the topographical maps and permanent features on the ground.	2	Understand
CO3	Interpret the 3 point problem and its remedial measures using hydrographic Survey.	3	Applying
CO4	Compute the terrestrial correction using trigonometric Levelling	2	Understand
CO5	Identify the theory of error and its solution in measured quantities.	3	Applying
CO6	Create awareness of modern surveying techniques such as total station, GIS, GPS and RS in surveying.	3	Applying

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO2	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO3	3	1	1	1	1	3	2	1	3	3	2	3	-	3

CO4	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO5	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO6	3	1	1	1	1	3	2	1	3	3	2	3	-	3

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Geodetic Surveying:** Introduction, Classification of Triangulation Systems, Triangulation figures, Concept of well-conditioned Triangle, Types of signals and towers. Intervisibility and height of stations. Introduction to trilateration, Advantages and disadvantages of Trilateration.	6	CO1
II	**Photogrammetry:** Introduction, classification, Applications, comparison of map and aerial photograph, Types of photographs, Scale & Relief displacement in vertical photograph, Difference in elevation between two points from differential parallax. Ground control points (GCP), Flight planning.	6	CO2
III	**Hydrographic Surveying:** Introduction, application, Shore line survey, Establishing horizontal and vertical controls. Sounding and its measurements using various equipment, Methods of locating soundings, Reduction and plotting of soundings, Nautical Sextant and its use, Three point problem and its application, Tides and tide gauges, determination of mean sea level (MSL).	6	CO3
IV	**Trigonometric Levelling:** Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations.	6	CO4
V	**Theory of Errors:** Introduction, types of errors, definitions, laws of accidental errors, laws of weights, Theory of least squares: Principle, rules for assigning weights and distribution of errors to the field observations, determination of the most probable values (MPV) of quantities.	6	CO5
VI	**Modern Surveying Techniques:** **Total Station**- Fundamental parameters and uses. **Global Positioning System (GPS) -** Introduction, Components, Applications of GPS in engineering field. **Remote Sensing(RS)** - Electromagnetic spectrum, Atmospheric windows, Importance of satellite data, digital elevation model (DEM) and application such as Land use and land cover mapping, Disaster management flood & Earthquake. **Geographical Information System (GIS)** - Definition, component, Projections, GIS data, Applications of GIS such as visibility analysis, slope analysis, watershed analysis & preparation of thematic maps. Quantum-GIS interface.	6	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	T. P. Kanetkar and S.V.Kulkarni	Surveying and Levelling Part- II	15th Ed	2015	Pune Vidyarthi Griha Prakashan.
2	S. K. Duggal	Surveying, Vol. II	05th Ed	2019	Tata Mc-Graw Hill
3	Peter A. Burrough and R. A. McDonnell	Principle of Geographical Information System	04th Ed	2013	Oxford University Press

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	B. C. Punmia, Ashok. K. Jain, Arun. K.Jain	Surveying Vol. II	16th Ed.	2016	Laxmi publications
2	K. R. Arora	Surveying Vol. II	15th Ed	2018	Standard Book House
3	A. M. Chandra and S. K. Ghosh	Remote sensing and Geographical Information System	2nd Ed.	2019	Narosa Publication

E-Resources: (Maximum 3)

Sr. No.	Link
1	www.nrsa.gov.in
2	www.iirs-nrsa.gov.in
3	https://nptel.ac.in/courses/105/107/105107158

Semester	**V**
Course Category	**Professional Elective-I**
Course Code	**ST305-B**
Course Title	**Design of Formwork**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Building Construction Materials, Concrete Technology

Course Objectives:

1	To study the requirement of formwork, formwork materials and classification of formwork.
2	To study the various design parameters.
3	To study the conventional and proprietary formwork for foundation, wall and column.
4	To study the slab and beam formwork.
5	To study the slipform techniques.
6	To study different supports of formwork and failure of formwork.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Classify the various types of formwork, formwork material.	2	Understand
CO2	Estimate the various design parameters and use those for the design of formwork.	4	Analyze
CO3	Compare conventional and proprietary formwork for foundation, wall and column through its requirements and design.	2	Understand
CO4	Design slab and beam formwork.	4	Analyze
CO5	Define slipform technique and their classification.	1	Remember
CO6	Classify various support requirement and causes of failure.	2	Understand

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

COs	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
CO1	3	2	2	2	3	3	1	1	-	-	1	3	-	1

CO2	3	3	3	3	3	3	3	1	-	-	3	3	3	-
CO3	3	3	3	3	3	3	3	2	-	-	3	3	3	-
CO4	3	3	3	3	3	3	3	2	-	-	3	3	3	-
CO5	3	2	3	2	3	3	3	2	-	-	3	3	3	-
CO6	3	3	3	3	3	3	3	1	-	-	3	3	3	-

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction:** Introduction to formwork as a temporary structure, requirements, selection, types of formwork, different formwork materials, impact of structural design on formwork costs, difference between formwork, shores and scaffolding.	6	CO 1
II	**Formwork supports, scaffolds and failure:** Introduction to supports, shores/props and drop-heads, trestle (crib) shoring, forces acting on vertical shores, multi-legged shoring towers, vertical and horizontal supports; introduction to scaffolds, classification of scaffolds, causes of collapse of scaffolds; causes of failure of formwork, prevention of formwork failures.	6	CO 2
III	**Slipform:** Introduction, basic parts of slipform, vertical and horizontal slipform, types, slipform components and their functions, assembly and dismantling of slipform, design and safety issues in slipform construction.	6	CO 3
IV	**Formwork Design-I:** Introduction to formwork design concept, loads on formwork and parameters influencing the pressure on formwork, design basis (assumptions), estimating permissible stresses, ACI 347 and IS: 14687-1999 method of calculating lateral pressure, form pressure on inclined formwork.	6	CO 4
V	**Formwork Design-II:** Conventional and proprietary foundation formwork, conventional and proprietary wall formwork, conventional and proprietary column formwork. Formwork design problems on foundation, wall and column.	6	CO 5
VI	**Slab and Beam Formwork:** Introduction, traditional slab and beam formwork, joints in traditional slab and beam formwork, **Mivan formwork:** Concept, advantages, components, numerical on slab and beam formwork design.	6	CO 6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	K. N. Jha	Formwork for Concrete Structures	---	2017	McGraw Hill
2	R. L. Peurifoy and G. D. Oberlender	Formwork for Concrete Structures	Indian Edition	2015	McGraw Hill
3	David W. Johnston	Formwork for Concrete	8th Ed.	2014	ACI Manual SP-4 (14)

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Leonard Koel	Concrete Formwork	5th Ed.	2015	Amer Technical Pub
2	Chris Souder	Temporary Structure Design	---	2014	Wiley Publication
3	P.S. McAdam and G. W. Lee	Formwork- A Practical Guide	1st Ed.	2010	Taylor & Francis

E-Resources: (Maximum 3)

Sr. No.	Link
1.	https://www.youtube.com/watch?v=4k_WPbuXR8w
2.	https://www.youtube.com/watch?v=5MUROtxq38k
3.	https://www.youtube.com/watch?v=pJzCoUR-CBM
4.	https://www.youtube.com/watch?v=3ie-77a8Hos
5.	https://www.youtube.com/watch?v=FFCxganItKY

IS Codes:

Sr. No.	Link
1.	IS:14687-1999, Guidelines for falsework for concrete structures, Bureau of Indian Standards, 1999.
2.	IS 4990: Plywood for concrete shuttering work - Specification

Semester	**V**
Course Category	**Professional Elective - I**
Course Code	**ST305-C**
Course Title	**Matrix Methods of Structural Analysis**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Analysis of Determinate Structures

Course Objectives:

1.	To gain basic knowledge of structural systems and matrix algebra.
2.	To learn the applications of flexibility matrix method for skeletal structures.
3.	To learn the applications of stiffness matrix method for skeletal structures.
4.	To learn and develop the computer programs based on the stiffness method for the analysis of skeletal structures.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Students will be able to gain basic knowledge of structural systems and matrix algebra.	3	Apply
CO2	Students will be able to solve problems of skeletal structures using flexibility matrix method.	4	Analyse
CO3	Students will be able to solve problems of bar structures using stiffness matrix method and write the computer program code for the bar structure analysis.	4	Analyse
CO4	Students will be able to solve problems of truss structures using stiffness matrix method and write the computer program code for the truss structure analysis.	4	Analyse
CO5	Students will be able to solve problems of beam structures using stiffness matrix method and write the computer program code for the bar structure analysis.	4	Analyse
CO6	Students will be able to solve problems of framed structures using stiffness matrix method and write the computer program code for the frame structure analysis.	4	Analyse

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	a) Structural analysis, equilibrium equation, compatibility, boundary condition, degree of freedom, constraints, supports, free body diagram, static equilibrium equation, determinate and indeterminate structures, unstable structures, degree of static and kinematic indeterminacy. b) Matrix algebra: Matrix and its properties, determinant, matrix inverse, singular and non-singular matrix, identity matrix, square matrix.	6	CO1
II	a) Fundamental concepts of flexibility matrix method of analysis, formulation of flexibility matrix, application to beams and rigid jointed rectangular portal frames (Involving not more than three unknowns).	6	CO2
III	Fundamental concepts of stiffness matrix method of analysis, formulation of stiffness matrix, transformation matrix, application of bar structure (member approach only). Computer program for analysis of bar structure.	6	CO3
IV	Formulation of stiffness matrix for truss structure, transformation matrix, application to truss structure (member approach only). Computer program code for analysis of truss structure.	6	CO4
V	Formulation of stiffness matrix for beam structure, transformation matrix, application to beam structure involving not more than three unknown (member approach only). Computer program code for analysis of beam structure.	6	CO5
VI	Formulation of stiffness matrix for framed structure, transformation matrix, application of framed structure involving not more than three unknowns (member approach only).Computer program code for analysis of framed structure.	6	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	W. Weaver and J. M. Gere	Matrix Analysis of Framed Structures	3rd edition		CBS Publisher, New Delhi

2	S. S. Bhavikatti	Matrix Method of Structural	1st edition	2011	I.K. International Publishing House Pvt. Ltd., New Delhi (ISBN: 978-93-81141-35-9)
3	A. S. Meghre and S. K. Deshmukh	Matrix Method of Structural analysis	1st edition	2003	Charotar Publishing House, (ISBN: 81-85594-08-2)

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	C.K. Wang	Matrix Method of Structural analysis	1st edition	1966	International Textbook Company
2	A. Ghali, A. M. Neville and T. G. Brown	Structural Analysis: A Unified Classical and Matrix Approach	6th edition	2007	Chapman & Hall.
3	D. Menon	Advanced Structural Analysis		2009	Narosa Publishing House

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105105180
2	https://www.youtube.com/watch?v=Wa9ZSWlrpnk

Semester	**V**
Course Category	**Professional Core (PC)**
Course Code	**ST306**
Course Title	**Surveying**
Credits	**2**
Teaching Scheme	**Lectures: 2 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 10 Marks** **Insem. Evaluation: 15 Marks** **Endsem. Evaluation: 25 Marks**

Prerequisite Course: Basic Concept in Civil Engineering

Course Objectives:

1	To study the fundamental concepts of compass, plane table surveying and levelling.
2	To learn the theodolite traversing using 20 Second transit theodolite.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the basic concept of linear and angular measurement of surveying.	2	Understand
CO2	Understand the concept for measurement of vertical distances	2	Understand
CO3	Understand the vertical and horizontal measurement using theodolite surveying.	2	Understand

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO2	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO3	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO4	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO5	3	1	1	1	1	3	2	1	3	3	2	3	-	3
CO6	3	1	1	1	1	3	2	1	3	3	2	3	-	3

Course Contents

Unit No.	Topic	Hrs.	COs

Unit No.	Topic	Hrs.	COs
I	**Compass and Plane Table Surveying** a) Introduction, principle, classification of surveying, plans & maps, concept of scale, chaining and traversing, bearing, meridian and their types, construction and use of prismatic and surveyor compass, local attraction and correction for local attraction, dip, Magnetic declination. b) Instrument and accessories for plane table surveying and their uses, Temporary adjustment, advantages and disadvantages, Errors, methods of plane table survey: Radiation, intersection.	6	CO1
II	**Levelling and Contouring** a) Introduction, Types of levelling, Types of bench marks, Booking and Reducing level, Study and use of Dumpy level, auto level, digital level and laser level in construction industry, reciprocal levelling, profile levelling, cross-sectioning and their applications. Curvature and refraction corrections. b) Contouring –Introduction, Contour interval, characteristics of Contour, Methods and Interpolation of Contouring, Application of contour maps.	6	CO2
III	**Theodolite Surveying.** a) Introduction, Study of twenty second vernier transit theodolite, Use of Theodolite for measurement of horizontal angles by repetition and reiteration method, Measurement of vertical angles, deflection angles, magnetic bearing, prolonging a Straight line. Fundamental lines and Desired Relations of transit Theodolite. b) Theodolite traversing –Traverse computation of consecutive coordinates Latitude and Departure, Closing Errors, Balancing the Closed traverse by Bowditch's and transit Rules, Gales Traverse table, omitted measurements.	6	CO3

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	R.Subramanian	Surveying and Levelling	02st Ed	2012	Oxford Publication.
2	Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain,	Surveying" Vol. I	17th Ed	2016	Laxmi Publication.
3	S.K.Duggal	Surveying", Vol. I	14th Ed	2017	Tata Mc-Graw Hill.

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	A. M. Chandra	Plane surveying	03rd Ed.	2015	New Age International, Publishers.
2	N. N. Basak	Surveying and Levelling	02nd Ed	2017	Tata Mc-Graw Hill
3	Dr. K. R. Arora	Surveying", Vol. I	17th Ed.	2019	Standard Book House.

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105104101

2	www.surveyofindia.gov.in

Semester	**V**
Course Category	**Professional Core (PC)**
Course Code	**ST307**
Course Title	**Surveying Lab**
Credits	**1**
Teaching Scheme	**Practical: 2 hrs./week**
Evaluation Scheme	**Practical Examination: 50 Marks**

Prerequisite Course: Nil

Course Objectives:

1	To study and use of various surveying and levelling instruments
3	To learn modern instruments and techniques for preparation of maps in surveying

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Create the layout map using various surveying and levelling instruments such as prismatic compass, plane table, digital level, theodolite.	4	Create
CO2	Create a Cross section and L-section of road using profile levelling	4	Understanding
CO3	Apply the knowledge of tachometric contouring to draw a contour map of hilly area.	3	Apply

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

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

List of Experiments

Sr. No.	Title	COs
1	Measurement of magnetic bearings of sides of a triangle or polygon	1
2	Correction for local attraction and calculations of true bearings using prismatic compass.	1

Sr. No.	Title	COs
3	Plane table survey by radiation and Intersection method.	1
4	Simple and differential levelling with at least three change points using digital level.	1
5	Measurement of horizontal angles (by repetition method) using Vernier Transit Theodolite.	1
6	Calculating a horizontal and vertical distance of an object by using Tacheometer.	1
7	Setting out a foundation plan of given building (minimum six co-ordinates).	1
8	**Projects 1**:Road project using Auto level for a minimum length of 500 m including fixing of Alignment with at least one circular curve, Profile levelling, Cross-sectioning, Plotting of L-Section and Cross Section	2
9	**Projects 2**:Tachometric contouring project on a hilly area with at least two instrument stations about 60 m to 100 m apart using theodolite	3

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	R.Subramanian	Surveying and Levelling	02st Ed	2012	Oxford Publication.
2	Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain,	Surveying" Vol. I	17th Ed	2016	Laxmi Publication.
3	S.K.Duggal	Surveying", Vol. I	14th Ed	2017	Tata Mc-Graw Hill.

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	A. M. Chandra	Plane surveying	03rd Ed.	2015	New Age International, Publishers.
2	N. N. Basak	Surveying and Levelling	02nd Ed	2017	Tata Mc-Graw Hill
3	Dr. K. R. Arora	Surveying", Vol. I	17th Ed.	2019	Standard Book House.

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105104101
2	www.surveyofindia.gov.in

Semester	**V**
Course Category	**Professional Core (PC)**
Course Code	**ST308**
Course Title	**Structural Analysis and Design using STAAD Pro**
Credits	**2**
Teaching Scheme	**Practical: 4 hrs./week**
Evaluation Scheme	**TW: 50 Marks**
	PR: 50 Marks

Prerequisite Course: Engineering Mechanics, Mechanics of Solids, Analysis of Determinate and Indeterminate Structures, Design of Steel Structures.

Course Objectives:

To provide skills of modeling, analysis and design of structural engineering industrial problems using STAAD Pro software

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Model the complex structural engineering problems in STADD Pro software.	3	Apply
CO2	Assign support conditions as well as material properties to different structures using STAAD Pro software.	3	Apply
CO3	Analyse and design framed steel structures as per Indian standards using STAAD Pro software.	3	Apply
CO4	Model, analyse and design industrial weir house, transmission tower and multi-storeyed frame structures using STAAD Pro software.	4	Analyse

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	1	1	1	2	2	2	2	3	-
CO2	3	3	3	1	3	1	1	1	2	2	2	2	3	-
CO3	3	3	3	1	3	1	1	1	2	2	2	2	3	-

CO4	3	3	3	1	3	1	1	1	2	2	2	2	3	-

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to STAAD Pro:** Features, starting STAAD Pro. creating New file, opening Existing File closing a file saving, overview of structural analysis & design, types of structures, idealization of structures, STAAD Pro. screen organization, GUI overview, Unit systems, Structure geometry and Coordinate systems (Global and Local), STAAD Pro Editor. **Structural Modeling:** Basic STAAD Pro. Commands and Input Instructions,Creating - Nodes, Beams, and Plates, Geometry Creation Methods, Structure Wizard, Selection of different Views, Translation Repeat, Circular Repeat, Insert Node, Add Beams between midpoints, Add beams by perpendicular intersection, Connect beams along an Axis, Cut Section, Undo / Redo, Dimensioning.	4	CO1
II	**Material Properties and Support :** material specification, material constants, prismatic property specification, tapered member specification, user table specifications, global support specifications i.e., fixed, pinned, fixed but, spring supports, inclined supports, Beta Angle, Member Grouping. **Loading:** Loading Specifications, Self-weight Loading Specifications, Member Load Specifications, Area Load / Floor Load Specifications, Area Load, Floor Load, Load Combination Specifications, Wind Load, Seismic Load.	4	CO2
III	**Analysis and Post Processing:** Analysis Specifications, Print Specifications, Pre Analysis Print Commands, Post Analysis Print Commands, Load List Specifications, Report Generation, Output file, Node Displacement, Node Reactions, Beam forces, Beam Stresses, Beam Graphs, Plate Contour, Plate Results Along line, Animation, Reports **Design:** Steel Design As per IS 800, Allowable Stresses, Axial Stresses, Bending Stresses, Shear Stress, Combined Stress, Parameter Specifications, Code Checking Specifications, Member Selection	4	CO3

Unit No.	Topic	Hrs.	COs
	Specifications, Tabulated Results of Steel Design.		
	Assignment No 1- Analysis and Design of truss structure	2	CO4
	Assignment No 2- Analysis and Design of continuous beam	2	CO4
	Assignment No 3- Analysis and Design of framed structure	2	CO4
	Project - I: Modelling, Analysis and Design of multi-storeyed frame structure	10	CO5
	Project - II: Modelling, Analysis and Design of industrial warehouse	10	CO5
	Project - III: Modelling, Analysis and Design of Transmission Tower	10	CO5

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. K. Duggal	Limit State Design of Steel Structures	3rd Ed.	2019	Tata McGraw Hill Education.
2	S. Ramamrutham and R. Narayan	Theory of Structures	9th Ed.	2014	Dhanpat Rai Publishing Company (P) Ltd.
3	T.S.Sarma	STAAD Pro V8i for Beginners: With Indian Examples	1st Ed.	2014	Notion Press.

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	N. Subramanian	Design of Steel Structure	2nd Ed.	2018	Oxford University Press.
2	C. S. Reddy	Basic Structural Analysis	3rd Ed	2017	Tata McGraw Hill Education.
3	T.S.Sarma	Design of Industrial Steel Buildings Using Staad Pro	1st Ed.	2020	Notion Press.

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://education.bentley.com
2	https://www.udemy.com/course/staad_prov8i/
3	https://www.udemy.com/course/staad-pro-latest-connect-edition-for-complete-beginners/
4	https://docs.bentley.com/LiveContent/web/STAAD.Pro%20Help-v15/en/GUID-576C4246-6A58-41D4-9F9A-9909FD744524.html

B.Tech. Honors

Honors Course – I: Computers and Structures

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Introduction to Data Processing Tools	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Problem Solving using Python	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Advanced Structural Analysis and Design using STAAD Pro.	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104		04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	Computers and Structures Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	Computers and Structures Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	**16**	**-**	**04**	**18**	**160**	**-**	**-**	**-**	**240**	**100**	**500**

Honors Course – II: Building Information Modeling

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Revit Architecture	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Revit Structure	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Revit MEP - I	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104		04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	BIM Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	BIM Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	**16**	**-**	**04**	**18**	**160**	**-**	**-**	**-**	**240**	**100**	**500**

Semester:	**V**
Course Category:	**Honors Course (Computers and Structures)**
Course Code:	**ST8101**
Course Title:	**Introduction to Data Processing Tools**
Credits:	**4**
Teaching Scheme:	**Lectures - 2 hrs./week**
Evaluation Scheme:	**OR-30 Marks** **PR-50 Marks**

Prerequisite Course: **Basic computer knowledge and OS**

Course Objectives:

1	To make students aware about use and applications of various data processing tools for different Structural/Civil engineering projects.
2	To understand the working interface, various toolbars, and different functions of data processing tool.
3	To apply various basic and advance functions of data processing tool for Structural/Civil Engineering problems.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand and use data processing tools.	2	Understand
CO2	Create, open and view worksheets using various toolbars and ribbons.	6	Create
CO3	Enter, edit and modify worksheet and workbook.	3	Apply
CO4	Apply basic mathematical and logical functions in a worksheet.	3	Apply
CO5	Apply advance functions in a worksheet for data management.	3	Apply
CO6	Identify proper data processing tool/functions for solving engineering problem.	4	Analyze

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

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

Course Contents

Unit No.	Topic	Hrs.	CO
Unit-I	**A) Word Processing Tools:** Introduction to Word Processing, formatting, header, footer, equation editor, tables, shapes, chart, fonts, colors, effect, columns, watermark. **B) Data Presentation Tools:** Introduction to Presentation tools, shapes, header and footer, design, animation, slide show. **C) Data processing Tools:** Use and applications in structural and civil engineering domain.	08	CO1
Unit-II	**Introduction to data processing tool:** Creating file, interface, Quick access toll bar and ribbons, opening new file and saving file, cell referencing, shortcut key combinations, and editing the worksheet, formatting cells, export and import sheets, Tables and Borders, Custom view, Adjusting worksheet, Text functions.	08	CO2
Unit-III	**Editing and formatting in data processing tool:** Tabs and tabs group, editing and formatting data, Characteristic of a cell, application of absolute, relative, and mixed cell references, Speak Cells, Text to columns, Comments, Inbuilt and advance fills and series, Name range, Creating different objects, Basic tables, dependent drop-down list,	08	CO3
Unit-IV	**Basic Functions in data processing tool:** Arithmetical formulas, Date functions, Logical Test, IF functions, Nested IF, AND function, Not and If error, Count function, Statistical functions, Sorting, Filters, Maths and trigonometric functions.	08	CO4
Unit-V	**Advance Functions in data processing tool:** Lookup, V-lookup, H-lookup, Index functions, Match functions, Protect sheet file and workbook, hyperlinking of sheets, Print page and print titles settings, Pivot tables, Conditional formatting, different charts and graphs. Introduction to macros, VBA applications, and Excel 365.	08	CO5
Unit-VI	**Case Study:** Learning from case studies and determining knowledge, understanding and application of Unit 1 to 5 of course. Detail project submission and presentation of processed data in context with Structural Engineering domain. 1. Structural element analysis or design. 2. SFD and BMD for beam analysis. 3. Structural load calculations and combinations. 4. Materials requirements and rate analysis. 5. Applications in surveying problem. 6. Any other Structural/Civil Engineering problem using Excel.	08	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Paul McFedries	Excel FORMULAS and FUNCTIONS	2nd	2016	Pearson Education, Inc.
2	Wayne L. Winston	Microsoft Excel 2019- Data Analysis and Business Modeling	6th Edition	2019	PHI Learning Pvt. Ltd.
3	Gunthar Pangaribuan	An Introduction to Excel for Civil Engineers	1st	2015	E-book

E-Resources:

Sr. No.	Link
1	https://www.youtube.com/watch?v=bi-zr7j-eCU&list=PLWPirh4EWFpEpO6NjjWLbKSCb-wx3hMql&index=4

2	https://www.coursera.org/specializations/everyday-excel

Semester	**V**
Course Category	**Honors Course (Building Information Modeling)**
Course Code	**ST8102**
Course Title	**Revit Architecture**
Credits	**4**
Teaching Scheme	**Lectures: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **OR: 30 Marks** **Practical: 50 Marks**

Prerequisite Course: Building drawing, Auto CAD.

Course Objectives:

1	To make the students aware about the features of Revit architecture.
2	To impart the knowledge of Key concepts of Revit architecture.
3	To impart the knowledge of Revit architecture for 3D modelling.
4	To study the editing and modifying the elements using Revit architecture.
5	To impart the knowledge of creating different views of a building.
6	To make the students aware about the annotation and detailing using Revit architecture.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Use different features in Revit architecture effectively.	3	Apply
CO2	Use the key concepts in Revit architecture for preparation of drawing.	3	Apply
CO3	Draw/sketch 3D model elements of a structure using Revit architecture.	3	Apply
CO4	Sketch the different structural elements using Revit architecture.	3	Apply
CO5	Sketch the different views of a building using Revit architecture.	3	Apply
CO6	Apply the annotation and detailing skill in building drawing using Revit architecture.	3	Apply

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction:** What is Autodesk Revit is and how it relates to BIM. Introduction, Interface and Navigation. Revit's ribbon menu layout, the properties palette, Project browser, drawing area, 2D and 3D navigation.	08	CO1
II	**Key Concepts:** Use of parameters in Revit, Difference between the instance and type parameters, Difference between 3D model and 2D detail element, revit levels, relationship between levels and views in Revit, Reference panels, Revit drawing aids, Creation of structural grid, Difference between Revit's project, Template and family file format.	08	CO2
III	**3D Model Element:** Creation of wall element, Openings, Doors and Windows, Stairs, Roofs, Columns, Model lines and text, Loading of 3D party components in to project.	08	CO3
IV	**Editing and Modifying the Elements:** Selecting and filtering the elements, Moving, Copying, Rotating, Mirroring and Alignment of elements.	08	CO4
V	**Creating Views:** Duplicating the views, Elevations, Sections, Drafting views, Revit's default 3D view, Camera views, Legend view, Graphics and visibility setting.	08	CO5
VI	**Annotation and Detailing:** Dimensions, Text, Detail lines, Symbols, Detail components, Repeating details, Filled regions.	08	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	BIM Scape	The complete beginners guide to Autodesk Revit Architecture.	--	--	BIM Scape
2	Evic Wing	Autodesk Revit Architecture, 2014	--	2014	Autodesk Official Press.
3	Linkan Sagar and Srishty Rawal	Revit 2019 architecture training guide.	1st	2019	BPB Publications

Reference Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	CAD Desk	Revit Architecture Reference Guide Book.	1st	2019	CAD Desk

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://bimscape.com/beginners-guide-to-revit-architecture/
2	https://www.coursera.org/learn/autodesk-revit-architectural-design
3	www.autodesk.in

Semester:	**VI**
Course Category:	**Professional Course**
Course Code:	**ST311**
Course Title:	**Design of Reinforced Concrete Structures**
Credits:	**3**
Teaching Scheme:	**Lectures-3 hrs./week**
Evaluation Scheme:	**CIA-20 Marks | Insem-30 Marks | Endem-50 Marks | Total-100 Marks**

Prerequisite Course: Engineering and Solid Mechanics, Concrete Technology, Analysis of Structures.

Course Objectives:

1	To introduce students with fundamentals of reinforced concrete design philosophies with emphasis on analysis and design of rectangular sections.
2	To understand the design of various structural members viz. Slab, beam, column, staircase and footing.
3	To make students aware about Indian standards of design and detailing of reinforced concrete structures.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Identify** and **apply** proper design philosophy for design of rectangular sections.	2	Understand
CO2	**Analyze** and design RCC slabs for flexure and shear.	4	Analyze
CO3	**Design** RCC staircase and flange beams .	3	Apply
CO4	**Analyze** and **design** RCC beams for primary and secondary actions.	3	Apply
CO5	**Understand** the behaviour and **design** columns.	3	Apply
CO6	**Design** isolated footing for axial load and bending.	4	Analyze

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

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

Course Contents

Unit No.	Topic	Hrs.	CO
I	**Introduction to reinforced concrete structures:** Properties of concrete & Reinforcing Steel, Characteristic Strength, Stress Strain Curves, types of actions on structures and design philosophies. a) **Working stress method (WSM):** Assumptions, stress block diagram, design constants, analysis and design of singly reinforced sections (SRS). b) **Limit state method (LSM)**: Assumptions, limit state of collapse, serviceability & durability, partial safety factors, stress-strain variation diagram, design fundamental for singly (SRS) and doubly reinforced sections (DRS).	06	CO1
II	**Design of Beams for flexure and shear:** Analysis and design of simply supported, cantilever and continuous beam with detailing using conventional and IS code coefficient method. Design of secondary reinforcement using vertical stirrups, Inclined stirrups and bent-up bars. **Design of Flange sections:** Analysis and design of flange Tee and L section.	06	CO2
III	**Design of Slab:** Design of slab spanning in one direction and two directions with detailing for - Simply supported, Cantilever , continuous and restrained conditions .	06	CO3
IV	**Design of Staircase:** Staircase geometry and requirements, design of Dog legged and open well stair case with detailing, concept of stringer beam. **Design of beams for Bond and Torsion:** Concept of bond and torsion, factors affecting, development length, torsional cracking, equivalent bending and shear due to torsion.	06	CO4
V	**Design of Columns:** Assumptions, minimum eccentricity, requirements of longitudinal reinforcement, design of short column with detailing for axial load and bending moment using standard interaction charts.	06	CO5
VI	**Design of Footings:** Types of footings and their selection, pressure distribution, Load assessment, design of isolated pad and sloped footing for axial load and bending moment with detailing.	06	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.C. Varghese	Limit State Design of Reinforced Concrete	2nd	2008	PHI Publication
2	Dr. VL Shaha Dr. SR Karve	Illustrated Reinforced Concrete Design	6th	2015	Structures Publication Pune
3	Punmia, Jain	Comprehensive Design of RC	5th	2012	Laxmi Standard

	& Jain	Structures			Book House

Reference Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	N. Subramanian	Design of Reinforced Concrete Structures	2nd	2013	Oxford University Press
2	P. Dayaratnram	Limit State Analysis and Design	2nd	2017	Wheeler Publishing Company
3	SU Pillai D. Menon	Reinforced Concrete Design	3rd	2017	Tata McGraw Hill New Delhi

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi
3	**IS 875-Part 1-1987:** Code of practice for design loads (other than earthquake) for buildings and structures: Part (1) dead loads-unit weights of building materials and stored materials, Bureau of Indian Standards, New Delhi
4	**IS 875-Part 2-1987:** Code of practice for design loads (other than earthquake) for buildings and structures: Part (II) imposed loads, Bureau of Indian Standards, New Delhi

E- Resources:

Sr. No.	Link
1	https://nptel.ac.in/courses/105105105
2	https://www.udemy.com/course/design-of-reinforced-concrete-structures

Semester	**VI**
Course Category	**Professional Core (PC)**
Course Code	**ST312**
Course Title	**Design of Industrial Structure**
Credits	**4**
Teaching Scheme	**Lectures: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Design of Steel Structure, Concrete Technology

Course Objectives:

1	To make the students conversant about the planning and design of industrial building;
2	To make the students competent for designing steel gantry girders.
3	To make the students competent for designing steel Pipe Rack
4	To make the students competent for designing steel portal frames.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe the different aspects associated with fabrication of industrial shade and also be able to explain Industrial shade planning and material to be used for achieving comfort.	3	Apply
CO2	Describe the pipe rack along with loading condition	3	Apply
CO3	Design Pipe Rack	4	Analysis
CO4	Design Steel Gantry Girder.	4	Analysis
CO5	Analyze Steel Portal Frames.	4	Analysis
CO6	Design Steel Portal Frames.	4	Analysis

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

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

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Location and planning of industrial areas:** Selection of site for an industry; site planning of an industry in a comprehensive manner with varied considerations; study of indoor and outdoor working environment as related to industrial process of manufacture; human component as related to illumination, ventilation, noise control, etc. in working environment **Industrial shade planning and aspects associated with fabrication of industrial shade** Pre-fabrication elements associated with shade fabrication, there sizes and materials used; Insulation material to be used for achieving comfort.	08	1
II	**Pipe Racks: Introduction:** What is Pipe Rack? Geometry, Application, General Support conditions, Design Guide lines; Loads & Load combination: Gravity Loads, Friction Loads, Seismic Loads, wind loads, Anchor loads Various load combinations. Study of Live example.	08	2
III	**Pipe Rack Design:** Pipe Supports, Types, Design Guide lines, its application, Cable Trays, Types of Trays & Support, Design of Tray supports	08	3
IV	**Steel Gantry Girders:** Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure and design problems.	08	4
V	**Pre Engineered Structures:** Concept, Components, The benefits of PEB buildings , Disadvantages of PEB buildings ,Green benefits of Pre-Engineered Buildings, demand for PEB on a global level, PEB Structures as sustainable buildings.	08	5
VI	**Pre Engineered Building:** Concept, Terminology, parameters, Different Types, Design Methodology and Detail design numerical of pre engineered building.	08	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M.L.Gambhir	Fundamentals of Structural steel design	2nd	2017	McGraw Hill Education India
2	Ashok kumar Dasgupta	Design of Industrial Structure	1st	2022	CRC Press
3	Dr. Ramchandra and Virendra Gehlot	Design of Steel Structure Vol II	13th	2015	**Std.Book House**

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
2	N.Subramanian	Design of Steel Structures: Limit State	4th	2018	Oxford University press India
3	Negi.L.S.	Design of Steel Structures	2nd	1995	Tata McGraw Hill India,

E-Resources: (Maximum 3)

Sr. No.	Link
1	NPTEL

Semester	**VI**
Course Category	**Professional Core (PC)**
Course Code	**ST313**
Course Title	**Finite Element Method**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Mechanics of Solids, Analysis of Determinate and Indeterminate Structures

Course Objectives:

1.	After completing this course, the students will be able to comprehend FEM as a numerical technique to analyze engineering problems.
2.	After completing this course, the students will be able to understand the basic concepts of Finite Element methods and its applications to complex engineering problems

Course Outcomes (Cos): At the end of this course, students will be able to,

CO No.	Course Outcomes (Cos):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Derive fundamental equations of 2D and 3D elasticity problems	3	Apply
CO2	Understand fundamental concepts of finite element method	2	Understand
CO3	Derive shape functions of different finite elements used in the analysis of structures	3	Apply
CO4	Describe the use and concepts of Isoparametric formulation	3	Apply
CO5	Formulate and analyze axially loaded bar problems, spring problems and truss problems using FEM	4	Analyze
CO6	Formulate and analyze continuous beam structures problems using FEM	4	Analyze

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

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

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No.	Topic	Hrs.	COs
I	Theory of elasticity, stresses, strains, displacements, plane stress and plane strain problems, axisymmetric problems, strain-displacement relations, stress-strain relations, equilibrium equations of 3D elasticity problem, stress and strain compatibility conditions.	06	1
II	Introduction to finite element method, Discretization, types of finite elements, advantages and disadvantages of FEM, Applications of FEM, coordinate systems, nodes, types of nodes, effective node numbering system, aspect ratio of element, step by step procedure of FEM, 2D & 3D Pascal's triangle, convergence criteria, displacement function for elements, Difference between CST and LST, Natural coordinates for two nodded bar element, area coordinates for CST element, Introduction to 3D elements,	06	2
III	Shape functions, methods of shape function of an element, shape functions of elements using polynomial, Lagrange and Serendipity family element, shape functions using Lagrange interpolation function.	06	3
IV	Isoparametric Formulation, parent element, mapped element, sub-parametric, super-parametric and Isoparametric elements, theorems of Isoparametric formulation, advantages and Disadvantages of Isoparametric formulation, transformation of coordinates, Jacabian matrix,	06	4
V	DOF for bar element, spring element and truss elements, stiffness matrix for bar element, spring element and truss element, global stiffness matrix, boundary conditions, reduced stiffness matrix. Analysis of bar structures, trusses and spring assembly using Finite Element Method (Problem involving not more than three unknowns)	06	5
VI	DOF for beam element, stiffness matrix for beam element, global stiffness matrix, boundary conditions, reduced stiffness matrix, element nodal load vector, equivalent load vector. Analysis of Continuous Beams using Finite Element Method (Problem involving not more than three unknowns)	06	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	P. Sheshu	Finite Element Analysis		2004	PHI Learning Pvt. Ltd. New Delhi
2	S. S. Bhavikatti	Finite Element Analysis		2005	New Age International
3	C.S. Desai and J. F. Abel	Introduction to Finite Element Method		2005	CRC Press, Tylor & Francis Group

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	O. C Zienkiewicz, R. L. Taylor, and J.Z. Zhu	The Finite Element Method: Its basis and Fundamentals	6th Edition	2005	Elsevier, Butterworth-Heinemann Publications
2	C.S. Krishnamurthy	Finite Element Analysis Theory and Programming		2011	Tata McGraw Hill Education Private Limited
3	Y.M. Desai, T.I. Eldo and A.H. Shah	Finite Element Method with Applications in Engineering	1st Edition	2011	Dorling Kindersley Pvt. Ltd. (Pearson), New Delhi

E-Resources: (Maximum 3)

Sr. No.	Link
1	**https://nptel.ac.in/courses/112104116**
2	https://www.youtube.com/watch?v=UOp6JEiJctA&list=PLSGws_74K018SmggufD-pbzG3thPIpF94 (Basics of Finite Element Analysis-I by Prof. Nachiketa Tiwari, IIT Kanpur)
3	https://www.youtube.com/watch?v=2iUnfPRk6Ro&list=PLLSzlda_AXa3yQEJAb5JcmsVDy9i9K_fi (Intro to the Finite Element Method)

Semester	**VI**
Course Category	**Professional Core (PC)**
Course Code	**ST314**
Course Title	**Fundamentals of Earthquake Engineering**
Credits	**2**
Teaching Scheme	**Lectures: 2 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 10 Marks** **Insem. Evaluation: 15 Marks** **Endsem. Evaluation: 25 Marks**

Prerequisite Course: Preliminary knowledge of Mechanics and Physics

Course Objectives:

1	To study the basics of earthquake engineering.
2	To study the basic difference between the magnitude and intensity of earthquake.
3	To study the IS1893 (Part1):2016 used for earthquake resistance design of structures.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	To understand the basics of earthquake engineering.	2	Understand
CO2	To understand the basic difference between the magnitude and intensity of earthquake.	2	Understand
CO3	To understand the IS1893 (Part1):2016 used for earthquake resistance design of structures.	2	Understand

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	--	--	2	--	--	--	--	--	--	1	1
CO2	1	1	1	--	--	2	--	--	--	--	--	--	1	2
CO3	2	2	2	--	--	2	--	--	--	--	--	--	3	3

Course Contents

Unit No.	Topic	Hrs.	COs
	Displacement Methods		
I	Introduction: Earth and it's interior, The circulations, Plate tectonics. Definition of earthquake, Types of earthquakes and faults, Seismic waves, Measuring instruments.	4	CO1
II	Measurement of magnitude and intensity: Basic terminology, Focus, Focal Depth, Epicenter, Magnitude and Intensity. Difference	4	CO2

Unit No.	Topic	Hrs.	COs
	Displacement Methods		
	between Magnitude and Intensity, Magnitude and Intensity in seismic design. Concept of SDOF system for free vibration.		
III	Introduction to IS1893(Part 1):2016: Study of IS1893(Part 1):2016, Understanding the terminology such as Damping, Critical Damping. Special terminology for building: Centre of Mass, Centre of Resistance, Eccentricity etc. Design Seismic base shear, P-Delta effect. General principles and design criteria, Load combinations, Design acceleration spectrum, Equivalent static method, Dynamic analysis method. Sample numerical on calculation of base shear.	10	CO3

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Agrawal, P. and Shrikhande, M	Earthquake Resistant Design of Structures	Eastern Economy Edition, 2017	2017	PHI Publications, New Delhi.

References Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	Paz, M.	Structural Dynamics-Theory and Computations.	Second	2015	CBS Publications, India.
2	Chopra, A. K..	Dynamics of Structures: Theory and Applications to Earthquake Engineering.	Fifth	2020	Pearson Publications.
3	Manicka Selvam	Elementary Structural Dynamics	Fourth	--	Dhanpatrai and Sons.

E-Resources: (Maximum 3)

Sr. No.	Link
1	http://www.iitk.ac.in/nicee/EQTips
2	https://nptel.ac.in/courses/105101004

Reference Codes

1. IS 1893(Part 1): 2016, Criteria for Earthquake Resistant Design of Structures, Part 1: General Provisions and Buildings, 6th Revision.

Semester	**VI**
Course Category	**Humanity Science (HS)**
Course Code	**HS 315**
Course Title	**Corporate Readiness**
Credits	**2**
Teaching Scheme	**Lectures: 2 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 50 Marks**

Prerequisite Course: Quantitative aptitude, Verbal and Non-verbal communication

Course Objectives:

1	To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2	To develop required aptitude skills.
3	To design the functional and chronological resume.
4	To demonstrate the importance of critical thinking ability and expression in group discussions
5	To prepare students for the various professional interviews.
6	To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Remember placement processes of various organizations and modern job search approach.	1	Remember
CO2	Understand Industry Specific skill set with a view to design an Ideal Resume.	2	Understand
CO3	Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.	3	Apply
CO4	Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests.	4	Analyse
CO5	Evaluate Technical/General Dataset to interpret insights in it.	5	Evaluate
CO5	Create an ideal personality that fits Industry requirement.	6	Create

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	--	--	2	--	--	--	--	--	--	1	1
CO1	--	--	--	--	--	--	--	02	00	02	01	01	--	--
CO2	--	--	--	--	--	--	--	02	03	03	03	01	--	--

CO3	--	--	--	--	--	--	--	01	03	03	02	01	--	--
CO4	01	01	--	--	--	--	--	--	--	01	01	--	--	--
CO5	01	01	--	--	--	--	--	--	--	--	--	--	--	--
CO6	--	--	--	--	--	--	--	02	03	03	02	03	--	--

Course Contents

Unit No.	Topic	Hrs.	COs
I	Placement Awareness: Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	06	1
II	Resume Writing: Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	05	2
III	Group Discussion and Presentation skills : Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion, do's and don'ts of GD and Presentation skills.	05	3
IV	Logical Reasoning I:oding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic.	05	4
V	Logical Reasoning II: Data Interpretation, Data Sufficiency	04	5
VI	Logical Reasoning III: Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle.	05	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	R.S. Agarwal.	A Modern Approach to Verbal & Non-Verbal Reasoning	---	---	---
2	B. S. Sijwali	Reasoning verbal and Non-Verbal.	---	---	---
3	Sheetal Desarda	Master the Group Discussion & Personal Interview - Complete Discussion on the topics asked by reputed B-schools & IIMs .	---	---	---

References Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	---	Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical).	---	---	---
2	M. K. Panday	Analytical Reasoning.	---	---	---

3	K. Gupta	Logical and analytical reasoning	---	---	---
4	Mishra & Kumar Dr. Lal.	Multi-dimensional reasoning .	---	---	---

E-Resources: (Maximum 3)

Sr. No.	**Link**
1	https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/
2	https://www.educationquizzes.com/11-plus/non-verbal-reasoning/
3	https://www.livecareer.com/resume/examples/web-development/e-learning-developer
4	https://novoresume.com/career-blog/how-to-write-a-resume-guide
E- Books:	
1	https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
2	https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

Semester	**VI**
Course Category	**PRJ**
Course Code	**PR 316**
Course Title	**IPR and EDP**
Credits	**2**
Teaching Scheme	**Lectures: 2 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **End Semester:30 Marks**

Prerequisite Course: NIL

Course Objectives:

1	To introduce the basic concepts of IPR
2	To teach patent and Design as an IPR
3	To teach copy right and trademark as an IPR
4	To make aware the selection type of IPR for appropriate inventions
5	To identify the Skill sets required to be an entrepreneur
6	To understand the Role of supporting agencies and Governmental initiatives to promote Entrepreneurship

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Interpret the need and importance of intellectual property rights.	2	Understand
CO2	Elaborate the process for Patent and Design registration	2	Understand
CO3	Explain the process for copy right and trademark registration	2	Understand
CO4	Select the IPR tool for protection of invention	3	Apply
CO5	Evaluating the Entrepreneurial abilities within an Individual.	5	Evaluate
CO5	Creating a Detailed Project Report with a due consideration to various supporting agencies and Governmental initiatives to promote Entrepreneurship.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO	PSO

										0	1	2	1	2	3
CO1	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--
CO2	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--
CO3	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--
CO4	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--
CO5	--	--	--	--	--	--	--	--	2	3	3	3	--	--	--
CO6	--	--	--	--	--	--	--	--	2	3	3	3	--	--	--

Course Contents

Unit No	Contents	Hrs.	COs
1	**Introduction to IPR** Introduction to Concept of Property, Types of Property, General Characteristics of Property Rights, Need of Intellectual property, Introduction to Intellectual Property, Philosophy of IPR, Different forms of Intellectual Property, IPR in India : Genesis and Development, International Organizational and Treaties, WIPO and its Role, International Treaties-Paris convection, TRIPS and PCT	4 Hrs.	1
2	**Patent and Design** Definition of Patents, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter, Anticipation, Registration Procedure, Time Frame and Cost, Rights and Duties of Patentee, International Protection, Commercialization, Infringement, Patent Databases, IP protection of Semiconductors and Integrated Circuits, Case studies Design, Difference from Patent, Protection of Designs, Procedure for Registration, Effect of Registration and Term of Protection, Non-Patentable Subject Matter, Infringement, Patenting biotechnological invention, Case studies	4 Hrs	2
3	**Copyrights and Trademarks** **Introduction to Copyright** -what is covered by Copyright, How long does copyright last, Why Protect Copyright, Registration Procedure, Term of protection, Ownership of copyright, Related Rights - Distinction between related rights and copyrights, Infringement. Difference between copyrights and other IPRs, Case studies **Introduction to Trademarks-** Different kinds of marks: brand names, logos, signatures, symbols, well known marks, Non-Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement., Introduction to Geographical Indications.	6Hrs.	3

Unit No	Contents	Hrs.	COs
4	**Trade Secrets and IPR Management** What are trade secrets; how trade secrets are to be maintained; how trade secrets are used in trade and businesses, Case studies Need of IP Valuation, IPR as an Instrument of Development, Impact of Intellectual Property System on Economic Growth, Role of Intellectual Property in Technology Transfer, Introduction to Biopiarcy and popular cases, Career opportunities in IPR.	6Hrs.	4
5	**Entrepreneurship: Introduction** **5.1 Concept and Definitions**: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **5.2 Entrepreneurial Competencies:** The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow. **5.3 Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programmes. **5.4 Steps in Entrepreneurial Process:** Deciding Developing Moving Managing Recognizing.	4 Hrs.	5

Unit No	Contents	Hrs.	COs
6	**Entrepreneurship support Systems** **6.1 Project Report Preparation:** Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both Economic and Market Preparation projected financial statement. **6.2 Role of Support Institutions and Management of Small Business:** Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, State Financial Corporation (SFC) EPC, ECGC. **6.3 Various Governmental Initiatives:** Make in India Start Up India Stand Up India Digital India Skill India **6.4 Case Studies of Successful Entrepreneurs**	4 Hrs	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Watal, Jayashree	Intellectual Property Rights in The WTO And Developing Countries	---	---	Oxford University Press.
2	R. Anita Rao & Bhanoji Rao	Intellectual Property Rights- A Primer	---	---	A Primer, Eastern Book Co.
3	Shiv Sahai Singh	The Law of Intellectual Property Right,			Eastern Book Co
4	Prabuddha Ganguli	Intellectual property right – Unleashing the knowledge economy			Tata McGraw Hill Publishing company

References Books: (Maximum 3)

Sr.	Authors	Title	Edition	Year	Publication

No.					
1	Subbaram N.R	Handbook of Indian Patent Law and Practice.	---	---	S. Viswanathan Printers and Publishers Pvt. Ltd.
2		Indian Patent Act, 1970	---	1970	
3		The Design Act 2020 (With recent Amendments)		2020	
4		The trademarks Act 1999		1999	
5		Copy right act 1957		1957	

CIA Activity

1. Students shall file on patent/Design/Copyright/Trademark- **15 marks**
2. Online EDP certification from Infosys- **05 marks**

Semester	**VI**
Course Category	**Professional Elective-II (PE)**
Course Code	**ST317-A**
Course Title	**Hydrology and Irrigation Engineering**
Credits	**3**
Teaching Scheme	**Lectures:3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Basic Sciences, Fluid Mechanics.

Course Objectives:

Sr. No.	Course Objectives
1	To teach and help students comprehend runoff, hydrographs, abstractions, and stream gauging while also introducing them to governmental bodies.
2	To explain the idea of floods, hydrologic routing, and reservoir planning, as well as

	to gauge reservoir capacity
3	Design canals and canal network based on the water requirement of various crops. Determine the reservoir capacity.

Course Outcomes: Students will be able to:

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Understand the importance of hydrology and its components.	2	Understanding
2	Compute runoff, stream flow and develop hydrographs along with the concept of reservoir planning and evaluate the capacity of reservoir	5	Evaluating
3	Estimate peak flood, Explain hydrologic routing	3	Applying
4	To find the quantity of irrigation water and frequency of irrigation for various crops.	5	Evaluating
5	Explain the concept of ground water hydrology, water logging, and drainage	4	Analyzing
6	Find the canal capacity, design the canal and compute the reservoir capacity.	2	Understanding

Mapping of Course Outcomes to Program Outcomes (POs):

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

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No	Topics	Hrs	COs
I	**Introduction to Hydrology:** Hydrologic cycle (Horton's) qualitative and engineering representation and Practical applications of hydrology. Hydrological data- classification of data and sources. Introduction to Government organizations: IMD, CWPRS, MERI, HDUG, WALMI, NIH, CWC. **Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs. **Evaporation:** Concept, Factors affecting and Measurement. Transpiration and Evapotranspiration: Process and measurement,	06	1,2

Unit No	Topics	Hrs	COs
	Modified Penman method. **Infiltration**: Concept, Technical terms, Factors affecting and Measurement of infiltration, Horton's infiltration model, and Infiltration indices.		
II	**Run-off:** Introduction, Catchment characteristics effecting the runoff, Rainfall-Runoff relationships and Empirical techniques to determine runoff. **Runoff hydrograph:** Introduction, Factors affecting flood hydrograph, Components of hydro- graph, Base flow separation and Effective rainfall. Unit hydrograph: Uses and Limitations of unit hydrograph, S-curve hydrograph and Concept of Synthetic unit hydrograph. **Reservoir Planning:** Introduction, Term related to reservoir planning, Investigation for reservoir planning, Significance and applications of mass and demand curves, Fixation of reservoir capacity from annual inflow and outflow	06	3,5
III	**Floods:** Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Flood forecasting, and Selection of design return period. **Hydrologic Flood Routing:** Introduction, Reservoir Routing and Channel Routing. **Groundwater:** Occurrence, types of aquifers, aquifer parameters, p orosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.	06	3
IV	**Irrigation:** Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, flow irrigation, lift irrigation. Bandhara irrigation. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.	06	2,5
V	**Water logging and Drainage:** Causes, Effects, Preventive and curative measures of water logging, Land drainage and types, Reclamation of water logged areas, Alkaline and saline lands. **Dams-Gravity Dam:** Introduction, Forces acting on Dam, Stability criterion, Elementary profile of dam, Drainage gallery, Hydraulic design of gravity dam. **Earth Dam:** Introduction, design principle, seepage throughout dam, seepage line, control of seepage, and design of filter. **Spillways:** Necessity and classification of Spillway, essential requirements of spillways capacity and their suitability, Hydraulic design of Ogee spillway. **Energy Dissipater**: Stilling basin and its hydraulic design, USBR and IS stilling basin and their hydraulic requirement.	06	4

Unit No	Topics	Hrs	COs
VI	**Diversion head works:** Types- selection of the suitable site for the diversion headwork components of diversion headwork- Causes of failure of structure on pervious foundation- Khosla's theory- Design of concrete sloping glacis weir **Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method. **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam. **Cross drainage works:** Types- selection of suitable type of CD works- aqueduct and Syphon aqueduct-determination of maximum flood discharge and waterway for drain, **River training works-** Canal falls: Necessity and classification of canal falls, hydraulic design of Sarda type and a Straight Glacis fall.	06	2

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. K. Garg	Irrigation Engineering and Hydraulic Structures	36th	2011	PHI Publications, New Delhi.
2	Dr. Punmia and Dr. Pande	Irrigation and Water Power Engineering	17th	2021	Laxmi Publications
3	P.N. Modi	Irrigation, Water Resources and water power engineering	5th	2020	Standard Book House

References Books: (Maximum 3)

Sr. No	Authors	Title	Edition	Year	Publication
1	M.J. Deodhar	Elementary Engineering Hydrology	3rd	2008	Pearson Education
2	H. M. Raghunath	Irrigation Engineering	2nd	2011	Wiley Publication
3	P.Jaya Rami Reddy	A Textbook of Hydrology	3rd	2016	USP Publishers

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://swayam.gov.in
2	www..iitb.ac.in/nptel

Semester	**VI**
Course Category	**Professional Elective-II (PE)**
Course Code	**ST317-B**
Course Title	**Advanced Concrete Technology**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Civil Engineering Materials**

Course Objectives:

1	To explain the microstructure and properties of the ingredients of concrete.

2	To summarise the concepts of conventional concrete and its influence at gaining strength.
3	To understand a suitable type of special concrete for appropriate application.
4	To design of concrete mix for field applications using mix proportioning principles.
5	To understand the various durability related problems in reinforced concrete and its mitigation.
6	To explain the use of destructive and non-destructive techniques as a tool to assess the condition of reinforced concrete structures.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Explain the microstructure and properties of the ingredients of concrete.	2	Understand
CO2	Summarise the concepts of conventional concrete and its influence at gaining strength.	2	Understand
CO3	Understand a suitable type of special concrete for appropriate application.	2	Understand
CO4	Design of concrete mix for field applications using mix proportioning principles.	3	Apply
CO5	Understand the various durability related problems in reinforced concrete and its mitigation.	2	Understand
CO6	Explain the use of destructive and non-destructive techniques as a tool to assess the condition of reinforced concrete structures.	2	Understand

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Concrete:** Properties of concrete, w/b ratio, gel space ratio, Problems on maturity concept, aggregate cement bond strength, porosity of paste and concrete, transition zone, elastic modulus, factors affecting strength and elasticity of concrete,Creep and shrinkage, Rheology of concrete in terms of Bingham's parameter, modern analysis methods- SEM, XRD, TEM etc.	6	CO1
II	**Special Concrete:** Structural Light weight concrete, ultra light weight concrete, vacuum concrete, mass concrete, waste material based concrete, sulphur concrete and sulphur infiltrated concrete, Jet cement concrete (ultra rapid hardening), gap graded concrete, high strength concrete, high performance concrete, Self curing concrete, Pervious concrete, High volume fly ash concrete, Geopolymer concrete, hot and cold weathering concrete, No fine concrete, Green concrete.	6	CO2
III	**Historical development of fibre reinforced concrete (FRC)**, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres, Basalt fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending. Properties of hardened FRC, behavior under compression, tension, and flexure of steel fibres and polymeric fibres, GFRC, SFRC, SIFCON - development, constituent materials, casting, quality control tests and physical properties.	6	CO3
IV	**Concrete Mix Design:** Design of high strength and high performance concrete mixes, design of light weight aggregate concrete mixes, design of flyash cement concrete mixes, design of high density concrete mixes, Design of pumpable concrete mixes, Design of self compacting concrete, Guidelines for Quality control & Quality assurance of concrete,	6	CO4
V	**Durability:** Permeability and Porosity, Chemical attack (Sulphate attack, Delayed Ettringite Formation, Chloride attack, Acid Attack, Sea Water attack, Carbonation, Freezing and Thawing, Alkali aggregate reaction, Alkali carbonate reaction Corrosion-Mode of action, failure, Tests , Protection methods.	6	CO5
VI	**Test on Hardened concrete**: Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Compression, tension and flexure tests. Poisson's Ratio, Static and dynamic shear modulus, Shear strength of concrete. Advanced non-destructive testing methods: ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermographs.	6	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M. S. Shetty	Concrete Technology	10th Ed	2020	S. Chand Publications.
2	A. M. Neville and J. J. Brooks	Concrete Technology	2nd Ed.	2009	Pearson Education
3	A.R.Santhakumar	Concrete Technology	2nd Ed.	2018	Oxford University Press
4	P. K. Mehta	Concrete: Microstructure, Properties, and Materials	4th Ed.	2017	McGraw Hill Education

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	M.L. Gambhir	Concrete Technology	2nd Edition	2009	McGraw Hill Publishers, New Delhi
2	P.N.Balguru & P.N.Shah	Fiber Reinforced Cement Composite			
3	P. C. Aitcin	High Performance Concrete		1998	E&FN Spon, London

IS Codes: (Maximum 3)

Sr. No.	Authors	Title
1	IS 269:1989	Specification for Ordinary Portland Cement, 33 grade
2	IS 383:1970	Specification for coarse and fine aggregates from natural sources for concrete
3	IS 456:2000	Code for practice for plain and reinforced concrete
4	IS 516:1959	Method for test for the strength of concrete
5	IS: 4031:1996	Methods of physical tests for hydraulic cement
6	IS: 10262:2019	Concrete Mix Proportioning — Guidelines

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://nptel.ac.in/courses/105106176
2	https://nptel.ac.in/courses/105102012
3	https://nptel.ac.in/courses/105104030

Semester	**VI**
Course Category	**Professional Elective-II (PE)**
Course Code	**ST317-C**
Course Title	**Equipment Foundation**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**

Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: **Foundation Engineering**

Course Objectives:

1	To Identify methods of design of horizontal vessels
2	Design the horizontal vessels, anchorage and foundation
3	To Identify methods of design of vertical vessels
4	Design the verticle vessels, anchorage and foundation
5	Design the heat exchanger foundation
6	Design the reactor foundation

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Identify methods of design of horizontal vessels	2	Understand
CO2	Design the horizontal vessels, anchorage and foundation	6	Create
CO3	Identify methods of design of vertical vessels	2	Understand
CO4	Design the vertical vessels, anchorage and foundation	6	Create
CO5	Design the heat exchanger foundation	6	Create
CO6	Design the reactor foundation	6	Create

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

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

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of COs to POs)

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Static Equipment foundations** **Horizontal vessel foundation.** Introduction to horizontal vessel as an equipment. Loads to be considered on horizontal vessel foundation. Load combinations to be used for horizontal vessel foundation design. Types of foundations	06	1
II	**Design of horizontal Vessel-** Design Considerations Vertical Loads, Horizontal Loads, Load Combinations, Anchor Bolts, Slide Plates, Pier Design, Column Design, Footing Design	06	2
III	**Vertical vessel/ process column/distillation column foundation.** Software used for VV foundation analysis & design purpose; Introduction to vertical vessel as an equipment. Different loads to be considered on vertical vessel foundation. Load combinations to be used for Vertical vessel foundation Design. (as per IS 456, IS 1893, PIP) Types of foundations. Pile foundation (isolated, combined) Open foundation, (Isolated, combined)	06	3
IV	**Design of Vertical Vessel** Vertical Loads Horizontal Loads Load Combinations Anchor bolt check.	06	4
V	**Heat exchanger Foundation.** The difference between HV & exchanger is the Bundle pull/push load at the time of maintenance & its application while designing foundation. Design of heat exchanger.	06	5
VI	**Reactor foundations** Generally, reactors are category I equipment's so their foundations are required to design for seismic MCE condition, hence resulting into heavy foundation sizes & huge reinforcements. Design of reactor foundation	06	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1.	PIP STE03350	Vertical Vessel Foundation Design Guide	--	--	Process Industry Practices Structural
0.	PIP STE03360	Heat Exchanger and Horizontal Vessel Foundation Design Guide	--	--	Process Industry Practices Structural

0.	Manjriker Gunaratne	The Foundation Engineering Handbook	1st Edition	2006	CRC Press, Taylor and Fancis Group

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	ACI 318M-11	Building Code Requirements for Structural Concrete An ACI Standard and Commentary	--	--	American Concrete Institute
2	J.E. Bowles	Foundation Analysis and Design	5th Ed.	2001	McGraw-Hill Book Company
3	W C Teng	Foundation Design	1st Ed	1962	Prentice Hall PTR, 1962

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://www.youtube.com/watch?v=Y_PRB7SFj0w
2	https://nptel.ac.in/courses/105108069
3	https://nptel.ac.in/courses/105/103/105103097/

Semester:	**VI**
Course Category:	**Professional Course**
Course Code:	**ST318**
Course Title:	**Design of Reinforced Concrete Structures Lab**
Credits:	**1**
Teaching Scheme:	**Practical -2 hrs./week**
Evaluation Scheme:	**Oral-50 Marks**

Prerequisite Course: Engineering and Solid Mechanics, Concrete Technology, Analysis of Structures and Auto Cad.

Course Objectives:

1	To introduce the students with fundamentals of reinforced concrete design with emphasis on-Architectural and structural planning, Loads on structure, analysis of structure.
2	To impart understanding of codal provisions for designing and detailing of RCC structural elements.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Apply** proper structural planning concepts as per architectural drawings and design requirements.	2	Understand
CO2	**Analyze and design** RCC elements viz. Slab, beam, staircase, columns & footings using conventional design practices and Excel programming.	4	Analyze
CO3	**Design and detailing** of RCC elements using drafting software	6	Create

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	3	1	1	1	3	2	1	2	3	2
CO2	2	3	3	2	3	1	1	1	3	2	1	2	3	2
CO3	2	1	3	1	3	1	1	1	3	2	1	2	3	2

Course Contents

Assignment No.	Topic	Hrs.	CO
A1	**Project1:** Analysis and Design of G+3 storied(Residential/Public/Commercial/Institutional) building covering all types of structural elements as follows; 1. Architectural and structural planning of building having floor area >200m^2 . 2. Analysis and design of all types of slabs	14	CO1 CO2 CO3

	3. Analysis and design of plinth beam, ground beam and floor beams. 4. Analysis and design of stair case(2nd flight) with mid landing beam(Dog legged/Open well) 5. Analysis and design of axially loaded column, axially loaded column with uni axial and bi axial bending with detailed load calculations. 6. Design of column footing for (i) Axial load (ii) Axial load+ Uni axial bending.		
A2	**Project2:** Analysis and design of all (A1) structural elements using Excel programming / Dynamic Spreadsheets	06	CO2 CO3
A3	**Project3:** Industrial visit report for building under constructions covering following points; 1. Elements covering slab, beam, staircase, column and footing. 2. Study of architectural and structural plans on site. 3. Reinforcement cutting and bending schedules. 4. Reinforcement laying, binding and checking as per structural plans.	04	CO1 CO2

Note:

1. Assignment to be completed in a group of maximum 4 students with different problem statement for design project.
2. Full imperial design detailing sheets to be drawn using drafting software (Any 4).
3. Detailing of RCC elements to be done as per SP34 and IS13920.

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Dr. VL Shaha Dr. SR Karve	Illustrated Design of Reinforced Concrete Building (G+3)	6th	2015	Structures Publication Pune
2	SU Pillai E. Menon	Reinforced Concrete Design	3rd	2017	Tata McGraw Hill New Delhi
3	Punmia, Jain	Comprehensive Design of RC	5th	2012	Laxmi

	& Jain	Structures			Standard Book House

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi
3	**IS 875-Part 1-1987:** Code of practice for design loads (other than earthquake) for buildings and structures: Part (1) dead loads-unit weights of building materials and stored materials, Bureau of Indian Standards, New Delhi
4	**IS 875-Part 2-1987:** Code of practice for design loads (other than earthquake) for buildings and structures: Part (II) imposed loads, Bureau of Indian Standards, New Delhi
5	**SP 34:** Handbook on Concrete Reinforcement and Detailing,Bureau of Indian Standards, New Delhi.

E-Resources:

Sr. No.	Link
1	https://nptel.ac.in/courses/105105105
2	https://www.udemy.com/course/design-of-reinforced-concrete-structures

Semester:	**VI**
Course Category:	**Professional Course**
Course Code:	**ST319**
Course Title:	**Design of Industrial Structures Lab**
Credits:	**1**

Teaching Scheme:	**Practical -2 hrs./week**
Evaluation Scheme:	**Oral-50 Marks**

Prerequisite Course: Engineering and Solid Mechanics, Design of Steel Structure, Analysis of Structures and STADD Pro.

Course Objectives:

1	To introduce the students with fundamentals of industrial structure design with emphasis on Loads on structure, analysis of structure.
2	To impart understanding of STADD pro for designing and detailing of industrial structural elements.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply proper steel structure concepts for design of industrial structure.	2	Understand
CO2	Analyze and design Gantry girder, Pre Engineered Building and Pipe Rack	4	Analyze
CO3	Design of industrial structure using STADD pro software.	6	Create

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	3	1	1	1	3	2	1	2	3	2
CO2	2	3	3	2	3	1	1	1	3	2	1	2	3	2
CO3	2	1	3	1	3	1	1	1	3	2	1	2	3	2

Course Contents

Assignment No.	Topic	Hrs.	CO
A1	**Project1:** Design of Pipe Rack with detail Drawing.	6	CO1 CO2 CO3

A2	**Project2:** Analysis and design of Gantry Girder	6	CO2 CO3
A3	**Project3:** Analysis and Design of Pre Engineered Building	6	CO1 CO2
A4	Solve any one project using STADD pro software also.	6	CO1 CO2

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	M.L.Gambhir	Fundamentals of Structural steel design	2nd	2017	McGraw Hill Education India
2	Ashok kumar Dasgupta	Design of Industrial Structure	1st	2022	CRC Press
3	Dr. Ramchandra and Virendra Gehlot	Design of Steel Structure Vol II	13th	2015	Std.Book House

Semester	**VI**
Course Category	**Mandatory Learning Course (MLC)**
Course Code	**MLC 321**
Course Title	**Mandatory Learning Course**
Credits	**Pass/Fail**

Teaching Scheme	**Lectures: 1 hr./week**
Evaluation Scheme	**Pass/Fail**

The mandatory learning course may be any one of the following, which will be decided by the department.

- English for Research Paper writing
- Disaster Management
- Value Addition
- Constitution of India
- Pedagogy Studies
- Stress Management by Yoga
- Personality Development through Life Enlightenment Skills.

B.Tech. Honors

Honors Course – I: Computers and Structures

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				

V	ST8101	Introduction to Data Processing Tools	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Problem Solving using Python	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Advanced Structural Analysis and Design using STAAD Pro.	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104		04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	Computers and Structures Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	Computers and Structures Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	**16**	**-**	**04**	**18**	**160**	**-**	**-**	**-**	**240**	**100**	**500**

Honors Course – II: Building Information Modeling

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Revit Architecture	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Revit Structure	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Revit MEP	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104		04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	BIM Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	BIM Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	**16**	**-**	**04**	**18**	**160**	**-**	**-**	**-**	**240**	**100**	**500**

Semester	**VI**
Course Category	**Honors Course (Computers and Structures)**
Course Code	**ST8102**
Course Title	**Problem Solving Using Python**
Credits	**04**
Teaching Scheme	**Lectures: 04 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks**

Insem Evaluation: 30 Marks Endsem. Evaluation: 50 Marks

Prerequisite Course: **Basics of mathematics**

Course Objectives:

1	To know about basic features of programming language preferably for Python
2	To know about execution and various functions in Python
3	To apply the loops and decision statements in Python.
4	To apply file handling and exception handling in Python
5	To Apply Tuples and dictionaries to access data in Python programs.
6	To apply Tkinter to design GUI

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand basic features of Python	2	Understand
CO2	Understand how Python executes some statements and skips other	2	Understand
CO3	Apply the loops and decision statements in Python.	3	Apply
CO4	Apply file handling and exception handling in Python	3	Apply
CO5	Apply Tuples and dictionaries to access data in Python programs.	3	Apply
CO6	Apply Tkinter to design GUI	3	Apply

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

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

Course Contents

Unit No.	Topic	Hrs.	COs
I	**An Introduction to Python** What is language?, Why should learn to write programs?, What is program?, the building block of program, computer hardware architecture, What is Python and history of Python?, unique features of Python, reserved keywords in Python,	06	CO1

	basic terminology, Python installation, first Python program, values and types, variables, variable names, statements, operators and operands, expressions, order of operations, modulus operator, string operations, comments, glossary		
II	**Conditional execution and functions** Boolean expressions, logical operators, conditional execution, alternative execution, chained conditionals, nested conditionals, short circuit evaluation of logical expressions, what is function and why?, built in functions, type conversion functions, math functions, random numbers, glossary	06	CO2
III	**Loops, iterations and strings** The while loop, infinite loops, break and continue, for loop, loop patterns, examples for looping, maximum and minimum looping, the if statement and its related statement, string, length of string, string slices, the *'in'* operator, string comparison, string methods, parsing strings, glossary	06	CO3
IV	**File Handling and Lists** File handling modes, reading files, writing and appending to files, handling file exceptions, errors, exception handling with try, handling multiple exceptions, example, lists, nested lists, index operator, slice operator, concatenation and repetition, count and index, split and join, glossary	06	CO4
V	**Dictionaries and Tuples** Tuple, basics operations, methods, packing and unpacking, tuples as return values dictionary basics, operations, methods, aliasing and copying with dictionaries, nested dictionaries, glossary	06	CO5
VI	**Date-Time, Writing GUIs in Python (Tkinter)** Get current date and time using date object in Python, calculate one's age using current date and birth date. Tkinter programming, Tkinter widgets, GUI designing	06	CO6

Note- Based on above syllabus students has to complete following seven project using Python program

1. Write a Python program on quantitative aptitude for competitive examination.
2. Write a Python program on the concepts of mechanics of solids.
3. Write a Python program on the concepts of mechanics of fluid.
4. Write a Python program on the concepts of surveying.
5. Write a Python program for the analysis of determinate and indeterminate structures.
6. Write a Python program on concepts of geotechnical engineering and foundation engineering respectively.
7. Write a Python program on concepts of Reinforced Concrete Structures.

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	E. Balagurusamy	Problem Solving and Python Programming	1st Ed.	2017	McGraw Hill Education

2	Reema Thareja	Python Programming: Using Problem Solving Approach	1st Ed.	2017	Oxford University Press
3	A. N. Kamthane and A. A. Kamthane	Programming and Problem Solving with Python	2nd Ed.	2020	McGraw Hill

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Bill Lubanovic	Introducing Python: Modern Computing in Simple Packages	2nd Ed.	2019	O'Reilly Media
2	Mark Lutz	Learning Python	5th Ed.	2013	O'Reilly Media
3	Martin C. Brown	Python: The Complete Reference	4th Ed.	2018	McGraw Hill Education

E-Resources: (Maximum 3)

Sr. No.	Link
01	https://onlinecourses.swayam2.ac.in/cec22_cs07/preview
02	https://www.py4e.com/
03	https://wiki.python.org/moin/BeginnersGuide/Download

Semester	**VI**
Course Category	**Honors Course (Building Information Modeling)**
Course Code	**ST8102**
Course Title	**Revit Structure**
Credits	**4**

Teaching Scheme	**Lectures: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: This course introduces the fundamental skills in learning how to use the Autodesk Revit Structure software. It is highly recommended that students have experience and knowledge in structural design and its terminology

Course Objectives:

1	To make the students aware about Revit Structure.
2	To impart the knowledge of Key concepts of Revit Structure.
3	To impart the knowledge of Revit Structure for 3D modelling.
4	To study the editing and modifying the elements using Revit Structure.
5	To impart the knowledge of creating different views of a building.
6	To make the students aware about the annotation and detailing using Revit Structure.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Use different features in Revit structure effectively.	3	Apply
CO2	Use the key concepts in Revit structure for preparation of drawing.	3	Apply
CO3	Draw/sketch 3D model foundations of a structure.	3	Apply
CO4	Sketch the different structural elements using Revit architecture.	3	Apply
CO5	Sketch the structural reinforcement using Revit structure.	3	Apply
CO6	Apply the annotation and detailing skill in building drawing.	3	Apply

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

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

Course Contents

Unit No.	Topic	Hrs	COs
I	**Introduction:** Introduction to BIM and Autodesk Revit, Overview of the interface, Starting a project, viewing commands, Use of general sketching tools, Editing elements, Working with basic modify tools,	08	CO1
II	**Starting Structural Projects:** Linking and importing CAD files, Linking in Revit Models, Setting up levels, Copying and Monitoring elements, Coordinating linked models, Adding structural grids, Placing structural columns.	08	CO2
III	Foundations: Modeling Walls, Adding Wall Footings, Creating piers and Pilasters (Column projecting from the wall), Adding Isolated footings.	08	CO3
IV	**Structural Framing:** Modeling Structural Framing, Modifying Structural Framing, Adding Trusses, Adding Structural Slabs, Modeling structural slabs, Creating shaft openings.	08	CO4

Unit No.	Topic	Hrs	COs
V	**Structural Reinforcement:** Structural reinforcement, Adding rebar, Reinforcing walls, floors and slabs.	08	CO5
VI	**Working with Views:** Setting the view display, Duplicating views, Adding callout views, Elevations and sections, Creating details, Scheduling.	08	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	ASCENT Center for Technical Knowledge.	Autodesk Revit 2023 Structure Fundamentals	1st	2022	SDC Publications

Reference Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Elise Moss	Revit Structure Basics 2014: Framing and Documentation.	1st	2014	SDC Publications

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://bimscape.com
2	https://www.coursera.org
3	www.autodesk.in
4	https://www.udemy.com/course/essential-autodesk-revit-structure-certification

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DEPARTMENT OF STRUCTURAL ENGINEERING

B. Tech. Structural Engineering

2020-Pattern

Curriculum

(With effect from Academic Year 2020-2021)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,
Maharashtra State, India PIN 423603

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies Structural Engineering, hereby declare that we have designed the Curriculum of B. Tech. (Structural Engineering) of Pattern 2020 i.e. A.Y. 2023-24 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

BOS Chairman

(Dean Academics)

(Director)

Department of Structural Engineering
Sanjivani College of Engineering
Kopargaon-423603

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
Approved

B.Tech. (Structural Engineering) (2020-Pattern)

Semester-VII

Cat	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PC	ST401	Design of Advanced Reinforced Concrete Structures	03	1	-	04	30	50	20	-	-	-	100
PC	ST402	International Design Standards	03	-	-	03	30	50	20	-	-	-	100
PE	ST403	Professional Elective-III	03	-	-	03	30	50	20	-	-	-	100
PE	ST404	Professional Elective-IV	03	-		03	30	50	20	-	-	-	100
PC	ST405	Design of Advanced Reinforced Concrete Structures Lab	-	-	02	01	-	-	-	50	-	-	50
PC	ST406	Structural Analysis and Design using ETABS	-	-	04	02	-	-	-	-	50	50	100
PC	ST407	Detailing of Structures using Tekla	-	-	04	02	-	-	-	-	50	50	100
PC	ST408	Structural Audit and Health Monitoring Lab	-	-	02	01	-	-	-	25	-	-	25
PRJ	ST409	Sports	-	-	02	01	-	-	-	-	25	-	25
MLC	MLC410	Mandatory Learning Course-VII (Financially Smart)	1	-	-	Pass/Fail	-	-	-	-	-	-	-
		Total	13	1	14	**20**	120	200	80	75	125	100	**700**

Semester-VIII

Cat	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	NPTEL Course Duration (Weeks)	Evaluation Scheme (Marks)					
			L	T	P			Theory		OR	PR	TW	Total
								ESE	CIA				
OE	ST411	Open Elective-I	03	-	-	03	12	75	25	-	-	-	100
OE	ST412	Open Elective-II	03	-	-	03	8	75	25	-	-	-	100
OE	ST413	Open Elective-III	02	-	-	02	8	75	25	-	-	-	100
PRJ	ST414	Project/Industrial Internship/ Entrepreneurship Development Project	-	-	20	10		-	100	100	-	150	250
		Total	8	-	20	**18**		225	175	100	-	150	650

BOS Chairman 16/2/24

Dean Academics

Director

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON Approved

List of Professional Electives

Track	Professional Elective –I	Professional Elective –II	Professional Elective –III	Professional Elective –IV
Competitive Services	Advanced Surveying	Hydrology and Irrigation Engineering	Water Supply Engineering	Estimating, Costing and Valuation
Entrepreneur/ Private sector	Design of Formwork	Equipment Foundation Design-I	Equipment Foundation Design-II	Structural Audit and Health Monitoring
Higher Studies	Matrix Methods of Structural Analysis	Advanced Concrete Technology	Theory of Elasticity	Theory of Plates and Shells

Honors Course – I: Computers and Structures

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Introduction to Data Processing Tools	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Problem Solving using Python	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Advanced Structural Analysis and Design using STAAD Pro.	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104	Advanced Structural Analysis and Design using ETABS	04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	Computers and Structures Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	Computers and Structures Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	16	-	04	18	160	-	-	-	240	100	500

Honors Course – II: Building Information Modeling

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Revit Architecture	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Revit Structure	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Revit MEP	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104	3D AutoCAD	04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	BIM Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	BIM Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	**16**	**-**	**04**	**18**	**160**	**-**	**-**	**-**	**240**	**100**	**500**

14/8/24

BOS Chairman

16/8/24

Dean Academics

Director

2024/09/11 17:01

Sanjivani Rural Education Society's Kopargaon

Semester:	**VII**
Course Category:	**Professional Course**
Course Code:	**ST401**
Course Title:	**Design of Advanced Reinforced Concrete Structures**
Credits:	**4**
Teaching Scheme:	**Lectures-3 hrs./week, Tutorial- 1 hrs./week**
Evaluation Scheme:	**CIA-20 Marks | Insem-30 Marks | Endem-50 Marks | Total-100 Marks**

Prerequisite Course: **Analysis of Structures, Fundamentals of Reinforced Concrete Design**

Course Objectives:

1	To introduce students with design concepts for advanced structures.
2	To analyze, design and prepare detailed structural drawing for advanced structures using relevant IS codes.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Analyze and design RC flat and circular slabs for flexure and shear.	4	Analyze
CO2	Analyze and design combined footings.	4	Analyze
CO3	Analyze and design RC retaining walls.	4	Analyze
CO4	Analyze and design RC ground supported water tanks.	4	Analyze
CO5	Analyze and design RC shear wall for lateral forces.	4	Analyze
CO6	Understand the concepts of prestressing and losses.	2	Understand

Course Contents

Unit No.	Topic	Hrs.	CO
I	**a) Design of Flat Slabs:** Introduction to flat slabs, types, design methods, proportioning of flat slab, direct design method, distribution of moments, design of an intermediate panel, design of end panel, detailing of flat slab. **b) Design of Circular Slabs:** Introduction to circular slabs, standard cases of design and circular slab with central post.	06	CO1
II	**Design of combined footings:** Concept of combined footings, need and types, choice of footing, design and detailing of combined trapezoidal and rectangular footing, introduction to eccentric footing.	06	CO2
III	**Design of retaining walls:** Introductions to retaining structures, functions and types, loads and pressure acting, stability, various backfill conditions, design of cantilever type retaining walls for different backfill conditions, design concept of counterfort and buttressed retaining walls.	06	CO3
IV	**Design of ground supported water tanks:** Types of liquid retaining structures, code provisions, analysis by IS code method, design of circular and rectangular water tanks resting on ground.	06	CO4
V	**Earthquake Forces and its response, design of shear wall:** Introduction to limit states, design approaches, factors affecting earthquake design, methods of estimation of earthquake forces, classification of shear wall, loads acting, design of rectangular and flanged shear walls.	06	CO5
VI	**Introduction to prestressed concrete:** Introduction, assumptions and effects of pre-stressing, **stress** analysis concept, load balancing concept, pre-stressing with bent tendon and parabolic tendon, concept of losses in pre-stressing.	06	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.C. Varghese	Advanced Reinforced Concrete Design	2nd	2018	PHI Publication
2	Dr.H.J. Shah	Reinforced Concrete Vol.I and II	10th	2014	Charotar Publishing House
3	Arthur H. Nilson & David Darwin	Design of Concrete Structures	12th	2003	Tata McGraw Hill
4	N Krishan Raju	Prestressed Concrete	6th	2018	Tata McGraw Hill

Reference Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. Ramamrutham	Design of Reinforced Concrete Structures	18th	2021	Dhanpat Rai Publishing Company
2	Sushil Kumar	Treasure of RCC Design	17th	2009	Standard Book House
3	SU Pillai D. Menon	Reinforced Concrete Design	3rd	2017	Tata McGraw Hill New Delhi

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi
3	**IS: 3370-2021:** Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi
4	**IS 1893-2002:** Criteria for Earthquake Design of Structures (5th revision) Bureau of Indian Standards, New Delhi

E-Resources:

Sr. No.	Link
1	https://onlinecourses.nptel.ac.in/noc23_ce109/preview
2	https://youtu.be/undsd92MM8w

Semester	**VII**
Course Category	**Professional Core**
Course Code	**ST402**
Course Title	**International Design Standards**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: IS 269-1989, IS 516-1959, IS 875 : 1987, IS 456:2000, IS 800: 2007, IS 1893 (Part 1): 2016, IRC 6 - 2010

Course Objectives:

1	To study the various codes requirement of building materials.
2	To compare clauses of loads acting as per IS 875 (Part 1, 2, 4, 5): 1987, IS 875 (Part 3): 2015, EN 1991:2002 Eurocode 1, ASCE-7
3	To compare the clauses of IS 456:2000, ACI 318-02/318R-02, ACI 301-99 and Eurocode 2 EN 1992: 2004 Part 1.1
4	To study and compare the clauses of IS 800: 2007, ANSI/AISC 360-10, ANSI/AISC 341-10, AISC 303-10 and Eurocode 3 EN 1993: 2005 for design of RCC structure.
5	To compare analysis and design of truss, continuous beam and framed structure by STAAD Pro. using IS 800:2007 and ANSI/AISC 360-10
6	To compare analysis and design of G+2 RCC structure by ETabs using IS 456:2000 and ACI 318-02/318R-02

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand requirements of building materials based on Indian, American and European standards	2	Understand
CO2	Understand the difference between the Indian, American and European criteria for loading on building	2	Understand
CO3	Study and compare the clauses of IS 456:2000, ACI 318-02/318R-02, ACI 301-99 and Eurocode 2 EN 1992: 2004 Part 1.1 for design of RCC structure.	2	Understand
CO4	Study and compare the clauses of IS 800: 2007, ANSI/AISC 360-10, ANSI/AISC 341-10, AISC 303-10 and Eurocode 3 EN 1993: 2005 for design of RCC structure.	2	Understand
CO5	To compare analysis and design of truss, continuous beam and framed structure by STAAD Pro. using IS 800:2007 and ANSI/AISC 360-10 codes	2	Understand
CO6	To compare analysis and design of G+2 RCC structure by ETabs using IS 456:2000 and ACI 318-02/318R-02	2	Understand

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Standards for building materials:** **Cement:**	6	CO1

Property	Indian Standard	American Code
Chemical Analysis	IS 269-2015	ASTM C114
Sampling and Acceptance	IS 269-2015	ASTM C183
Setting time	IS 269-2015	ASTM C191
Fineness	IS 269-2015	ASTM C430

IS 269-2015-Ordinary Portland Cement
ASTM C114 Chemical Analysis of Hydraulic Cement
ASTM C183 Sampling and Acceptance of Hydraulic Cement
ASTM C191 Time of Setting of Hydraulic Cement by Vicat Needle
ASTM C430 Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve.

Concrete:

Property	Indian Standard	American Code
Making and Curing of test specimens	IS 516-1959	ASTM C31
Methods for testing strength of concrete	IS 516-1959	ASTM C39

IS 516-1959-methods for testing strength of concrete
ASTM C39 Compressive Strength of Cylindrical Specimens
ASTM C31 Making and Curing Test Specimens.

Aggregates:

Property	Indian Standard	American Code
Effect of Organic Impurities in Fine Aggregates on Strength of Mortar	IS 383-1970	ASTM C87
Specific Gravity and Absorption of Coarse Aggregate	IS 383-1970	ASTM C127
Specific Gravity and Absorption of Fine Aggregate	IS 383-1970	ASTM C128
Sieve Analysis of Fine and Coarse Aggregates	IS 383-1970	ASTM C136
Total Moisture Content of Aggregate by Drying.	IS 383-1970	ASTM C566

IS 383-1970 coarse and fine aggregate
ASTM C87: Effect of Organic Impurities in Fine Aggregates on Strength of Mortar
ASTM C127 Specific Gravity and Absorption of Coarse Aggregate
ASTM C128 Specific Gravity and Absorption of Fine Aggregate
ASTM C136 Sieve Analysis of Fine and Coarse Aggregates
ASTM C566 Total Moisture Content of Aggregate by Drying.

Steel:

Property	Indian Standard	American Code
Tension Test - Steel Products	IS 432-1982	ASTM A370 (Sec. 5-13)/E8
Charpy Impact Testing - Steel Products	IS 432-1982	ASTM A370 (Sec. 18-23)/E18

IS 432-1982-mild steel
ASTM A370 (Sec. 5-13)/E8 Tension Test - Steel Products
ASTM A370 (Sec. 18-23)/E18 Charpy Impact Testing - Steel Products.

II	**Standards for Building Loading:**	6	CO2

Property	Indian Standard	American Code	Euro Code
Design loads (Other than Earthquake)- **Dead Loads**	IS 875 (Part 1): 1987	ASCE-7	EN 1991:2002
Design loads (Other than Earthquake)- **Imposed Loads**	IS 875 (Part 2): 1987	ASCE-7	EN 1991:2002
Design loads (Other than Earthquake)- **Wind Loads**	IS 875 (Part 3): 2015	ASCE-7	EN 1991:2002

IS 875 (Part 1, 2): 1987- Code of Practice For Design Loads (Other than Earthquake) for Buildings and Structures
IS 875 (Part 3): 2015- Code of Practice For Design Loads (Other than Earthquake) for Buildings and Structures
EN 1991:2002 Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings
ASCE-7: Minimum design loads for buildings and other structures.

III	**Design of RCC Structures:**	6	CO3

Property	Indian Standard	American Code	Euro Code
Plain and Reinforced Concrete - Code Of Practice	IS 456:2000	ACI 318-02/318R-02	EN 1992-1-1 (2004): 2
Specifications for Structural Concrete for Buildings	IS 456:2000	ACI 301-99	EN 1992-1-1 (2004): 2

IS 456:2000 Plain and Reinforced Concrete - Code Of Practice
EN 1992-1-1 (2004): Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
ACI 318-02/318R-02: Building Code Requirements for Structural Concrete and Commentary
ACI 301-99: Specifications for Structural Concrete for Buildings.

IV	**Design of Steel Structures:**	6	CO4

Property	Indian Standard	American Code	Euro Code
General Construction in Steel	IS 800:2007	ANSI/AISC 360-10	EN 1993-1-1 (2005): 3

IS 800: 2007- General Construction in Steel-Code of Practice
ANSI/AISC 360-10: Specification for Structural Steel Buildings
EN 1993-1-1 (2005): Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings.

V	**Analysis and Design Using STAAD Pro:**	6	CO5

Property	Indian Standard	American Code
Analysis and design of truss structure	IS 800:2007	ANSI/AISC 360-10
Analysis and design of continuous beam	IS 800:2007	ANSI/AISC 360-10

	<table><tr><td>Analysis and design of framed structure</td><td>IS 800:2007</td><td>ANSI/AISC 360-10</td></tr></table> **Assignment No 1-** Comparison of analysis and design of truss structure using IS 800:2007 and ANSI/AISC 360-10: Specification for Structural Steel Buildings **Assignment No 2-** Comparison of analysis and design of continuous beam using IS 800:2007 and ANSI/AISC 360-10: Specification for Structural Steel Buildings **Assignment No 3-** Comparison of analysis and design of framed structure using IS 800:2007 and ANSI/AISC 360-10: Specification for Structural Steel Buildings		
VI	**Analysis and Design Using ETabs:** <table><tr><th>Property</th><th>Indian Standard</th><th>American Code</th></tr><tr><td>Modelling, analysis and design of G+2 RCC Building</td><td>IS 456:2000</td><td>ACI 318-02/318R-02</td></tr><tr><td>Specifications for Structural Concrete for Buildings</td><td>IS 456:2000</td><td>ACI 301-99</td></tr></table> Comparison between modelling, analysis and design of G+2 RCC Building using IS 456:2000 and ACI 318-02/318R-02: Building Code Requirements for Structural Concrete and Commentary, ACI 301-99: Specifications for Structural Concrete for Buildings.	6	CO6

References Codes:

Sr. No.	Title
	Indian Standard Codes
1	IS 269-2015-Ordinary Portland Cement Specification (Sixth Revision)
2	IS 383-1970- Specification for Coarse and Fine Aggregates From Natural Sources for Concrete (Second Revision)
3	IS 875 (Part 1, 2, 4, 5): 1987- Code of Practice for Design Loads for Buildings and Structures (Second Revision), IS 875 (Part 3): 2015- Design Loads for Buildings and Structures-Code of Practice (Third Revision)
4	IS 456:2000 Plain and Reinforced Concrete - Code Of Practice (Fourth Revision)
5	IS 800: 2007- General Construction in Steel- Code of Practice (Third Revision)
	American Standard Codes
6	ASTM C114 Chemical Analysis of Hydraulic Cement.
7	ASTM C183 Sampling and Acceptance of Hydraulic Cement.
8	ASTM C191 Time of Setting of Hydraulic Cement by Vicat Needle.
9	ASTM C430 Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve.
10	ASTM C87: Effect of Organic Impurities in Fine Aggregates on Strength of Mortar.
11	ASTM C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
12	ASTM C127 Specific Gravity and Absorption of Coarse Aggregate.
13	ASTM C128 Specific Gravity and Absorption of Fine Aggregate.
14	ASTM C136 Sieve Analysis of Fine and Coarse Aggregates.
15	ASTM C566 Total Moisture Content of Aggregate by Drying
16	ASCE-7: Minimum design loads for buildings and other structures.
17	ACI 318-02/318R-02: Building Code Requirements for Structural Concrete and

	Commentary.
18	ACI 301-99: Specifications for Structural Concrete for Buildings.
19	ANSI/AISC 360-10: Specification for Structural Steel Buildings.
20	ANSI/AISC 341-10: Seismic Provisions for Structural Steel Buildings.
21	AISC 303-10: Code of Standard Practice for Structural Steel Buildings and Bridges.
EuroCodes	
22	EN 1991:2002 Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings.
23	EN 1992-1-1 (2004): Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
24	EN 1993-1-1 (2005): Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings.

Semester	**VII**

Course Category	**Professional Elective-III**
Course Code	**ST403A**
Course Title	**Water Supply Engineering**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem Evaluation: 30 Marks** **Endsem Evaluation: 50 Marks**

Prerequisite Course: Environmental Engineering

Course Objectives:

Sr. No.	Objectives
1	To learn Components of Water supply scheme, demands of water and characteristics of raw water
2	To learn water treatment plant, treatments units involved and their working.
3	To train the students of civil engineering with good scientific and engineering breadth so that they can analyze, design and execute the water supply works.
4	To learn the advanced water treatment process, distribution of water and plumbing fixtures used in building

Course Outcomes (COs): At the end of the course students will able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Students will be able to understand sources of water and components of water supply scheme.	2	Understand
2	Analyze and asses the water quality and quantity requirements for different demands.	3	Apply
3	Identifying suitable treatment process as per IS code.	3	Apply
4	Estimating hydraulic dimensions of various water treatment units.	3	Apply
5	Applying knowledge of basic principles of treatment in removal of miscellaneous impurities.	2	Understand
6	Implementing various techniques in distribution of water and plumbing fittings.	3	Apply

Course Contents

Unit No.	Course Contents	No. of Hours	COs
I	**Government of India initiatives** such as SMART city mission and AMRUT mission for improvement of water infrastructure sector, Introduction to Jal Jeevan mission and its implications in rural India. **Introduction to water supply scheme:** Components and layout of water supply scheme, Design period and Factors affecting design period, Sources of water and Intake structures. **Water Quality parameters:** Physical, Chemical and microbiological, principles of their analysis, Drinking water Standards as per IS: 10500 (2012).	06	1
II	**Water demand:** types of demand, Factors affecting rate of demand, Population forecasting. **Water treatment:** Necessity and objectives, Principles of water treatment operations and processes, Water treatment plant flow sheet.	06	2

	Aeration: Process details and design consideration of aeration unit.		
III	**Sedimentation:** Types of sedimentation, efficiency of an ideal settling basin, Types of sedimentation tanks, Design of sedimentation tank. **Coagulation and flocculation:** Principle of coagulation, Common coagulants, other coagulant aids like bentonite clay, Lime stone, Silicates and Polyelectrolytes and natural coagulants, Design of Clari-flocculator.	06	3
IV	**Filtration:** Theory of filtration, Mechanism of filtration, Filter media, Types of sand filters, Components, working, back-washing and operational troubles of Rapid sand gravity filter, Design of Rapid sand gravity filters.	06	4
V	**Disinfection:** Mechanism, factors affecting disinfection, methods of disinfection, Chlorination- types and methods, Bleaching powder estimation. **Advanced water treatments-** Water softening, base exchange or Zeolite process, Demineralisation, Desalination, membrane filtration and Reverse osmosis.	06	5
VI	**Water distribution system:** Continuous and intermittent system. Different types of distribution network and their limitations. ESR- Design of ESR capacity. Packaged treatment plants. Household water treatment methods. **Plumbing:** common plumbing fixtures, water efficient fixtures, pipe materials and roughness coefficients, types of fittings, types of valves, types of traps, equivalent lengths for fittings and valves as per standards, types of drainage systems in buildings.	06	6

Text Books:

Sr.No.	Title
1	Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2	Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, DhanpatRai Publishing Company, New Delhi.
3	Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
4	**Water Supply and Treatment Manual: Govt. of India Publication**

Reference Books:

Sr.No.	Title
1	Environmental Engineering: Peavy and Rowe, McGraw Hill Publications
2	Optimal Design of Water Distribution Networks: P. R. Bhave, Narosa Publishing House.
3	CPHEEO Manual on Water Supply & Treatment.
4	Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association)

Semester	**VII**
Course Category	**Professional Elective-III**
Course Code	**ST403B**
Course Title	**Equipment Foundation Design-II**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Foundation Engineering

Course Objectives: The objective of this course is

1	Students will be able to design foundation for the equipment subjected to dynamic loading

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand and analysis of theory of vibrations	2	Understand
CO2	Identify methods of design of Machine foundation	3	Apply
CO3	Design of machine foundation-block & frame foundation	4	Analyis
CO4	Design of foundation for various vibrating equipment foundation and vibrating insolation.	4	Analyis

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Theory Of Vibration** - Single Degree of Freedom System-Free Vibration, Forced Vibration, Damped System	09	1
II	**Dynamic Equipment foundations** Importance of Machine foundation, preliminary sizing criteria, Block Foundation, Frame Foundation, Tuning of the Foundation , Foundation Material, Foundation Analysis and Design	09	2
III	**Block Foundation -** Foundation Sizing, Foundation Stiffness, Strength Design, Minimum Reinforcement **Frame Foundation -** Foundation Sizing, Stiffness Parameters, Strength Design, Minimum Reinforcement	09	3
IV	Design aspects of Reciprocating machines and Impact and Impulsive Load Machines. **Vibration Isolation**- Spring and Rubber Mounts, Inertia Block Bolt or Pad, Mounting Bolt Installation, Grouting, Design Checklist.	09	4

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1.	K.G. BHATIA	Foundations For Industrial Machines	1st	2008	D-CAD Publishers
2.	Mohamed A. El-Reedy	Construction Management and Design of Industrial Concrete and Steel Structures	--	2011	CRC Press Taylor & Francis Group
3.	James P. Lee and Yelena S.	Foundations for Dynamic Equipment	--	2004	ACI 351.3R-04

	Golod				

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Suresh C. Arya	Design structures and foundation for vibrating machines	4th	1984	Golf Publishing Company Japan
2	J.E. Bowles	Foundation Analysis and Design	5th Ed.	2001	McGraw-Hill Book Company
3	W C Teng	Foundation Design	1st Ed	1962	Prentice Hall PTR, 1962

IS Codes

Sr. No.	Code book names
1	IS 2974-1: Code of Practice for Design and Construction of Machine Foundations, Part 1: Foundations for Rotary Type Machines (Medium and High Frequency)
2	IS 2974-2: Code of Practice for Design and Construction of Machine Foundations, Part 2: Foundations for Impact Machines (Hammer Foundations)
3	IS 2974-3: Code of Practice for Design and Construction of Machine Foundations, Part 3: Foundations for Rotary Type Machines of Low Frequency
4	ACI 351.3R-04: Foundations for Dynamic Equipment.

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://www.youtube.com/watch?v=Y_PRB7SFj0w
2	https://nptel.ac.in/courses/105108069
3	https://nptel.ac.in/courses/105/103/105103097/

Semester	**VII**
Course Category	**Professional Elective-III**
Course Code	**ST403C**
Course Title	**Theory of Elasticity**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Analysis of Determinate Structures

Course Objectives:

1.	To apply the basic concepts to understand the concept of elasticity.
2.	To apply the basic concepts of stress and strain to derive the equations of elasticity.
3.	To derive the compatibility equations of elasticity.
4.	To solve 2-D problems of elasticity.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Students will be able to understand the basic concepts of elasticity.	2	Understand
CO2	Students will be able to apply the basic concepts of stress and strain to derive the equations of elasticity.	3	Apply
CO3	Students will be able to derive the compatibility equations of elasticity.	3	Apply
CO4	Students will be able to solve 2-D problems of elasticity	3	Apply
CO5	Students will be able to analyze the bars subjected to torsion.	4	Analyse
CO6	Students will be able to analysis of beams on elastic foundations.	4	Analyse

Course Contents

Unit No.	Topic	Hrs.	COs
I	Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.	6	CO1
II	Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.	6	CO2
III	Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.	6	CO3
IV	Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.	6	CO4
V	Torsion of Prismatic Bars: Saint Venant's Method, Torsion of Rectangular Bar. Torsion of elliptical cross section bar, equilateral triangular cross sectional bar, Torsion of hollow c/s bar, Torsion of hollow elliptical c/s bar.	6	CO5
VI	Beams on elastic foundation: Methods of analysis, elastic line method, idealization of soil medium, Wrinkler model, infinite beams, semi infinite	6	CO6

	and finite beams, rigid and flexible, uniform cross section, point load and udl, solution by finite differences.		

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. Sing	Theory of Elasticity		1988	Khanna Publisher, New Delhi
2	S. Timoshenko S. and JN. Goodier	Theory of Elasticity		1961	McGraw Hill
3	LS. Srinath	Advanced Mechanics of Solids		2000	Tata McGraw Hill

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	AC. Ugural and SK. Fenster	Advanced Strength and Applied Elasticity		2003	Prentice hall professional technical reference, New Jersy.
2	PC. Chwo P.C. and NJ. Pagano	Elasticity Tensor, Dyadic and Engineering applications		1967	D.Van Nestrand Co., In Co.
3	PDS. Verma	Theory of Elasticity		1997	Vikas Publishing Pvt. Ltd. New Delhi

E-Resources: (Maximum 3)

Sr. No.	Link
1	http://52.7.61.3/civil/
2	https://nptel.ac.in/courses/105/105/105105177/
3	https://ocw.snu.ac.kr/node/2695

Semester	**VII**
Course Category	**Professional Elective-IV**
Course Code	**ST404A**
Course Title	**Estimating, Costing and Valuation**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Basic Mathematics, Civil Engineering Materials and Architectural Planning and Drawing

Course Objectives:

1	To learn the estimation methods and procedure to carryout quantities of various items of work for load bearing and RCC framed structure.
2	To learn the procedure of rate of items, and drafting specification of items of work
3	To learn the valuation term, procedure and various methods for carrying out valuation.
4	To study the tender procedure, method of execution, contract, condition of contract and arbitration.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand concept of estimates and prepare approximate estimate for various engineering works.	2	Understand
CO2	Prepare detailed estimate of various items of work by different methods.	3	Apply
CO3	Evaluate depreciation and valuation of property on the basis of present condition, specifications and market trend.	5	Evaluate
CO4	Apply concepts of specification to draft brief specification, detailed specification and prepare detailed rate analysis report.	3	Apply
CO5	Understand the conditions of contract and aspects of Arbitration.	2	Understand
CO6	Describe tendering process, construction contracts, methods of executing works and prepare tender documents	3	Apply

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to Estimate** Definitions: Estimation and valuation. Application, Purpose of estimation. Type of estimates. Data required for estimation as a pre requisite. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum & prime cost items, contingencies, work charge establishment, centage charges. Introduction to S. S. R. Approximate estimate: Meaning, purpose Methods of approximate estimate for engineering works: like building, roads, irrigation, electrical works, water supply & sanitary works with numerical.	6	CO1
II	**Detailed Estimating Method**	6	CO2

Unit No.	Topic	Hrs.	COs
	Detailed estimates: factors to be considered while preparing detailed estimate, methods of detailed estimate- P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing, Detailed estimates of R.C.C framed structures, Working out quantities of steel reinforcement and bar bending schedule.		
III	**Valuation and Methods of Valuation** Purpose of valuation. Meaning of price, cost and value. Factors affecting value. Concept of free hold and lease hold property. **Types of value:** only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Estimation versus valuation. methods of calculating depreciation, obsolescence, sinking fund, years purchase, annuity & obsolescence. **Methods of Valuation:** Rental Basis, Land and Building Method, Profit based method, Reproduction and Replacement.	6	CO3
IV	**Specifications and Rate Analysis:** Introduction, types, meaning and purpose of specification. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work. **Rate Analysis:** Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Task work or out turn, factors effecting task work. Working out Rate Analysis for the items mentioned in specifications above. Special rates concerning to mountainous, hilly, forest and urban areas.	6	CO4
V	**Contracts and Arbitration** **Contracts**: Definition, objectives & essentials of a valid contract as per Indian Contract Act-1872, termination of contract. Types of contracts: only lump sum, item rate, cost plus. Conditions of contract: General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill **Arbitration:** Introduction to Arbitrations as per Indian Arbitration & Conciliation Act-1996, Meaning and need of arbitration, qualities and powers of an Arbitrator.	6	CO5
VI	**Tendering and Execution of Works:** **Tenders**: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, Comparative statement, Pre-bid conference, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Acceptance/ rejection of tenders, Various forms of BOT & Global Tendering, E-tendering method. **Methods of Executing Works**: Procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD, Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour.	6	CO6

Text Books: (Maximum 3)

Sr.	Authors	Title	Edition	Year	Publication

No.					
1	D D Kohli and R C Kohli	A Textbook of Estimating and Costing (Civil)	13th Ed.	2013	S.Chand & company, New Delhi
2	B. S. Patil	Civil Engineering Contracts and Estimates	4th Ed.	2015	Orient Blackswan Private Ltd
3	G.S. Birdie	A Text Book of Estimating and Costing for Civil Engineering	7th Ed	2015	Dhanpat Rai Publishing Company.

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	B. N Dutta and S. Dutta	Estimating and Costing in Civil Engineering: Theory and Practice.	28th Ed.	2020	CBS Publishers and distributors
2	M. Chakraborty	Estimating, Costing Specifications & valuation in Civil Engineering	29th Ed	2006	Chakraborty Publishing
3	R. C. Rangwala	Estimating ,Costing and Valuation book	17th ED	2017	Charotar Publishing House Pvt Ltd, Anand

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://dsr.emahapwd.com

Semester	**VII**
Course Category	**Professional Elective-IV**
Course Code	**ST404B**
Course Title	**Structural Audit and Health Monitoring**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Prerequisite Course: Concrete Technology, Civil Engineering Materials

Course Objectives:

1	To study necessity, stages involved and Bye-laws for Structural Audit.
2	To study the causes of deterioration in structure and factors affecting health of structure.
3	To study the aspects of testes performed in structural audit.
4	To study the preparation of structural audit report.
5	To understand the structural health monitoring and its potential applications.
6	To understand the measures of retrofitting and structural strengthening of various components of structures.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the necessity, stages involved, Bye-laws and process of structural audit	2	Understand
CO2	Diagnosis the distress in the structure understanding the causes and factors.	3	Apply
CO3	Assess the health of structure using destructive and non-destructive methods.	2	Understand
CO4	Prepare the Structural audit report after the investigations.	3	Apply
CO5	Understand the structural health monitoring and its potential applications.	3	Apply
CO6	Suggest the repairs and strengthening measures of the components of structure.	2	Understand

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Introduction to Structural Audit** - Introduction, Objectives, Bye-laws, Importance, Various Stages involved, Visual inspection: scope, coverage, limitations, Factors to be keenly observed. Investigation Management, Aspects of audit of Masonry buildings, RC frame buildings, Steel Structures	06	1
II	**Structural Health**- Factors affecting Health of Structures, Causes of deterioration in RC structures-Permeability of concrete, capillary porosity, air voids, Micro cracks and macro cracks, corrosion of reinforcing bars, sulphate attack, alkali silica reaction Causes of deterioration in Steel Structures: corrosion, Uniform deterioration, pitting, crevice, galvanic, laminar, Erosion, cavitations, fretting, Exfoliation, Stress, causes of defects in connection Maintenance and inspection of structures.	06	2
III	**Elementary aspects of Non-Destructive and Destructive Testing**	06	3

	Concrete Strength Assessment: Rebound hammer, Ultrasonic Pulse velocity, Penetration resistance, Pull out test, Chemical test: Carbonation test, Chloride test, Corrosion potential assessment, Structural Integrity and soundness assessment: Radiography, Impact echo test, dynamic testing of structure, Interpretation and evaluation of test results. Structural Safety in Alteration.		
IV	**Structural Audit Report**: Study of sample Structural audit report for up-gradation of existing building, Audit for continuation of usage of old Buildings, Audit for Buildings damaged due to Earthquakes, Fire.	06	4
V	**Structural Health Monitoring:** Concept, Objectives, SHM Procedures-Data Acquisition Systems, Challenges, Static and vibration based SHM, Sensor technology, Future of SHM	06	5
VI	**Retrofitting of structures** –Introduction, Waterproofing of concrete structures, Structural strengthening and stabilization of beams, slabs, columns, joints and connections. Case studies on structural repair: Bridge, Commercial and Residential apartment.	06	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Victor Giurglutiu	Structural Health Monitoring with Wafer Active Sensors,	2nd	2014	Academic Press Inc
2	Kaustubh Raiker and Chetan Raiker,	Structural Health Evaluation Vis – A – Vis Prescriptive "Mandatory Format of Structural Audit	-	2020	Proceeding by Indian Society of Structural Engineers
3	Arun Kelkar	Building: Structural Audit, Repairs and Restoration	1st	2018	Majestic Publishing House
4	IS516: 2018	**Part4**: Hardened Concrete —Methods of Test Part 4 Sampling, Preparing and Testing of Concrete Cores (First Revision) **Part 5**: Hardened Concrete —Methods of Test Part 5 Non-destructive Testing of Concrete Section Ultrasonic Pulse Velocity Testing (First Revision)			
5	BS1881:Part 201	Guide to the Use of Non-Destructive Methods of Test for Hardened Concrete			

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	CPWD	Handbook on Repair and Rehabilitation of RCC Buildings	1st	2002	CPWD, Govt. of India
2	Douglas E Adams	Health Monitoring of Structural Materials and Components Methods withApplications	1st	2007	John Wiley and Sons

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://www.ripublication.com/ijcer_spl/ijcerv5n4spl_17.pdf
2	https://www.researchgate.net/publication/273059503_Introduction_to_Structural_Health_Monitoring.
3	https://books.google.co.in/books?id=DXOsGoqtiggC&printsec=frontcover#v=onepage&q&f=false

Semester	**VII**
Course Category	**Professional Elective-IV**
Course Code	**ST404C**
Course Title	**Fundamentals of Beams, Plates and Shells**
Credits	**3**
Teaching Scheme	**Lectures: 3 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **Insem. Evaluation: 30 Marks** **Endsem. Evaluation: 50 Marks**

Course Contents

Unit No.	Topic	Hrs.	COs
I	**Theory of Elasticity:** State of a stress at a point, State of a strain at a point, 2D & 3D elasticity problems; Airy's stress function; plane stress, plane strain and axisymmetric problems; equilibrium equations for 3D elasticity problems, strain-displacement relations, strain-compatibility relations,	06	1
II	**Bending of Beams**: Introduction, Euler-Bernoulli beam theory, Assumptions, Governing Equation, and Boundary Conditions, Introduction to Timoshenko Beam Theory and Reddy-Bickford Beam Theory.	06	2
III	**Analysis of Beams:** Bending, buckling and free vibration of simply-supported beams using Euler-Bernoulli beam theory.	06	3
IV	**Bending of Rectangular Plates:** Classical Plate Theory/Kirchhoff Plate Theory: Assumptions, Governing Equation, Boundary Conditions. Navier's Method for bending analysis of Simply Supported Rectangular Plates.	06	4
V	**Fundamentals of Shells:** Basic Concepts of Shell Type of Structures - Classification of shells, Membrane action, Stress-strain and force displacement relations, stress resultants, Load transfer mechanism, Characteristics of shell surfaces, etc.	06	5
VI	**Composites:** Introduction, Types of composites, Polymer-Matrix Composites: Carbon Fiber-Reinforced Polymer Composites, Glass Fiber-Reinforced Polymer Composites, Aramid Fiber-Reinforced Polymer Composites, Metal-Matrix Composites, Ceramic-Matrix Composites, Carbon–Carbon Composites, Hybrid Composites, Structural Composites: Laminated Composites, Sandwich Panels, Nanocomposites, etc.	06	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Rudolph Szilard	Theories and Applications of Plate Analysis: Classical, Numerical and Engineering Methods,	2nd	2004	John Wiley & Sons Inc.,
2	Autar K. Kaw	Mechanics of Composite Materials.	2nd	2007	CRC Press Taylor & Francis
3	C.M. Wang, J.N. Reddy, K.H. Lee	Shear Deformable Beams and Plates: Relationships with Classical Solutions.	3rd	2000	Elsevier Science

References Books

Sr. No.	Authors	Title	Edition	Year	Publication
1	S. Timoshenko, J.N. Goodier	Theory of Elasticity,	5th	1988	McGraw-Hill Book Company
2	R. M. Jones	Mechanics of Composite Materials,	3rd	2018	CRC Press, Boca Raton New York
3	J.N. Reddy	Theory and analysis of elastic plates	2nd	1999	Taylor & Francis Publications

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://archive.nptel.ac.in/courses/105/103/105103209/
2	https://ocw.mit.edu/courses/2-081j-plates-and-shells-spring-2007/
3	https://youtu.be/OmFMF29v23M

Semester:	**VII**
Course Category:	**Professional Course**
Course Code:	**ST405**
Course Title:	**Design of Advanced Reinforced Concrete Structures Lab**
Credits:	**1**
Teaching Scheme:	**Practical -2 hrs./week**
Evaluation Scheme:	**Oral-50 Marks**

Prerequisite Course: Analysis of Structures, Fundamentals of Reinforced Concrete Design Auto CAD

Course Objectives:

1	To introduce the students with design fundamentals of advanced RCC structures.
2	To impart understanding of codal provisions for designing and detailing of advanced RCC structures.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Analyze and design of flat and circular slab.	4	Analyze
CO2	Analyze and design retaining wall.	4	Analyze
CO3	Analyze and design ground supported water tank.	4	Analyze
CO4	Design of slab, retaining wall and water tank using Excel spreadsheets and detailing using drafting software.	6	Create

Course Contents

Assignment No.	Topic	Hrs.	CO
A1	Analysis, design and detailing of flat and circular slabs for various conditions.	06	CO1
A2	Analysis, design and detailing of retaining wall for various conditions.	06	CO2
A3	Analysis, design and detailing ground supported water tank for various conditions.	06	CO3
A4	Preparation of dynamic spreadsheets for designing of slab, retaining wall and water tank with detailing using drafting software.	06	CO4

Note:

1) Assignment to be completed in a group of maximum 3 students with different problem statement for design project.

2) Detailing of RCC elements to be done as per SP34 and IS13920.

3) As a part of self-learning activity interested students according to willingness can solve below assignment for which evaluation will be made in CIA marks finalization.

Self-Learning Assignment

Assignment No.	Topic	Hrs.	CO
SLA1	Analysis, design and detailing of eccentric footing.	02	CO2
SLA2	Analysis, design and detailing of raft foundation.	02	CO2
SLA3	Analysis, design and detailing of counter-fort retaining wall.	02	CO3

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.C. Varghese	Advanced Reinforced Concrete Design	2nd	2018	PHI Publication
2	Dr.H.J. Shah	Reinforced Concrete Vol.I and II	10th	2014	Charotar Publishing House
3	Arthur H. Nilson & David Darwin	Design of Concrete Structures	12th	2003	Tata McGraw Hill

Reference Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	T. Ramamrutham	Design of Reinforced Concrete Structures	18th	2021	Dhanpat Rai Publishing Company
2	Sushil Kumar	Treasure of RCC Design	17th	2009	Standard Book House
3	SU Pillai E. Menon	Reinforced Concrete Design	3rd	2017	Tata McGraw Hill New Delhi

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi
3	**IS: 3370-2021:** Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi
4	**IS 1893-2002:** Criteria for Earthquake Design of Structures (5th revision) Bureau of Indian Standards, New Delhi

E-Resources:

Sr. No.	Link
1	https://onlinecourses.nptel.ac.in/noc23_ce109/preview
2	https://youtu.be/undsd92MM8w

Semester:	**VII**
Course Category:	**Professional Core**
Course Code:	**ST406**
Course Title:	**Structural Analysis and Design using ETABs**
Credits:	**2**
Teaching Scheme:	**Practical -4 hrs./week**
Evaluation Scheme:	**PR-50 Marks** **Oral-50 Marks**

Prerequisite Course: Engineering and Solid Mechanics, Design of Steel Structure, Design of RCC Structures.

Course Objectives:

1	To provide skills of modeling, analysis and design of RCC structures using ETAB software

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the basic tools of ETAB	1	Understand
CO2	Learn and Understand the basic commands of Modelling in ETAB	1	Understand
CO3	Model the complex structural engineering problems in ETAB software.	2	Apply
CO4	Assign static and dynamic loads to the structure	4	Analyze
CO5	Analyze and design RCC Building as per Indian standards using ETAB software.	4	Analyze
CO6	Perform Pushover and Time History Analysis on RCC Building.	4	Analyze

Course Contents

Unit No.	Topic	Hrs.	CO
I	**Introduction to ETAB**: Features, starting ETAB Creating New file, opening Existing File closing a file saving, overview of structural analysis & design, types of structures, idealization of structures, ETAB screen organization, Unit systems, Structure geometry and Coordinate systems (Global and Local) **Modeling:** File operation, ETABs window / floor information, Creating basic grid systems, Creating structural model, Creating centre line plan and importing in ETAB. Defining storey data, Add structural objects using templates/manually, Drawing of point, line and area objects, Reference lines and planes.	6	CO1
II	**Material Properties and Support :** Material specification, material constants, prismatic property specification, global support specifications i.e., fixed, pinned, fixed but, spring supports, inclined supports, Assign model properties for beams/ columns etc. Member Grouping. Modeling	6	CO2

Unit No.	Topic	Hrs.	CO
	of slabs as membrane. **Loading:** Loading Specifications, Define static load case assignment, Area object assignments, Self-weight multiplier, Modify an existing static load case, Load combination, dynamic Earthquake loading, Static Wind Load.		
III	**Analysis and Design:** Model analysis with various combination, Analysis options, Analysis log, Locking and unlocking the model, Study of Bending, shear & torsion for Beam members, Study of Axial load & Bi axial moments for Column members, Study of Deformation of nodes and deflection of various structural members. Assigning design parameters as per I.S 456,Study of Design summary results in terms of percentage of reinforcement, Study of Design report for each structural component like (Footing, Column, and Beam) and interpolate with the manual calculations, How to assign the data for various elements like (footings, columns and beams) to the R.C.C detailer.	8	CO3
	Project - I: Modelling, Analysis and Design of G+2 RCC Building	6	CO4
	Project - II: Modelling, Analysis and Design of G+10 RCC Building	8	CO5
	Project - III: Pushover Analysis of G+10 Building.	4	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.C. Varghese	Limit State Design of Reinforced Concrete	2nd	2008	PHI Publication
2	Dr. VL Shaha Dr. SR Karve	Illustrated Reinforced Concrete Design	6th	2015	Structures Publication Pune
3	Punmia, Jain & Jain	Comprehensive Design of RC Structures	5th	2012	Laxmi Standard Book House

IS Codes

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi
3	**IS: 3370-2021:** Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi
4	**IS 1893-2002:** Criteria for Earthquake Design of Structures (5th revision) Bureau of Indian Standards, New Delhi

Semester	**VII**
Course Category	**Professional Core**
Course Code	**ST407**
Course Title	**Detailing of Structures using Tekla**
Credits	**2**
Teaching Scheme	**Practical: 4 hrs./week**
Evaluation Scheme	**PR-50 Marks** **Oral-50 Marks**

Prerequisite Course: Design of Steel Structures, Design of reinforced concrete structures

Course Objectives:

1	To study the overview and basic toolbars in Tekla Software.
2	To learn the various commands used in modeling a components of structure using Tekla.
3	To learn the various applications and components provided in Tekla.
4	To study the various drawing categories available and plotting of them using Tekla.
5	To study the modelling of handrail, stair, Ladder using Tekla.
6	To model the shop drawing of RCC building using Tekla.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the overview and basic toolbars in Tekla Software.	2	Understand
CO2	Learn and understand the various commands used in modeling a components of structure using Tekla.	2	Understand
CO3	Understand the various applications and components provided in Tekla.	2	Understand
CO4	Understand the various drawing categories available and plotting of them using Tekla.	2	Understand
CO5	Prepare the model of handrail, stair, Ladder using Tekla.	3	Apply
CO6	Prepare model the shop drawing of RCC building using Tekla.	3	Apply

Course Contents

Unit. No.	Topic	Hrs.	COs
I	**Introduction of Modelling**: Overview of Tekla Structures, Create New Model, Save As Single User & Multi-user models, Creating Grid / add Grid line, Creation of Views along Grid lines, View list Basic view Contextual Toolbar, About Base point, Member inputting & Procedure – (Column, Girder, Beam, Post, Braces, Poly beam, Curved beam, Twin profiles etc.) Member Orientation, Member Name & symbols, Material Grade, Filtering Option.	6	1
II	**Modelling Tools / Commands**: Construction line, construction circle, Points Measuring Tools, Split & Combine, Move, Copy, Mirror, to another plane, Polygon cut, Line cut, Part cut, Fit part Weld, Weld Properties & Polygon weld Bolt, Bolt Properties, Site bolts, inquire bolt parts & modify bolt parts. Slotted holes, Inquire Object, inquire assembly, Remove from assembly, Selecting switches & snapping, Attach material to part Chamfer edge, Rendering Options Work area / Work plane, Switch to 3D or plane.	6	2
III	**Applications and Components (Joints and Connections):**Base plate,	6	3

	Haunch, End plate, Splice, Fin plates, Shear plate Clip angle, Bolted gusset, Stiffened end plate, Stub connection Joining plates, Tube gusset, Swap handles, Box girder Doubler plate, Gusset Stiffeners, Man lock beam / column Batten plates, Wing plates, Hole Generation, Stiffeners, Welded connections etc., Create basic custom components manually and using in-built.		
IV	**Introduction to drawing categories and drawing list:** Drawing Properties & Drawing Creations Creating GA drawings (30 model, Plan views, Elevations etc.) Editing GA drawings (Dimensions, Section views, Detail views Weld mark, Level mark, Symbols) Export drawings DWG or DXF	6	4
V	**Miscellaneous Steel:** Inputting Handrail, / Ladder / Stair Create Drawings-GA, Assembly.	6	5
VI	**Tekla project**: Crating a shop drawing for RCC building	6	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Celfrey Salamanes	Tekla Structures Structural Steel Modeling and Detailing (DIY)	--	2018	Kindle Edition
2	Celfrey Salamanes	How to Learn Basic Tekla Structures Reinforcement Modeling	--	2018	Kindle Edition

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi
3	**IS: 3370-2021:** Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi
4	**IS 1893-2002:** Criteria for Earthquake Design of Structures (5th revision) Bureau of Indian Standards, New Delhi

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://www.udemy.com/course/tekla-structures-analysis-and-design-of-buildings/
2	https://www.udemy.com/course/a-complete-tekla-structures-essential-training-for-beginners/
3	https://www.udemy.com/course-dashboard-redirect/?course_id=4165158

Semester	**VII**
Course Category	**Professional Core**
Course Code	**ST408**
Course Title	**Structural Audit and Health Monitoring**
Credits	**1**
Teaching Scheme	**Practicals: 2 hrs./week**
Evaluation Scheme	**OR: 25 Marks**

Prerequisite Course: **Concrete Technology, Civil Engineering Materials**

Course Objectives:

1	To check the concrete strength using nondestructive methods.
2	To study the behavior of the beam under dynamic loading
3	To know the health of building and its expected life

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Estimate the concrete strength using non-destructive methods	3	Apply
CO2	Estimate the frequency and hence strength of member against vibration load.	3	Apply
CO3	Understand the structural health monitoring and its potential applications.	2	Understand

Course Contents

Expt. No.	Topic	Hrs.	COs
I	**Non-Destructive Tests (Any 4)** 1. Study of Rebound Hammer test on concrete 2. Ultrasonic Pulse Velocity test on Concrete 3. Study of half-cell Potentiometer and measurement of corrosion in RCC. 4. Core removal from concrete structure and compression testing 5. Carbonation Test on concrete	8	1
2	Study on Case study report of Structural Audit	4	2
3	Carry out the Structural Audit of Residential / Commercial building and write a report on it.	2	3

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Victor Giurglutiu	Structural Health Monitoring with Wafer Active Sensors,	2nd	2014	Academic Press Inc
2	Kaustubh Raiker and Chetan Raiker,	Structural Health Evaluation Vis – A – Vis Prescriptive "Mandatory Format of Structural Audit	-	2020	Proceeding by Indian Society of Structural Engineers
3	Arun Kelkar	Building: Structural Audit, Repairs and Restoration	1st	2018	Majestic Publishing House

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	CPWD	Handbook on Repair and Rehabilitation of RCC Buildings	1st	2002	CPWD, Govt. of India
2	Douglas E Adams	Health Monitoring of Structural Materials and Components Methods withApplications	1st	2007	John Wiley and Sons

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://www.ripublication.com/ijcer_spl/ijcerv5n4spl_17.pdf
2	https://www.researchgate.net/publication/273059503_Introduction_to_Structural_Health_Monitoring.
3	https://books.google.co.in/books?id=DXOsGoqtiggC&printsec=frontcover#v=onepage&q&f=false

Semester	**VII**
Course Category	**Project**
Course Code	**ST409**
Course Title	**Sports**
Credits	**1**
Teaching Scheme	**Practicals: 2 hrs./week**
Evaluation Scheme	**PR: 25 Marks**

Sports Guidelines:

1. All students compulsory participate in any one of the indoor or outdoor sports.
2. Ensure that all participants to demonstrate fair play, respect, and good sportsmanship throughout the event.
3. Proper safety, necessary protocols each students follow.
4. The final decision taken by referee/Higher authorities is mandatory all participants.
5. All the students make sure that sign on student list at the time of playing.

The following sports are included in sports category

Sr.No.	Type of Sport	Name of Sport
1	Outdoor	Cricket
2	Outdoor	Volleyball
3	Outdoor	Football
4	Outdoor	Basketball
5	Outdoor	Kabaddi Boys
6	Outdoor	Kabaddi Girls
7	Outdoor	Kho-Kho Boys
8	Outdoor	Kho-Kho Girls
9	Indoor	Badminton
10	Indoor	Chess
11	Indoor	Carrom
12	Outdoor	Tug of War
13	Outdoor	Foot Cricket
14	Outdoor	Shot put
15	Outdoor	Discus Throw

Semester	**VII**
Course Category	**Mandatory Learning Course -VII (Financially Smart)**
Course Code	**MLC-410**
Course Title	**Mandatory Learning Course**
Credits	**Pass/Fail**
Teaching Scheme	**Lectures: 1 hr./week**
Evaluation Scheme	**Pass/Fail**

Personal Financial Literacy Program for Young Adults - Being Financially Smart

Course Contents

Unit No.	Topic	Hrs.
I	**Behavioural Finance** Section 1 – Let's Talk Money 1. Psychology of Money 2. Your Relationship with Money 3. Human Behaviour in Financial Markets Section 2 –Why Financial Literacy? 1. Importance of Financial Literacy 2. Costly Money Mistakes	3
2	**Money Management Skills** Section 1 – Important Concepts 1. Saving vs Investing 2. Inflation 3. Power of Compounding Section 2 – Money Management Techniques 1. S.M.A.R.T.E.R way to wealth 2. Money Jar Method	3
	Micro-Project 1 - Exercise	
3	**Steps of Financial Planning** Section 1 – Let's Start Planning 1. Need & Components of Financial Planning 2. Personal Income Statement– Cashflow Mgt & NetWorth Mgt. 3. S.M.A.R.T Goal Setting Section 2 - Goal Based Investment Planning 1. Contingency/Emergency Fund Planning 2. Lifestyle/ Retirement Planning **3.** Estate Planning	3
4	**Risk & Investment Management** Section 1 - Risk Management 1. Understanding Risk Management 2. Life Insurance 3. Health Insurance Section 2 - Investment Management 1. Asset Allocation	3

	2. Mutual Funds - Overview 3. Review & Action	
	Micro-Project 2 - Case Study	
5	Introduction to Business Finance 1. How to Read an Income Statement 2. How to Read a Balance Sheet	3
	Micro-Project 3 - Case Study	
	1. B- Google Survey (via email) 2. Post -session: - 1. Evaluation 2. Feedback 3. Certification	

Honors Courses

Semester	**VII**
Course Category	**Honors Course (Computers and Structures)**
Course Code	**ST8103**
Course Title	**Advanced Structural Analysis and Design using STAAD Pro.**
Credits	**4**
Teaching Scheme	**Lecture: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **OR: 30 Marks** **PR: 50 Marks**

Prerequisite Course: Basics of STAAD Pro.

Course Objectives:

1	Applying their skills to design safe and efficient G+5 buildings while complying with industry standards and best practices.
2	To Develop skills in wind and earthquake load analysis techniques for structural design.
3	Gain a comprehensive understanding of the principles, philosophy, and methodologies of Performance-Based Design for structures.
4	Gain expertise in designing pre-engineered buildings (PEB) according to Indian Standard IS 800, AISC 360, and ASCE 07
5	Acquire knowledge and skills in designing foundations and water tank by Finite Element Method based on AISC 360 standards
6	Familiarize oneself with the finite element method and its application in analyzing and assessing the stability of retaining walls.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Develop professional ethics and solid understanding of structural analysis, design, and detailing principles of G+5 story building projects using STAAD Pro software	4	Analyze
CO2	Apply the principles of codal provisions to critically analyze and evaluate the design solutions for structures subjected to wind and dynamic loads	4	Analyze
CO3	Apply advanced non-linear static analysis to evaluate Performance-based design of Structures using IS 1893 and ASCE 7 codal provisions.	5	Evaluate
CO4	Synthesize the design principles of IS 800, AISC 360, and ASCE 07 to analyze, evaluate, and propose innovative design solutions for pre-engineered buildings.	5	Evaluate
CO5	Analyze and synthesize the design solutions for foundations and water tank by Finite Element Method, guidelines outlined in AISC 360	4	Analyze
CO 6	Demonstrate proficiency in creating accurate and reliable finite element models of retaining walls in STAAD Pro software.	4	Analyze

Course Contents

Unit No.	Title	COs
1	**Analysis and Design of G+ 5 Story Building:** Perform analysis, design, and detailing for a G+5 story building, generating detailed report in STAAD Pro and RCDC	1
2	**Wind and Earthquake Load Analysis and Design of structures:** Wind load analysis of structure as per IS 875 (Part 3) and as per ASCE07 and ATC Hazards codal provisions. Linear and Nonlinear Dynamic Analysis of Building as per IS456, IS13920 and NBC 2016	2
3	**Performance-based design of Structures**: Linear and Nonlinear static analysis of structure as per the design codes and guidelines of IS 1893 and ASCE 7 to allow engineers to assess structural response beyond the elastic range and identify potential failure modes.	3
4	**Design of Pre-Engineered Buildings:** Analysis of Design of Pre-Engineered Buildings (PEB) as per Indian Standard IS 800 and AISC 360 & ASCE 07. Parametric studies and comparative studies with different codal provisions	4
6	**Analysis and Design of Foundation and water tank by Finite Element Method:** Analysis and Design of Foundation and water tank by Finite Element Method using STAAD Pro	5
7	**Stability Checks** for Retaining wall by Finite Element Method: perform a rigorous stability analysis for retaining walls using the Finite Element Method in STAAD Pro.	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Krishnan Sathia	Principles of Structural Analysis-Static and Dynamic Loads	01st Ed	2014	Bentley Institute Press
2	T. S. Sarma	Staad Pro v8i for beginners	01st Ed	2014	Notion Press
3	Bungale S. Taranath	Wind and Earthquake Resistant Buildings: Structural Analysis and Design	01st Ed	2004	CRC Press Inc

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Sukanta Adhikari Dr Alka Pisal	Guide To Structural Engineering Using Staad. Pro Connect: General Theory & Practical Application	01st Ed	2021	New Age International, Publishers.
2	Sanjib Das	STAAD.Pro CE - Seismic Analysis Using IS 1893 (PART-1)-2016	01st Ed	2019	Bentley Institute Press
3	Srinivasan Chandrasekaran	Advanced Steel Design of Structures	01st Ed	2020	CRC Press

E-Resources: (Maximum 3)

Sr. No.	Link
1	https://archive.nptel.ac.in/courses/105/106/105106113/
2	https://www.goodreads.com/en/book/show/57502511
3.	https://www.youtube.com/playlist?list=PL5LpElzkNC9kJ3HsmXehiUDDquxjevBQC

Semester:	**VII**
Course Category:	**Honors Course (BIM)**
Course Code:	**ST8103**
Course Title:	**Revit MEP**
Credits:	**4**
Teaching Scheme:	**Lectures - 4 hrs./week**
Evaluation Scheme:	**CIA-20 Marks** **OR-30 Marks** **Practical-50 Marks**

Prerequisite Course: **Basic knowledge of Revit software**

Course Objectives:

1	To make the students aware about the Revit software.
2	To make the students familiar with different modules of the Revit software.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Use different features in Revit MEP effectively and study basic commands in MEP.	3	Apply
CO2	Use the concept of layers and grids and interface and linking of Revit files.	3	Apply
CO3	Start new project in MEP, linking a Revit Architecture model.	3	Apply
CO4	Draw Ducts, Diffusers and HVAC Component using Revit.	3	Apply
CO5	Draw electrical system using Revit software	3	Apply
CO6	Draw piping systems and different plumbing fixtures.	3	Apply

Course Contents

Unit No.	Topic	Hrs.	CO
I	Introduction to MEP, use of basic commands used in MEP. Study of user interface and setting, Study of layers and grids.	08	CO1
II	Layers and grid, basics. Create and modify tools. Starting a MEP project, linking a Revit architectural model.	08	CO2
III	Component and Family Creating different Views, Visibility and graphics settings. Introduction to MEP Systems MEP Settings.	08	CO3
IV	Creating Ducts, Diffusers and HVAC Components Modifying Ducts, Diffusers and HVAC Components, Legends and schedules.	08	CO4
V	Electrical Systems, Placing Lights, Switches and other Electrical Components, Modifying Lights, Switches and other Electrical Components, Creating Circuit Systems, Modifying Circuit Systems, Creating Switch Systems, Modifying Switch Systems	08	CO5
VI	Plumbing System, Creating piping systems, Creating fire fitting systems, Creating sanitary and drainage piping systems	08	CO6

Text Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	ASCENT center for technical knowledge.	Autodesk Revit 2022 MEP fundamentals.	--	2021	SDC Publications
2	Prof. Sham Tickoo Purdue Univ. and CADCIM Technologies	Exploring Autodesk Revit 2022 for MEP, 8th Edition	8th	2022	CADCIM Technologies, USA.
3	Linkan Sagar and Srishty Rawal	Revit 2019 architecture training guide.	1st	2019	BPB Publications

E-Resources:

Sr. No.	Link
1	https://www.youtube.com/watch?v=jpEYfWiAMPseCU&list=PLWPirh4EWFpEpO6NjjWLbKSCb-wx3hMql&index=4
2	https://www.youtube.com/@BIMModeller
3	https://www.youtube.com/watch?v=xCBYGG9kJFk

Semester-VIII

Sr.No.	Name of NPTEL Courses	NPTEL Link	Duration
	OE-ST411-Open Elective-I		
1)	Concrete technology	https://onlinecourses.nptel.ac.in/noc24_ce46/preview	12 Weeks
2)	Basic construction materials	https://onlinecourses.nptel.ac.in/noc24_ce06/preview	12 Weeks
3)	Air Pollution and Control	https://onlinecourses.nptel.ac.in/noc24_ce03/preview	12 Weeks
	OE-ST412-Open Elective-II		
1)	Construction methods and equipment management.	https://onlinecourses.nptel.ac.in/noc24_ce07/preview	8 Weeks
2)	Construction Management	https://onlinecourses.nptel.ac.in/noc24_ce41/preview	8 Weeks
3)	Introduction to civil Engineering Profession	https://onlinecourses.nptel.ac.in/noc24_ce45/preview	8 Weeks
	OE-ST413-Open Elective-III		
1)	Construction methods and equipment management.	https://onlinecourses.nptel.ac.in/noc23_ce90/preview	8 Weeks
2)	Construction Management	https://onlinecourses.nptel.ac.in/noc23_ce59/preview	8 Weeks
3)	Introduction to civil Engineering Profession	https://onlinecourses.nptel.ac.in/noc23_ce69/preview	8 Weeks

Open elective I, II and III will be conducted on the NPTEL platform.
Open electives department will provide the NPTEL courses list.
Students can give its examination either in the SEM-VII or SEM-VIII.
No separate examination will be conducted by the examination department for these courses.
The department NPTEL coordinator has to record and forward the final marks to exam cell.

PRJ: (ST414): Project/Industrial Internship/ Entrepreneurship Development Project

Teaching Scheme	Evaluation Scheme:
Practical: 20 Hrs./ Week	**Oral Exam : 100 Marks** **CIA : 100 Marks** **Term Work : 50 Marks**
Credits: 10	**Total : 250 Marks**

Course Objectives:

Sr. No.	Course Objectives
1	To get opportunity to observe modern technological developments related to the structural engineering infrastructure project.
2	To get opportunity to learn, understand and sharpen the actual experiences on the industry or field.
3	To get exposure of the onsite/industrial environment

Course Outcomes (COs): At the end of the course students will able to:

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Understand the modern technological developments related to the infrastructure.	2	Understand
2	Apply technical skills to propose the solution to actual problem facing on the site/field.	3	Apply
3	Acquaint the professional competency in the field of civil engineering.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	3	2	3	2	3	2	3	3	2	2	-	3
CO2	-	2	2	-	3	-	-	-	3	3	2	2	-	3
CO3	2	--	2	-	3	2	2	-	3	3	-	2	-	3

Course Contents

Guidelines for Internship

Minimum of 12 weeks or 3 months training in an industry in the field of Structural Engineering. The professional internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project, which may be assigned to him/her. The outcome of the internship should be presented in the form of a report.

There are two different options available for students to earn internship credit.

1. SAP: Students shall register for SAP (ABAP module) certification course under the **SAP** Academy Centre of the Department. After registration, students will attend the 200 hour training under the module provided by **SAP** Academy. Students shall attend the internship provided under the specific module. Credits shall be awarded to the students on successful completion of the Global Certification examination conducted by **SAP India**.

2. Center of Excellence Placement cum Internship:

1	Two guides shall supervise the internship project work, one from the department and another one from industry.
2	Industry shall submit the month-wise satisfactory attendance of the students to the institute/department
3	Students must have to maintain diary document and send their progress to their respective guide.
4	Students must submit Geotag photo to the concerned faculty.
5	The presentation is a way to evaluate student performance, so the students must be ready as an institute guide, internal and external examiners evaluate them.
6	Students must submit a comprehensive report to the department before giving a presentation in front of external as per provided format.

Steps to applying for an internship

1	In the beginning of the Semester, to identify the organization, industry or government office, such as PWD, Irrigation etc. (Hereafter called as organization) involved the structural designing and execution.
2	Students who join training in the concerned industry must submit a permission letter from the office of Training & Placement cell of the college.
3	After scrutiny by the HOD and B.Tech. coordinator, the department will issue a request letter to that organization from where the student will pursue his/her internship.
4	After acceptance of the letter by the said organization, students should submit the letter of joining the internship. The letter should be submitted to the B.Tech. Co-ordinator.

5	Students should present the progress done by them at the time of Dissertation Phase oral through power point presentation in front of the faculty members and external examiner.
Evaluation process for internship	
1	After joining the internship, students should report the progress to their concerned guide/supervisor. The frequency of the report should be monthly.
2	After successful completion of the internship, students should submit the comprehensive internship report in the prescribed format to the department. The report should consist of a letter from the organization about the successful completion of the internship work.
3	Students who will opt for an internship as a part of dissertation need not have to publish a research paper which is a mandatory requirement for dissertation.

Project Guidelines:

I. General:

The main objective of the project is to identify and experience the process of conducting a good research project. The project identification process involves identifying a research problem or engineering challenge that the student wishes to address through their graduate engineering project. This process typically involves Brainstorming, Defining the Problem, Developing Research Questions or Objectives, Conducting a Feasibility Study and Proposal Development.

Overall, the project identification process requires careful consideration of potential research topics or engineering challenges, as well as an understanding of the feasibility and relevance of the proposed project. By following a structured approach, students can ensure that their project is well-defined and feasible, and that students can choose a project based on a variety of factors, including their interests, skills, and career goals.

Some possible categories of projects that students may consider include: Societal Projects, Agri-Based Projects, Health Projects, Environment Projects, Research Projects, Sponsored Projects, and Projects Based on Competitions.

Some Advanced Projects:

- Bridges and Flyovers Projects.
- Highway Projects.
- Beams and Columns Projects.
- Energy Efficient Projects.
- Water and Soil Projects.
- Earthquake Resistant Projects.
- Maintenance Projects.

- Planning Projects.
- Data Science Projects,
- Robotics and Automation Projects,
- Aerospace and Defense Projects,
- Materials Science and Engineering Projects,
- Structural Engineering Projects,
- Cyber security Projects

The project work shall consist of any demanding area such as.

1. Experimental investigation in the particular domain of an engineering field.
2. Software development and usage of software is for solving complex engineering problems.
3. Benefits cost of economic analysis / optimized solutions
4. Working model design and fabrication / product development
5. Industrial applications / Environmental issues / Awareness / sustainable solutions
6. Case study with development of methodology using soft computing tools.
7. Society problem / Agricultural problems / new material evaluation
8. Live industry problems / industry sponsored projects.

Additional weight will be given if projects / research related to

Option A: Industry Sponsored Project

Option B: Project as an Entrepreneur

Option C: Internal Product development

Option D: Interdisciplinary projects

Option E: National / International Journal paper publication

Option F: filling patents based on project work.

II. Project Allocation and Guide selection:

1. The Head of the department / Project coordinator shall constitute a review committee for the project group. The project guide shall be one member of that committee by default.

2. An assistant Professor/Associate Professor/Professor can guide the project without compromising the quality of the work. The project group (minimum 2 to maximum 5 students in one group) allocated to the one guide. The project group shall not include more than 5 students. Students need to take prior permission for extra member before registration for the project work.

3. Students should identify a project of enough complexity, which has at least 4-5 major functionalities. Preferably, the projects must be industry sponsored or part of high-level research / Sponsored research project / live industry problem, new product development or entrepreneurship project.

4. Each project group will submit the registration form along with a synopsis or brief abstract including title of the project, key words and relevant mathematics associated with the project, review of conference/journal papers (at least 15 International and 10 National papers, supporting the project idea, plan of project execution using planner or like project management tool. (Recommended in 1 or 2 weeks after commencement of the term).

5. The students or project group should give presentations on the synopsis or abstract including title of the project and project progress made by them before the Review committee in the seventh semester's first week after commencement of the term.

6. Students should identify stakeholders and write a detailed problem statement for the system.

7. The review committee should revisit the "Feasibility Review" conducted by examiners during Oral examination in the seventh semester to finalize the project title and scope of the project.

8. If a change in the project topic is unavoidable, then the students should complete the process of project re-approval of the project title and scope of the project by submitting a synopsis along with the review of important papers. This new project topic should be approved by the review committee.

9. The record of the remarks/suggestions of the review committee should be properly maintained and made available at the time of examination.

10. Each student/group is required to give a presentation as part of the review for 10 to 15 minutes, followed by a detailed discussion.

11. Students should revisit and reassess the problem statement mentioned in the project-based seminar activity periodically and make appropriate changes if required.

12. By following these guidelines, students and faculty can ensure that the graduate engineering projects are well-structured, timely, and successful.

13. There shall be two project reviews to monitor project progress in semester-I (VIIth) before final project exam.

14. The Project Review committee will be responsible for maintaining project standards, timely progress monitoring, conducting reviews, evaluating and final project examination.

How to write project objectives and the outcomes:

- **Define the problem:** Start by defining the problem that your project aims to solve. This should be a clear and concise statement that explains the issue that your project is addressing.
- **Identify the project objectives:** Once you have defined the problem, identify the objectives of your project. These are specific, measurable, achievable, relevant, and time-bound (SMART) statements that outline what your project aims to achieve.
- **List the project outcomes:** Outcomes are the tangible results or benefits that your project will produce. They should be specific and measurable, and demonstrate the impact of your project on the target audience or stakeholders.

- **Use action verbs:** Use action verbs to describe the project objectives and outcomes. Action verbs convey a sense of urgency and purpose, and make it clear what actions will be taken to achieve the project objectives.
- **Prioritize:** Prioritize the objectives and outcomes based on their importance and relevance to the project. This will help you focus your efforts and resources on the most critical aspects of the project.
- **Review and revise:** Review and revise your project objectives and outcomes regularly to ensure they are still relevant and aligned with the project goals. Make adjustments as needed to reflect changes in project scope, timelines, or priorities.

Project objectives must be clear, concise and outcomes based. Also, essential for effective project planning and implementation. They help to stay focused on what and how to achieve or measure success.

Sample Project Outcomes:

1. **Project Title:** Designing a Sustainable Housing Project
2. **Project Outcomes:** By the end of the project, students will be able to:

- Analyze the needs of the target community and develop a comprehensive design brief for a sustainable housing project.
- Apply principles of sustainable design and construction to create a cost-effective and environmentally-friendly housing solution.
- Utilize design software and tools to create detailed architectural plans and specifications for the project.
- Collaborate effectively with project team members to manage project timelines, budgets, and resources.
- Present the project to stakeholders, including investors and community members, with clear and persuasive communication.

III. Evaluation Guidelines:

a) Project work will be evaluated (as per the rubrics applicable for a particular project) by an individual student based on the individual students' contribution, time taken for completion, final presentation, quality of report presented and submitted.

b) It is mandatory; every student must be physically available at the time of the final project presentation and examination as scheduled by the department. Absent students will not be entertained under any circumstances and they have to reappear for the final project presentation and examination next year.

c) Before appearing for the final project exam presentation, it is mandatory to prepare a project report in draft copy first, get it checked from a guide and make the necessary changes.

d) Project reports should not be hardbound without final approval / permission of the guides, internal and external examiners.

e) Final project exam presentation must contain a well-defined final project topic / title, literature survey, objectives based on the gaps identified, methodology to be used, planning schedule / flow chart for completion of project.

f) Demo of project prototyping: At the end, students will prepare a short video on a project in which implementation, execution and application parts will be covered.

IV. Final Project Report:

Sequence of front pages: i) Front Cover Page ii) Certificate iii) Program Outcomes iv) Acknowledgement v) Synopsis / Abstract vi) Contents / Index vii) Notations viii) List of Tables ix) List of Figures x) List of Graphs.

Chapter 1 Introduction (This chapter should consist of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives, 1.4 Scope of the Project Works, 1.5 Needs of the investigation, 1.5 Limitations of study, 1.6 Expected outcome)

Chapter 2 Literature Review / Survey from minimum of 15 articles published in International Journals and 10 articles published in national journals, books, I. S. Codes, etc. (It shall include details regarding work done by various researchers in the area, methods established / used, any new approaches. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.).

Chapter 3 Methodology used / scientific approach used

Planning Schedule/ Flow chart for completion of project. References and Bibliography

Chapter 4 Results and Discussion

Chapter 5 Conclusions

References and Bibliography

(The references should include the name of author/code/manual/book, title of paper, name of the journal, month & year of publication, volume number / ISBN number, page number. (References shall be mentioned at the end as per universal standards as mentioned in any international journal of professional body).

V. Report printing details:

A. The report must be typed as per the following format on **A4 size Executive Bond paper,** preferably on one side of paper with 1.5 spacing.

B. The report must be printed in **black color hard bound with front cover embossed.**

C. The number of reports (**black color hard bound with front cover embossed**) to prepare / submit are 1 College copy, + 1 Guide copy + each individual copy student.

Format of project report:

Page Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm. Give page number at the bottom margin center.

Font size & font Type:

1. **Chapter Number and Name -** 14 Font size, Times New Roman in **Capital Bold Letters**.
2. **Main Titles (e.g 1.1, 2.5 etc) -** 12 Font size, Times New Roman in **Bold Capital Letters**.
3. **Sub Titles (e.g. 1.1.5, 4.5.1 etc) -** 12 Font size, Times New Roman in **Bold Title case**.
4. **All other matter / content -**12 Font size, Times New Roman sentence case.
5. **Figure name -** 12 Font size, Times New Roman below the figure **Bold** in sentence case.
6. **Table title** - 12 font size, **Bold** Times New Roman **sentence case** above the above the table.
7. No **blank sheet** / **page** should be left in the report.

Layout of typed content:

A. **Chapter Number and Name –** Center of Page.

B. **Main Titles and Sub Titles -** Justified

C. **All other matter / content -** Justified

D. **Figure & Figure name – figure should be at** the centre of the page and the figure **name should be at** the centre of the page and below the figure.

E. **Table & Table title** - The table **should be at** the centre of the page and the table **title should be** at the **center of the** page and above the table.

B.Tech. Honors

Honors Course – I: Computers and Structures

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Introduction to Data Processing Tools	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Problem Solving using Python	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Advanced Structural Analysis and Design using STAAD Pro.	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104	Advanced Structural Analysis and Design using ETABS	04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	Computers and Structures Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	Computers and Structures Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	16	-	04	18	160	-	-	-	240	100	500

Honors Course – II: Building Information Modeling

Semester	Course Code	Course Title	Teaching Scheme (Hrs./Week)			Credits	Evaluation Scheme (Marks)						
			L	T	P		Theory			OR	PR	TW	Total
							CIA	ISE	ESE				
V	ST8101	Revit Architecture	04	-	-	04	20	-	-	30	50	-	100
VI	ST8102	Revit Structure	04	-	-	04	20	-	-	30	50	-	100
VII	ST8103	Revit MEP	04	-	-	04	20	-	-	30	50	-	100
VIII	ST8104	3D AutoCAD	04	-	-	04	20	-	-	30	50	-	100
VII	ST8105	BIM Lab-I	-	-	02	01	-	-	-	-	-	50	50
VIII	ST8106	BIM Lab-II	-	-	02	01	-	-	-	-	-	50	50
		Total	**16**	**-**	**04**	**18**	**160**	**-**	**-**	**-**	**240**	**100**	**500**

BOS Chairman **Dean Academics** **Director**

Honors Courses

Semester	**VIII**
Course Category	**Honors Course (Computers and Structures)**
Course Code	**ST 8104**
Course Title	**Advanced Buildings Analysis and Design using ETABS.**
Credits	**4**
Teaching Scheme	**Lecture: 4 hrs./week**
Evaluation Scheme	**Continuous Internal Assessment: 20 Marks** **OR: 30 Marks** **PR: 50 Marks**

Prerequisite Course: Basics of ETABS.

Course Objectives:

1	Applying their skills to design safe and efficient RCC buildings while complying with industry standards and best practices.
2	To Develop skills advanced modelling in ETABS
3	Gain a comprehensive understanding of the principles, philosophy, and methodologies of Performance-Based Design for structures.
4	Acquire knowledge and skills in designing foundations in ETABS

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Develop proficiency in using ETABS software for advanced modeling	4	Analyze
CO2	Compare the ETABS design calculations with manual design calculations.	4	Analyze
CO3	Develop proficiency in using ETABS software for structural analysis and design of Shear Wall.	5	Evaluate
CO4	Analyze and design Pile foundation using ETABS software	5	Evaluate
CO5	Design Isolated Footing using ETABS software.	4	Analyze
CO 6	Analysis and Design of high rise irregular shape building	4	Analyze

Course Contents

Unit No.	Title	COs
1	**Advanced modelling on ETABS:** Import Plan, Assign Properties, Draw Slab, Modelling Centre, Adding History, Outro, Merging of Models.	1
2	**Design of G+3 Building (Manually and using ETABS):** Beam Size, Column Size, Modelling of staircase, Assigning load, design check, Shear force and Bending Moment Calculations, Reinforcement Calculations.	2
3	**Design of Shear wall using ETABS:** Draw Shear Wall,Support Conditions, Pier Levels, Spandrel Level, Assigning Sections, Design, Reinforcement design.	3

4	**Analyze and Design of pile foundation using ETABS:** Define Properties, Assign Properties, define load pattern, assign frame load, design Pile with Pile cap, Analyze and Design.	4
5	**Design of Isolated footing using ETABS:** Modelling of footing,Modelling of column, Assigning the column load, Draw design strips,Deformation check, Reaction check, Punching shear check,Design and detailing.	5
6	**Analysis and Design of high rise irregular shape building using ETABS:** Modelling, slab design, Beam design, column main bar and tie bar design, Stair design and footing design.	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.C. Varghese	Advanced Reinforced Concrete Design	2nd	2018	PHI Publication
2	Dr.H.J. Shah	Reinforced Concrete Vol.I and II	10th	2014	Charotar Publishing House
3	Arthur H. Nilson & David Darwin	Design of Concrete Structures	12th	2003	Tata McGraw Hill

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Ramamrutham	Design of Reinforced Concrete Structures	18th	2021	Dhanpat Rai Publishing Company
2	Sushil Kumar	Treasure of RCC Design	17th	2009	Standard Book House

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi.

E-Resources: (Maximum 3)

Sr. No.	Link
1	Bing Videos
2	Bing Videos

Semester	**VIII**
Course Category	**Honors Course (Computers and Structures)**
Course Code	**ST 8106**
Course Title	**Computer and Structures Lab II**
Credits	**1**
Teaching Scheme	**Lecture: 2hrs./week**
Evaluation Scheme	**Term Work-50 Marks**

Prerequisite Course: Basics of ETAB.

Course Objectives:

1	Applying their skills to design safe and efficient RCC buildings while complying with industry standards and best practices.
2	To Develop skills advanced modelling in ETABS
3	Gain a comprehensive understanding of the principles, philosophy, and methodologies of Performance-Based Design for structures.
4	Acquire knowledge and skills in designing foundations in ETABS

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Develop proficiency in design RCC Beam on ETABS	4	Analyze
CO2	Design a RCC Column on ETABS	4	Analyze
CO3	Develop proficiency in using ETABS software for structural analysis and design of Shear Wall.	5	Evaluate
CO4	Analyze and design Pile foundation using ETABS software	5	Evaluate
CO5	Design Isolated Footing using ETABS software.	4	Analyze
CO 6	Analysis and Design of high rise irregular shape building	4	Analyze

Course Contents

Assign No.	Title	COs
1	Design of RCC Beam on ETABS and Validation Manually.	1
2	Design of RCC Column on ETABS and Validation Manually.	2
3	Design of Rectangular Shear wall on ETABS	3
4	Analyze and Design of pile foundation on ETABS	4
5	Design of Isolated footing on ETABS	5
6	Analyze and Design of high rise irregular shape building using ETABS	6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.C. Varghese	Advanced Reinforced Concrete Design	2nd	2018	PHI Publication
2	Dr.H.J. Shah	Reinforced Concrete Vol.I and II	10th	2014	Charotar Publishing

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3	Arthur H. Nilson & David Darwin	Design of Concrete Structures	12th	2003	Tata McGraw Hill

References Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	Ramamrutham	Design of Reinforced Concrete Structures	18th	2021	Dhanpat Rai Publishing Company
2	Sushil Kumar	Treasure of RCC Design	17th	2009	Standard Book House

IS Codes:

Sr. No.	Description
1	**IS 456-2000:** Plain and reinforced concrete-code of practice, Bureau of Indian Standards, New Delhi.
2	**IS 13920-2016:** Ductile design and detailing of reinforced concrete structures subjected to seismic forces - code of practice, Bureau of Indian Standards, New Delhi.
3	**IS: 3370-2021:** Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi.

E-Resources: (Maximum 3)

Sr. No.	Link
1	Bing Videos
2	Bing Videos

Semester:	**VIII**
Course Category:	**Honors Course (BIM)**
Course Code:	**ST8104**
Course Title:	**3D AutoCAD**
Credits:	**4**
Teaching Scheme:	**Lectures-4 hrs/week**
	Practical - 2 hrs/week
Evaluation Scheme:	**CIA-20 Marks**
	Oral-30 Marks
	Practical-50 Marks.

Prerequisite Course: **Basic knowledge of AutoCAD**

Course Objectives:

1	To make the students aware about the 3D Auto CAD
2	To make the students familiar with different techniques useful for 3D modeling.

Course Outcomes (COs): **At the end of this course, students will be able to,**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply the basic commands used in 3D AutoCAD.	3	Apply
CO2	Use the basic command in AutoCAD for the development of elevations.	3	Apply
CO3	Use the command for 3D modelling.	3	Apply
CO4	Develop 3D model using different commands.	3	Apply
CO5	Use UCS (User Coordinate System)	3	Apply
CO6	Demonstrate the 3D modelling skill using 3D navigation.	3	Apply

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

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

Course Contents

Unit No.	Topic	Hrs.	CO
Unit-I	Introduction to 3D AutoCAD, Study of interface of 3D AutoCAD, Basics of 3D interface, 3D view port, Navigation wheel, Setting of steering wheel/Navigation wheel.	08	CO1
Unit-II	Thickness and Elevations, Thickness command, Changing the existing thickness, Elevation.	08	CO2
Unit-III	Visualizing 3D model, Hide command, Visual style manager,	08	CO3
Unit-IV	3D coordinates, 3D point filters, Moving in Z direction.	08	CO4
Unit-V	User coordinate system, UCS icon properties, UCS overview, Dynamic UCS, Naming UCS, UCS dialogue box,	08	CO5
Unit-VI	3D Navigation, Viewing camera, 3D model objects, 3D faces, Extrude surfaces, 3D modelling drawings.	08	CO6

Text Books: (Maximum 3)

Sr. No.	Authors	Title	Edition	Year	Publication
1	P.S.Gill	AutoCAD 3D Modeling Fundamentals	--	2021	S.K. Kataria & Sons
2	Shawana Lockhart and James Leach	AutoCAD2023 Instructor	--	2022	SDC Publications
3	Prof. Sham Tickoo	Exploring AutoCAD Civil 3D 2018	8th	2018	BPB Publications

E-Resources:

Sr. No.	Link
1	https://www.youtube.com/watch?v=y41ZgOdExOo
2	https://www.youtube.com/watch?v=A2EldEav4t8
3	https://www.autodesk.com/autodesk-university/class/3D-Modeling-AutoCAD-2017 (3D Modeling in AutoCAD)

Semester:	**VIII**
Course Category:	**Honors Course (BIM)**
Course Code:	**ST8106**
Course Title:	**BIM Lab-II**
Credits:	**1**
Teaching Scheme:	**Practical - 2 hrs/week**
Evaluation Scheme:	**TW- 50 Marks.**

Prerequisite Course: Basic knowledge of Revit software

Course Objectives:

1	To make the students aware about the 3DAuto CAD
2	To make the students familiar with different techniques useful for 3D modeling.

Course Outcomes (COs): At the end of this course, students will be able to,

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply the basic commands used in 3DAutoCAD.	3	Apply
CO2	Use the basic command in AutoCAD for the development of elevations.	3	Apply
CO3	Use the command for 3D modelling for residential/commercial buildings.	3	Apply

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1					3	1			2			2		
CO2			2		3	1			1			2		
CO3			2		3							2		

Course Contents

Assignment	Topic
1	Assignment on use of basic commands in 3D AutoCAD, Baics of 3D interface and one simple drawing using the basic commands.
2	Assignment on thickness and Elevations, Thickness command, Changing the existing thickness, Elevation.
3	Assignment on visualizing 3D model, Hide command, Visual style manager.
4	Assignment on 3D coordinates, 3D points filters, Moving in Z direction.
5	Assignment on what is user coordinate system, UCS icon properties, UCS overview, Dynamic UCS, Naming UCS, UCS dialogue box,
6	Assignment on 3D Navigation, viewing camera, 3D model objects, 3D faces, Extrude surfaces, 3D modelling drawings.
7	A complete project on a residential building showing plan, elevation, section, and 3D drawing.

Text Books: (Maximum 3)

SrNo	Authors	Title	Edition	Year	Publication
1	P.S.Gill	AutoCAD 3D Modeling Fundamentals	--	2021	S.K. Kataria & Sons
2	Shawana Lockhart and James Leach	AutoCAD2023 Instructor	--	2022	SDC Publications
3	Prof. Sham Tickoo	Exploring AutoCAD Civil 3D 2018	8th	2018	BPB Publications

F-Resources:

Sr. No.	Link
1	https://www.youtube.com/watch?v=y41ZgOdExOo
2	https://www.youtube.com/watch?v=A2EldEav4t8
3	https://www.autodesk.com/autodesk-university/class/3D-Modeling-AutoCAD-2017 (3D Modeling in AutoCAD)