SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE

and

SYLLABUS- 2021 PATTERN

SECOND YEAR B. Tech

Semester-III and IV

W.e.f June 2022

Board of Studies in Civil Engineering, June 2022

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute affiliated to SPPU, Pune)

D E C L A R A T I O N

We, the Board of Studies (Civil Engineering), hereby declare that, we have designed the Curriculum of Second Year Civil Engineering Program Curriculum Structure and Syllabus for semester III & IV of Pattern 2021 w.e.f. from A.Y 2022-23 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

(Dr.M.V.Jadhav)

BoS Chairman

Approved by

Dean Academics	Director
Dr.A.B.Pawar	Dr.A.G.Thakur

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SECOND YEAR B. TECH

Profile: Sanjivani College of Engineering was established in the year 1983. The Civil Engineering Department is a part of the institute since its inception. The Department has grown over the years with qualified teaching faculty members who are passionate to impart quality education. The department laboratories are fully equipped with latest equipment, software and with all necessary teaching aids. It is now recognized as one of the prominent departments and known for academic excellence under the Pune University. The department is having valid Accreditation by 'NBA' from 31 July 2015 to June 2025. Besides high quality teaching and instruction at UG, PG and Ph. D., the department is actively involved in basic and applied research and consultancy services. The department is providing quality technical and advisory support through consultancy to various private construction agencies, State Government, Central Government projects.

Apart from academic knowledge, we also, train our students to face the challenges in their profession by providing value added courses like Communication and Presentation skills, building of Team Sprit through field study, expert talk etc. The department also, provides an opportunity to learn software like AUTOCAD, REVIT ARCHITECTURE, STAD- PRO, ETAB, MS-PROJECT etc. to make our students more digitalized.

We arrange regular interaction of our stake holders like students, parents and faculty along with a Training and Placement cell which works full time for bright future of our students. The results are consistently above 90% and considerable number of student ranks in SPPU merit list. Students from Civil department have made incredible mark national and international levels and we are sure will continue in times to come.

The Infrastructure development in India is growing at a faster rate and there are many career paths for civil engineers. Civil engineers are essential in government sector, public and private sector and Multinational companies, to build various mega projects like highways, Industrial structures, smart cities, and reservoirs etc. The next decade will be most demanding and rewarding for Civil engineers.

Civil Engineering Department

VISION

- To become a premier source of competent Civil Engineering Professionals for providing service to the Nation.
-

MISSION

- To provide quality education in Civil Engineering profession.
- To impart knowledge to students for socio-economic growth of India.
- To promote Civil Engineering Graduates to become an entrepreneur.
- To motivate Civil Engineering Professionals towards competitive services, higher studies and research**.**

Program Educational Objectives: (PEOs)

PEO 1*:* Excellence in civil engineering profession by acquiring knowledge of advanced civil engineering technologies.

PEO 2: Capable to identify, analyze and design solutions for civil engineering problems in context of social, environmental , ethical and economic growth of the nation

PEO 3: To improve their technical and professional skills through value addition programs, software's to develop a long term productive career in industry, Govt Services or an enterpreur.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes: (PSOs)

***PSO1*:** To understand experimental, analytical and advance techniques for the solution of Civil Engineering and or multidisciplinary Engineering problems.

***PSO2*:** Enhancing the employability skills of students in oral and written communications and exhibit good team work skills to have a successful career

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DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

SECOND YEAR B. TECH.

(w.e.f. June 2022)

Board of Studies in Civil Engineering, June 2022

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BS	Basic Science	HSC	Humanity Science
PCC	Professional Core	CIA	Continuous Internal Assessment
PEC	Professional Elective	OR	Oral Examination
OE	Open Elective	PR	Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
BS	Basic Science	PRJ	Project/Seminar/Internship/Online Course

SEMESTER-III

Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme					Total Marks
			L	T	P		Theory		OR	PR	TW	
							CIA	ESE				
PCC	CE201	Solid Mechanics	4	-	-	4	40	60	-	-	-	100
BS	BS202	Engineering Mathematics-III	3	1	-	4	40	60	-	-	-	100
PCC	CE203	Surveying	4	-	-	4	40	60	-	-	-	100
PCC	CE204	Building Technology and Materials	3	-	-	3	40	60	-	-	-	100
HSC	HS205	Universal Human Values and Ethics	3	-	-	3	40	60	-	-	-	100
PCC	CE206	Solid Mechanics Lab	-	-	2	1	-	-	50	-	-	50
PCC	CE207	Surveying Lab	-	-	2	1	-	-	-	50	-	50
PCC	CE208	Building Technology and Basics of AUTO CAD Lab	-	-	4	2	-	-	50	-	50	100
MLC	MC210	Mandatory Course - III	2	-	-	No Credits	-	-	-	-	-	Pass / Fail
		Total	**19**	**01**	**08**	**22**	**200**	**300**	**100**	**50**	**50**	**700**

MC210	**Mandatory Course-III**	**Constitution of India – Basic features and fundamental principles**

COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

SECOND YEAR B. TECH.

(w.e.f. June 2022)

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LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
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SEMESTER-IV

Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks					
			L	T	P		Theory		OR	PR	TW	Total
							CIA	ESE				
PCC	CE211	Programming in Civil Engineering	3	-	-	3	40	60	-	-	-	100
PCC	CE212	Concrete Technology	3		-	3	40	60	-		-	100
PCC	CE213	Geotechnical Engineering	4	-	-	4	40	60	-	-	-	100
PCC	CE214	Analysis of Structures	3	1	-	4	40	60	-	-	-	100
PCC	CE215	Computer Aided Architectural building drawing Lab	-	-	4	2	-	-	50	-	-	50
HMSC	HS216	Corporate Readiness-I	-		2	1		-	-	-	50	50
PCC	CE217	Programming in Civil Engineering Lab	-	-	2	1		-	-	-	50	50
PCC	CE218	Concrete Technology Lab	-	-	2	1		-	50	-	-	50
PCC	CE219	Geotechnical Engg. Lab	-	-	2	1		-	-	50	-	50
PRJ	CE220	Seminar/Mini Project /PBL	-	-	4	2		-	50	-	-	50
MLC	MC221	Mandatory Course-IV	2	-	-	No Credits	-	-	-	-	-	Pass / Fail
		Total	15	1	16	**22**	160	240	150	50	100	**700**

MC221	**Mandatory Course-IV**	**Innovation - Project based – Sc., Tech, Social, Design & Innovation**

PCC: (CE201): SOLID MECHANICS

Teaching Scheme Lectures: 04 Hrs. / Week	Evaluation Scheme: CIA : 40 Marks End Sem Exam: 60 Mark
Credits : 04	Total Marks: 100

Prerequisite Course: **Fundamentals of Engineering Mechanics and Mathematics**

Course Objectives:

Sr. No.	Course Objectives
1	To learn and understand the concepts of stresses and strains thereby strength of materials.
2	To learn and understand the SFD and BMD for various types of beams and loadings.
3	To learn and understand the concepts of bending and shear for different loadings and cross sections.
4	To learn and understand torsion mechanism for hollow and solid cross sections shafts in series and parallel.
5	To study the principal stresses and strains on various planes.
6	To learn and understand the buckling behaviour and use of column theories to design the columns.

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

CO.No.	COURSE OUTCOME (S)	BLOOM'S TAXONOMY	
		Level	Descriptor
1	Determine stresses, strains and elongations in axially loaded bar structures; and members subjected to thermal loads.	3	Apply
2	Analyze and draw shear force and bending moment diagrams for simply supported and cantilever beams of uniform cross-section.	4	Analyze
3	Determine bending stresses, shear stresses and moment resisting capacity of prismatic beams using Euler-Bernoulli beam theory.	3	Apply
4	Solve problems relating to torsional deformation and compare the strength of shafts of using torsion theory.	3	Apply
5	Determine and illustrate principal planes and stresses, normal stresses and tangential stresses acting on a structural member.	3	Apply
6	Determine critical buckling load of axially and eccentrically loaded columns using Euler's and Rankine's formulae.	3	Apply

Mapping of COs to POs & PSOs:

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

Course Contents

Unit No	Unit Title	No.of Hours	COs
I	**Simple Stresses and Strain:** Hook's Law, Stress-Strain Diagram for elastic, plastic materials and brittle material, Idealized stress-strain diagram, Concept of axial stresses (compression, tension), strains (linear, lateral, shear and volumetric). Deformations of prismatic and composite bars, Elastic constants and their relations, Stresses and strains due to change in temperature. Stresses, strains and deformations in determinate structures, compound bars.	06	1
II	**Shear Force and Bending Moment Diagram:** Concept of determinate and indeterminate beams, Concept of shear Force and bending Moment, Shear force and bending moment diagrams for standard cases, Shear force and bending moment diagrams for simply supported, overhanging and cantilever beams subjected to point loads, UDL, UVL and Moments, Concepts of fixed beam, SFD & BMD for fixed beam.	06	2
III	**Bending and Shear Stresses:** Stress due to bending: Theory of simple or pure bending, Bending stress distribution diagrams, Moment of Resistance, Numericals Bending stress variations for different cross sections, Shear stresses in beams: concept of shear, complimentary shear, Shear stress formula, shear stress distribution for various cross sections. Maximum and average shear stress for circular and rectangular sections, Concept of Shear flow and shear connector.	06	3
IV	**Torsion:** Torsion of circular shafts: theory of torsion, assumptions, derivation of torsion formula Stresses, strains and deformations in determinate and indeterminate shafts of hollow, solid section. Stresses, strains and deformations in determinate and indeterminate shafts. Homogeneous and composite shafts subjected to twisting moments.	06	4
V	**Principal Stresses and Strains:** Principal stresses and strains: concept of principal planes and principal stresses, concept of normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses, Maximum shear stress, Combined effect of axial stress, bending	06	5

	moment Combined effect of shear and torsion, Theories of failure: maximum normal stress, Maximum shear stress, maximum strain theory.		
VI	**Axially and Eccentrically Loaded Columns:** Axially loaded columns: concept of critical load and buckling, Euler's formula for buckling load with hinged ends, concept of equivalent length for various end conditions, Rankine's formula, safe load on column limitations of Euler's formula. Direct and bending stresses for eccentrically loaded short column. Uniaxial and bi-axial bending. Concept of core of section for solid, hollow and rectangular section.	06	6

Text Books:

1. S. S. Ratan, "Strength of Materials", Tata McGraw Hill Publication **ISBN:978-066895-9**
2. R. Subramanian, "Strength of materials", Oxford University Press**. ISBN:10:0-19-567590-4**
3. S.S.Bhavikatti, "Strength of Materials", Vikas Publishing House Pvt.Ltd. 4th Edition. **ISBN:** 9789325971578
5. B.C.Punmia, Ashoak kumar Jain, Arun Kumar Jain. "Mechanics of Materials, Laxmi Pub. Pvt. Ltd. **ISBN:978-81-318-0646-3.**

Reference Books:

1. Gere and Timoshenko, "Mechanics of materials, CBS Publication.**ISBN:978-8123908946**
2. Ferdinand P. Beer, E.Russell Johnston Jr., John T. Dewolf, david F.Mazurek. "Mechanics of Materials.5th Edition, Tata McGraw Hill Education Pvt.Ltd. New Delhi. **ISBN10:0-07-015389-2**
3. E.P.Popov, "Introduction to Mechanics of Solids, Prantice Hall Publication. **ISBN:978-0134877693**
4. S.Timoshanku Strength of Material (Third Edition**)** CBS Publication
5. S. Ramamrutham & R. Narayanan "Strength of Materials", Dhanpat Rai Publication Company. **ISBN:9788187433545.**

E-Resources: https://nptel.ac.in/courses/105/105/105105108/

BS (BS202): Engineering Mathematics-III

Teaching Scheme	Evaluation Scheme
Lectures: 03 Hrs. / Week **Tutorial: 01 Hrs./ Week**	**CIA : 40 Marks** **End Sem Exam: 60 Marks**
Credits : 04	**Total Marks: 100 Mark**

Prerequisite Course: Linear Algebra and Stochastic Process, Multivariate Calculus

Course Objectives:

Sr. No	Course Objectives
1	To describe and recall basics of calculus.
2	To understand the concept and problem solutions of a curriculum.
3	To apply core concept for any applied problems in engineering.
4	To analyze the problem of which kind and use particular method for finding solution in engineering field.
5	To justify the statements for using specific method to applications problems in engineering field.
6	To organize the suitable problems in engineering field and present thoughts related to the problems

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

COs No	Course Outcomes	Bloom's Taxonomy	
		Level	Descriptor
CO1	Recall core knowledge of calculus	1	Remember
CO2	Illustrate the concept and use in solving engineering problems.	2	Understand
CO3	Apply core concept for any applied problems in engineering.	3	Apply
CO4	Analyze the problem of which kind and use particular method for finding solution in engineering field.	4	Analyze
CO5	Justify the statements for using specific method to applications problems in engineering field.	3	Apply
CO6	Organize the suitable problems in engineering field and present thoughts related to the problems.	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	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-	-	-

COURSE CONTENTS

Unit No.	Unit Title	No. of Hrs.	COs
I	**VECTOR DIFFERENTIATION:** Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function ∅, Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	08	1
II	**VECTOR INTEGRATION:** Line integral, Greens theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem.	08	2
III	**HIGHER ORDER DIFFERENTIAL EQUATION:** Homogeneous and non-homogeneous linear differential equation of n^{th} order and its solution, Method of variation of parameter, operator method for particular integral, solution of certain types of linear differential equation:-Cauchy's and Legendre's differential equation.	08	3
IV	**SERIES SOLUTION OF DIFFERENTIAL EQUATION**:Linear differential equations with variable coefficients, solution about ordinary point, about singular point (Frobenius method) series solution of Bessel's equation, series solution of Legendre's equation,	08	4
V	**PARTIAL DIFFERENTIAL EQUATION:** Formation of partial differential equation, Partial differential equation of order one (linear and nonlinear), Charpit method, PDE of higher order with constant coefficient	08	5
VI	**APPLICATIOS OF PARTIAL DIFFERENTIAL EQUATION** : One dimensional heat equation, Wave equation, Two dimensional heat equation (Laplace equation), Telephone equation, Radio equations	08	6

Text Book(s):

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, ISBN-13: 978-8174091154.
2. N. P. Bali and Manish Goyal, A Text Book of Engineering, Mathematics, 8/e, Lakshmi Publications, 2012. ISBN: 9788131808320.
3. H. K. Das, Engineering Mathematics, S Chand, 2006, ISBN-8121905209

References:

1. K.A. Stroud & D. S. Booth, Advanced Engineering Mathematics, Industrial Press, 5/e, 2011, ISBN-9780831134495.
2. P. C. Matthews, Vector Calculus, Springer, 2/e, 2012, ISBN-9783540761808.
3. Robert C. Wrede, Introduction to vector and tensor analysis, Dover, 2013, ISBN-048661879X.
4. W. E. Boyce, R. C. Diprima, Elementary differential equation and boundary value problems.
5. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2014. ISBN-13: 978-1842653418.

PCC: (CE203): Surveying

Teaching Scheme	Evaluation Scheme
Lectures: 04 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam : 60 Marks**
Credits: 04	**Total Marks : 100 Marks**

Prerequisite Course: Knowledge of basic civil engineering surveys

Course Objectives:

Sr. No.	Course Objectives
1	To learn the fundamental concepts and instruments used for Surveying and levelling
2	To study various types of curves and methods of setting out of curves
3	To study the modern instruments and techniques including GIS, GPS, EDM and Total station for civil engineering projects

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

CO's No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Explain the concept of compass surveying and Plane table surveying	2	Understand
2	Make use of dumpy level for various types of levelling and contouring.	3	Apply
3	Experiment with theodolite for horizontal and vertical angle measurement and traversing.	3	Apply
4	Utilize the Tacheometer for determination of horizontal distances and elevations of points and Tachometric contouring.	3	Apply
5	Categorize various types of curves, their design and application in civil engineering projects.	4	Analyse
6	Examine the modern instruments and techniques including GIS, GPS, EDM and Total station to develop different survey maps for engineering projects.	4	Analyse

Mapping of Course Outcomes to 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	2	-	-	-	-	3	2	2	2	3	2
CO2	3	2	2	2	-	-	-	-	3	2	2	2	3	2
CO3	3	1	2	2	-	-	-	2	3	2	2	2	3	2
CO4	3	2	2	2	-	-	-	-	3	2	2	2	3	2
CO5	3	2	3	-	2	2	-	2	3	3	2	2	3	3
CO6	3	2	3	2	3	2	2	2	3	3	3	3	3	3

Course Contents

Unit-I	Unit Title	No.of Hrs	COs
I	**Compass and Plane Table Ssurveying:** Introduction, Principles of surveying, Plans and maps, concept of Scale, Chain Surveying, use of Prismatic Compass, Bearing of lines, Local attraction, Magnetic declination. Plane Table survey: Instrument and accessories for plane table survey, Orientation of plane table, advantages and disadvantages, Errors in plane table surveying, Mmethods of plane table survey: Radiation and Intersection.	08	1
II	**Measurement of Vertical Distances:** Introduction, Types of levelling, Types of bench marks, Booking and Reducing levels, Study and use of Auto level, Digital level and Laser level. Reciprocal levelling, profile levelling, Cross-sectioning and their applications. Curvature and refraction corrections. **Contouring:** Introduction, characteristics of Contours, Methods of Contouring, and Application of contours. Introduction to Golden Surfer software.	08	2
III	**Theodolite Surveying:** Introduction, Study of 20" Vernier transit Theodolite, fundamental axes. Use of Theodolite for measurement of horizontal angles by repetition and reiteration method, deflection angles, magnetic bearing, prolonging a Straight line. Theodolite Traversing: computations of Consecutive and Independent coordinates. Latitude and Departure, Closing Errors, Balancing the Closed traverse by Bowditch's and Transit Rules, Gales Traverse table, omitted measurement, area calculations.	08	3
IV	**Tacheometry:** Introduction, Instrument, applications, Principle of Stadia, fixed hair method with vertical staff to determine horizontal distances and elevations of points, Determination of tachometric constants. Tachometric contouring.	08	4
V	**Curves:** Introduction, classification of curves, simple circular curves, Definitions and Notations. Linear and Angular methods, (Rankine's method of deflection angles). Numerical on simple circular curves, Transition curves: necessity and types.	08	5
	Modern Surveying Techniques: Total Station- fundamental parameters and	08	6

VI	uses, EDM- Types, Principle and Measurements, GPS- Introduction, Components, Applications of GPS in Civil Engineering, GIS- Introduction to the basic component and Applications of GIS in Civil Engineering.		

Text Books:

1. T. P. Kanetkar and S.V. Kulkarni, "Surveying and Levelling Vol. I and Vol. II", Pune Vidyarthi Griha Prakashan, ISBN:8185825114 & ISBN: 8185825009.
2. Dr. B. C. Punmia,, Ashok K. Jain, Arun K. Jain, "Surveying" Vol. I, Laxmi Publications, ISBN:9788170088530
3. S. K. Duggal, "Surveying", Vol. I & II, TataMc-Graw Hill, ISBN:1259029832.

Reference Books

1. A. M. Chandra, "Plane Surveying", New Age International Publishers, 812241902X, 9788122419023
2. N. N. Basak, "Surveying and Levelling", Tata McGraw Hill, ISBN: 0-07-460399-x.
3. Dr. K. R. Arora, "Surveying", Vol. I & II, Standard Book House, ISBN-13: 9788189401238

Foreign References Books

1. W. Schofield & M Breach, "Engineering Surveying" Spon Press Oxon, ISBN: 13:978-0-7506-6949-8; 10:0-7506-6949-7.
2. Arthur Bannister, Stanley Raymond, Raymond Baker, "Surveying", Pearson Education India, ISBN: 13:978-058230 2495&10.0582302498. University of Salford, Manchester.

E-resources

https://nptel.ac.in/courses/105107122

http://www.nitttrc.edu.in/nptel/courses/video/105104101/L02.html

PCC (CE204): Building Technology and Materials

Teaching Scheme	Evaluation Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam : 60 Marks**
Credits: 03	**Total: 100 Marks**

Prerequisite Course: Engineering Graphics

Course Objectives:

Sr. No.	Course Objectives
1	To enumerate different types of buildings, illustrate masonry and understand the concept of formwork.
2	To study different types of flooring, roofing materials, doors, windows, arches and lintels.
3	To study different types of vertical circulation, protective coatings, miscellaneous materials and concept of green building.

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

COs No.	Course Outcomes (s)	Bloom's Taxonomy	
		Level	Descriptor
1.	Illustrate different types of buildings, structures and masonry	2	Understand
2.	Explain types of block masonry, formwork, casting procedure and necessity of underpinning and scaffolding.	2	Understand
3.	Make use of different types of flooring and roofing materials.	3	Apply
4.	Illustrate types of doors, windows, arches and lintel.	2	Understand
5.	Categorize means of vertical circulation and protective coatings	3	Apply
6.	Classify miscellaneous materials and interpret the concept of green building	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	--	--	--	-	--	--	--	--	--	--	1	1	2	2
CO2	-	2	2	-	1	--	--	--	2	--	-	3	1	2
CO3	-	--	-	2	2	1	-	--	1	2	--	--	2	2
CO4	-	--	2	1	--	-	-	--	2	2	-	1	-	2
CO5	-	-	-	-	1	2	3	--	3	1	-	3	3	3
CO6	-	-	-	-	-	-	3	--	3	3	3	1	2	2

Course Contents

Unit No.	Unit Title	No.of Hrs	COs
I	**Introduction to Building Construction and Masonry:** **a) Introduction to building construction**– Definition, types of building as per National Building Code. Building components and their basic requirements i.e. substructure and superstructure requirements. Superstructure: Concept and advantages of load bearing and framed structure, Introduction to Prefabricated construction. RCC framed structures. Substructure – shallow and deep foundations and their suitability, plinth filling and soling. **b) Masonry**– Stone masonry: Principal terms, types of stone masonry. Brick masonry: Characteristics of good building bricks, IS specification and tests, classification of bricks. Brick work, types of bonds: English, Flemish, Header, Stretcher, construction procedure, supervision.	06	1
II	**Block Masonry and Form work**: **a) Block Masonry** – Cellular lightweight concrete blocks, Autoclaved Aerated Concrete (AAC), hollow blocks, cavity wall construction. Requirement of a good partition wall: wooden partition, Glass sheet partition wall. Composite masonry: types, advantages, applications, materials required and construction procedure. b) **Form work: C**asting procedure for reinforced concrete columns, beams and slabs, curing methods, precast and pre-stressed concrete construction and joints in concrete work, Slip form work, underpinning, Scaffolding: purpose, types and suitability.	06	2
II	**Flooring and Roofing Materials:** **a) Flooring and Flooring Materials –** Functional requirement of flooring, types of floor finishes and their suitability. Types of flooring. **b) Roofing Materials –**Types of roofing materials, fixing details of roof covering and construction procedure. Roof construction: types and their suitability, method of construction, types of trusses. Types of shell structure: dome, translation shells, space and frame structure: pneumatic structures and prefabricated structures.	06	3

IV	**Doors, Windows, Arches and Lintels:** **a) Doors and Windows** – definition of technical terms, installation of doors and window frames and their size specifications, fixtures and fastenings. Types of doors and windows. Ventilators: purpose and types. **b) Arches and Lintels** – principle of arch action, types of arches, method of arch construction, centering and removal of centering. Lintels: necessity and types, chajja or weather shade necessity and types.	06	4
V	**Vertical Circulation and Protective Coatings:** **a) Vertical Circulation** – Consideration in planning, design of staircase and types of staircase. Details and types of ramps, ladders, lifts, and escalator. **b) Protective Coatings** – plastering types: lime plaster, cement plaster, gypsum plaster, textured plaster and their application. Pointing: purpose and types. Mortar preparation and types. Painting and varnishing, types and application.	06	5
VI	**Miscellaneous Materials and Green Building:** **a) Miscellaneous Materials –** Properties, types and uses of following materials: lime, gypsum and glazed wares, Timber, aluminium, stainless steel, fibrous, laminated, particulate, glass claddings, aluminium composite panel cladding, wall paper . **b) Ceramic products:** ceramic sanitary application, water closet, urinals, washes basins, their common sizes, pipes and fittings. **c) Eco-friendly materials:** eco-friendly decorating materials, eco-friendly flooring, thatch, bamboo, linoleum, cork. **d) Green building**: Energy efficient building, Smart building.	06	6

Text Books:

1. Building Construction by B.C. Punmia, 11th Edition, Laxmi Publications, ISBN: 9788131804285.
2. Building Materials by S.V.Deodhar, 5th Edition, Khanna Publication, ISBN-13:9788174091994
3. Building Construction by Bindra and Arora, Dhanpat Rai Publications, ISBN: 978818992880.

Reference Books

1. Building Materials by S. K. Duggal, 4th Edition, New Age International Publishers, ISBN: 9788122433791

2. Civil Engineering Materials by TTTI Chandigarh, Tata McGraw Hill Publications, ISBN-13: 978-0074604311.
3. Materials of construction by D.N Ghose, 13th Edition, Tata McGraw Hill, ISBN 13, 9780074516478
4. Building Construction by S.C. Rangwala, 34th Edition, Charotdar Publications, ISBN-13 : 978-9385039041
5. National Building Code of India 2005.
6. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.

e – Resources:

www.nptel.iitm.ac.in/courses/iitkanpur

HSC (HS205): UNIVERSAL HUMAN VALUES AND ETHICS

Teaching Scheme	Evaluation Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam: 60 Marks**
Credits: 03	**Total: 100Marks**

Prerequisite Course: Nil

Course Objectives:

Sr. No.	Course Objectives
1	To make the students aware about the concept and need of value education.
2	To help the students appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity
3	To facilitate the development of a holistic perspective among the students towards life and profession.
4	To facilitate the understanding of harmony at various levels staring from self and going towards family, society and nature.
5	To make the students aware about the correlation between engineering ethics and social experimentation in various situations.
6	To highlight the importance of professional ethics in the wake of global realities.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Recognize the concept of self-exploration as the process of value education.	1	Remember
2	Interpret the human being as the coexistence of self and body.	2	Understand
3	Apply the holistic approach for fulfilling human aspirations for the humans to live in harmony at various levels.	3	Apply
4	Organize the universal human order in correlation with professional ethics.	4	Analyze
5	Implement ethical practices in engineering profession.	3	Apply
6	Outline the importance of various ethical practices in the wake of global realities.	4	Analyze

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

Course Contents

Unit No	Unit Title	No.of 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	06	1
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	06.	2
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	06	3
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	06	4
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	06	5
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	06	6

Text Books:

1. R. R. Gaur, R. Sangal, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books Pvt. Ltd.
2. R. S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International (P) Ltd. Publishers

Reference Books

1. B. P. Banerjee, “Foundations of Ethics and Management”, Excel Books Pvt. Ltd.
2. P. L. Dhar, R. R. Gaur, “Science and Humanism”, Commonwealth Publishers
3. M. K. Gandhi, “The Story of my Experiments with Truth”, Discovery Publisher
4. http://uhv.org.in/

PCC: (CE206): Solid Mechanics Lab

Teaching Scheme	Evaluation Scheme
Practical: 02 Hrs./ Week	**Oral Exam: 50 Mark**
Credits : 01	**Total Marks: 50 Mark**

Prerequisite Course: **Fundamentals of Engineering Mechanics and Mathematics**

Sr. No.	Course Objectives
1	Students will know the various material testing methods.
2	Students will test bricks, tiles, timber and metal samples in laboratory and will check the quality as per I.S. specifications method.
3	Students will able to select the good quality of material and can decide suitable materials for different construction purposes.

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

CO's No.	COURSE OUTCOME (S)	BLOOM'S TAXONOMY	
		Level	Descriptor
1	Apply the scientific methods for material characterization.	3	Apply
2	Apply basic concepts of material testing and know the strength of different civil engineering materials.	3	Apply
3	Interpret the findings as per I.S. specifications to decide the material quality.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & 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	1	---	2	2	2	---	2	3	---
CO2	3	---	1	1	2	1	---	2	2	2	---	2	3	---
CO3	3	---	1	1	2	1	---	2	2	2	---	2	3	---

List of Experiments: Laboratory work

A. Test on bricks

1. Field test and water absorption of bricks
2. Efflorescence test on bricks.
3. Compressive Strength of Bricks

B. Test on Tiles

4. Flexural strength of Flooring Tile.
5. Abrasion test of Flooring Tile

C. Test on Timber

6. Compression test on timber
7. Bending test on timber.

D. Test on Metals

8. Tension test on mild steel and TMT steel
9. Shear test on mild steel (Single and double shear)
10. Impact test on mild steel, Aluminum, Brass, Copper (Izod and Charpy)

PCC: (CE207): Surveying Lab

Teaching Scheme:	Evaluation Scheme:
Practical: 02 Hrs./ Week	Practical Exam : 50 Marks
Credits: 01	Total Marks : 50 Marks

Prerequisite Course: Nil

Course Objectives:

Sr No.	Course Objectives
1	To study and use of various surveying and levelling instruments
2	To compile and analyse surveying data for different civil engineering projects
3	To learn modern instruments and techniques for preparation of maps in surveying

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

CO's No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Make use of various surveying and levelling instruments such as prismatic compass, plane table, digital level, theodolite, GPS.	3	Applying
2	Evaluate and interpret surveying data for different civil engineering projects	5	Evaluate
3	Justify the data collected through surveying instruments for mapping	5	Evaluate

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	3	2	2	3	3	2	2	-	3	3	2	2	3	2
CO2	3	2	3	2	3	2	2	1	3	3	2	2	3	2
CO3	3	2	2	1	3	-	-	-	3	2	2	2	3	3

List of Laboratory Work:

A) 1. Measurement of magnetic bearings of sides of a triangle or polygon

2. Correction for local attraction and calculations of true bearings using prismatic compass.

3. Plane table survey by radiation and Intersection method.

4. Simple and differential levelling with at least three change points using digital level.

5. Measurement of horizontal angles (by repetition method) using Vernier Transit Theodolite.

6. Calculating a horizontal and vertical distance of an object by using Tacheometer.

7. Setting out a building from a given foundation plan (minimum six co-ordinates).

8. Determination of coordinates of the traverse using GPS

a) Project I: 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.

b) Project II: Traversing using a total station.

c) Project III: Tachometric contouring project on a hilly area with at least two instrument stations about 60 m to 100 m apart using theodolite, GPS and generating contours using Golden Surfer Software.

PCC: (CE208): Building Technology and Basics of AutoCAD Lab

Teaching Scheme **Practical: 04 Hrs./ Week**	Evaluation Scheme **Term work: 50 Marks**
Credits: 02	**Total: 50 Marks**

Prerequisite Course: Engineering Graphics

Course Objectives:

Sr. No.	Course Objectives
1	To study measured building drawing of Residential Building.
2	To learn building components and study their standard dimensions.
3	To learn and apply fundamentals of AutoCAD

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

COs No.	Course Outcomes (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Develop Residential Building Plan	3	Apply
2	Identify building components and their standard dimensions	3	Apply
3	apply fundamentals of AutoCAD for various drawing	3	Apply

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

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

List of Practical:

It shall consist of the following exercises.

A) Measurement drawing exercise of a residential building (G+1)

Draw a detailed plan, elevation and section using suitable scale on same sheet.

Following sketches pertaining to the above plan (with Standard Dimensions).

a. Door- Panelled door b. Window c. Stair

B) Draw sketches using AutoCAD of the following:

1. Details of the shallow footings.
2. Details of arch showing different components

C) Students should prepare working drawing of Foundation Plan on AutoCAD and prepare tracing for the above Residential Building Plan. It should contain detailed foundation plan with foundation details. (Use suitable scale 1:50 or 1:100).

D) Site visits and technical report on the visit.

1. Site visit based on existing residential building (G+1) as noted in part A above.

2. Any on-going construction site (visit report should contain: details of the project, stage of construction, sketches of components with cross section and dimensions, materials used and site plan, etc.).

E) Detailed report on basics of AutoCAD.

F) Market survey of various construction materials and tools.

Term work: Based on the above syllabus.

MLC: (MC210): Mandatory Course – III (Constitution of India)

Teaching Scheme: Lectures: 02 Hrs. / Week	Evaluation Scheme: Audit Course- No credits

Course Objectives:

Sr. No	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: At the end of the course students will able to:

COs No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Explain historical background, salient features and preamble of Indian constitution	2	Understand
CO2	Understand about their obligations, responsibilities, privileges and fundamental rights	2	Understand
CO3	Explain directive principle of state policy and fundamental duties.	2	Understand
CO4	Understand the system of government through parliamentary and federal system.	2	Understand
CO5	Understand formation, administrative and judicial set up of central government.	2	Understand
CO6	Understand the formation, administrative and judicial set up of state government.	2	Understand

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

COURSE CONTENTS

Unit No.	Unit Title	No. of Hrs.	COs
I	**Introduction to Constitution of India** a. Historical background b. Salient features c. Preamble of constitution	07	1
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	2
III	**(A) Directive principle of state policy:** a. Features of directive principle b. Classification of directive principle c. Criticism of directive principle 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	05	3
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	4

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	5
VI	**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, Lok Adalats, Family court, Gram Nyayalayas	05	6

Reference Books

1. Indian Polity for Civil Service Examination, M Laxmikanth, Mc GrawHill Education, Fifth Edition.
2. Introduction to the Constitution of India, Durga Das Basu, LexisNexis, 22nd Edition

Semester-II

(CE211): Programming in Civil Engineering

Teaching Scheme: **Lectures: 03 Hrs. / Week**	**Evaluation Scheme:** **CIA : 40 Marks** **End Sem Exam: 60 Marks**
Credits: 03	**Total: 100Marks**

Prerequisite Course: Linear Algebra and Stochastic Process, Multivariate Calculus, Vector Calculus and Differential Equation

Sr. No.	Course Objectives
1	To understand the basics of Python Programming
2	To understand the different types variables and data types.
3	To use Python data structures: lists, tuples, and dictionaries.
4	To apply different operators in Python Programming.
5	To create Python programs using conditionals and loops.
6	To understand object oriented programming concept in python.

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 Python Programming	2	Understand
CO2	To understand the different types variables and data types.	2	Understand
CO3	To use Python data structures: lists, tuples, and dictionaries.	3	Apply
CO4	To apply different operators in Python Programming.	3	Apply
CO5	To create Python programs using conditionals and loops.	6	Create
CO6	To understand object oriented programming concept in python.	2	Understand

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

Course Contents

Unit No	Unit Title	No.of Hrs	COs
I	**Introduction to Python:** Why Python Programming, Installing and using python, History of Python.Types of Modules, PIP and Comments in Python.	06	1
II	**Data types and Variables in Python:** Introduction data types and variables, types of Data types and variables	06.	2
III	**List, Tuples, Dictionaries and Sets: Introduction** to list and tuples, dictionaries and sets.	06	3
IV	**Operators:** Types of operators and their uses **Access Modifiers:** Types of access modifiers **Functions and recursions:** Introduction, Classification of Functions	06	4
V	**Control statements:** Conditional expressions and concept of loops in python.	06	5
VI	**Object oriented programming language:** Introduction to OOPs concept in python. Classes, Objects, Inheritance, Polymorphism and Encapsulation.	06	6

Text Books:

- Mark Pilgrim, ―Dive into Python 3‖, Apress, 2009.
- Allen Downey, Jeffrey Elkner, Chris Meyers, ―How to Think Like a Computer Scientist - Learning with Python‖, Green Tea Press, 2002.
- Michel Dawson, "Python Programming for Absolute Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009.

Reference Books:

- John V. Guttag, ―Introduction to Computation and Programming using Python‖, Prentice Hall of India, 2014.
- Mark Lutz, ―Learning Python: Powerful Object-Oriented Programming‖, Fifth Edition, O'Reilly, Shroff Publishers and Distributors, 2013.

PCC: (CE212): Concrete Technology

Teaching Scheme:	Evaluation Scheme:
Lectures: 03 Hrs./ Week	CIA : 40 Marks End Sem Exam : 60 Marks
Credits: 03	Total: 100 Marks

Prerequisite Course: **Building Technology and Materials**

Course Objectives:

Sr. No	Course Objectives
1	To know the various ingredients required for concrete and their properties
2	To study the suitability and compatibility of admixtures as per site requirement.
3	To learn the behaviour and properties of fresh concrete.
4	To know the various mechanical properties of concrete in hardened stage.
5	To learn and develop the concrete mix design using I.S. method and DOE method
6	To understand the use of special concretes and their durability aspect with variation in properties.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Know the various ingredients of concrete and suggest relevant cement and aggregate as per the site conditions.	1	Remember
2	Decide the relevant admixtures for modern concrete using scientific approach for different weather conditions.	2	Understand
3	Apply the knowledge of fresh concrete in civil engineering construction projects to maintain quality in the work.	3	Apply
4	Apply knowledge of hardened concrete in civil engineering construction projects to decide the suitability of concrete.	3	Apply
5	Design the concrete for required grade using BIS and DOE Codes	3	Apply
6	Design new generation concrete like special concretes as per their specific applications using of admixtures.	3	Apply

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

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

Course Contents

Units	Topics	No of Hrs	COs
I	**Ingredients of Concrete:** **Cement:** -Historical background, Manufacturing of Portland cement, Chemical composition and properties-hydration of cement, IS Specifications, Bogue's Compound, Classifications and types of cement, Tests on cement as per I.S. Standards. **Aggregate**: - Classification, Mechanical and Physical properties, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial (crushed sand) and Recycled aggregate. **Water**:-Mixing Water, Curing water.	06	1
II	**Admixtures and Additives in Concrete:** **Admixtures**: Functions, Classification, Types; Mineral and Chemical. **Chemical Admixtures:** Plasticizers, Super plasticizers, Retarders, Air entraining agents. **Mineral Additives:** use of Pozzolanic additives like Fly ash, Silica Fume, GGBS, Rice husk ash, Metakeoline, etc., **Natural water proofers:** Natural water proofers and its effects on durability and properties **Fibres:** natural, artificial and Synthetic, etc.	06	2
III	**Properties of Fresh Concrete:** **Workability:** Definition, Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete. Effect of time and temperature on fresh concrete properties. **Curing**: Methods of curing, Influence of temperature, Maturity rule, Steam curing.	06	3
IV	**Properties of Hardened Concrete** **Properties of concrete:** General, Factors affecting strength, Micro cracking and stress strain relationship, Relation between tensile and compressive strength, modulus of elasticity, Poisson's Ratio. **Non Destructive Testing**: Rebound hammer, Ultra Sonic Pulse Velocity, Impact echo test, core test, Resonance frequency, Rebar locator**.**	06	4

V	**Concrete Mix Design** Factor affecting concrete mix design, Types of Mixes, Methods of Mix Design: IS code method and DOE method, Acceptance criteria for concrete Mix as per IS specifications. Recent practices and future trends. Introduction to Performance based Mix design using artificial and natural sand.	06	5
VI	**Durability of Concrete and Special Concretes** **Durability of concrete-** Fundamental concept and Significance, Permeability, Creep, Shrinkage, chloride attack, sulphate, carbonation attack and sea water attack on concrete. Rebar corrosion, **Special Concretes:** Light weight concrete, Fibre reinforced concrete, High performance concrete, High strength concrete, Self-compacting Concrete, Ready mixed concrete, Roller compacted concrete, Geopolymer concrete. **Special concreting techniques**: Pumped concrete, Underwater concrete, vacuum dewatered concrete, hot and cold weather concreting.	06	6

Text Books:

1. M. L. Gambhir, "Concrete Technology", Tata McGraw Hill Publications, ISBN 0070583749, 9780070583740. 2018.
2. M. S. Shetty, "Concrete Technology", S. Chand Publications, ISBN 978-93-525-3380-0, 2019.
3. A. R. Shantakumar, "Concrete Technology", Oxford University Press, ISBN 13: 9780199458523, 2018.
4. A. M. Neville, "Properties of Concrete", Pearson Education India, ISBN 10: 0273755803 / ISBN 13: 9780273755807, 2012.

Reference Books:

1. A. M. Neville, J. J. Brooks.," Concrete Technology" Pearson Education, India, ISBN 10: 9353436559, ISBN 13: 9789353436551, 2019.
2. P. Kumar Mehta, "Microstructure and properties of concrete", Prentice Hall.SP-26, ISBN 10: 933920476XISBN 13: 9789339204761, 2014.
3. V. M. Malhotra, "Fly ash in concrete", Canmet, ISBN 10: 097315070XISBN 13: 9780973150704, 2002.
4. P. N. Balguru and S. P. Shah, "Fibre Reinforced Cement composites", McGraw Hill, 1992.
5. D.J. Hannant, "Fibre cements and fibre concrete, Wiley- Interscience, Newyork, ISBN-10: 0471996203, ISBN-13 : 978-0471996200, 2011.
6. **IS Codes:** IS 456, IS 383, IS 9103, IS 10262 Latest revised editions.

e-resources:

1. https://nptel.ac.in/courses/105102012
2. https://nptel.ac.in/courses/105104030

PCC: (CE213): Geotechnical Engineering

Teaching Scheme Lectures: 04 Hrs. / Week	Evaluation Scheme: CIA : 40 Marks End Sem Exam: 60 Marks
Credits: 04	Total: 100 Marks

Prerequisite Course: Engineering Chemistry, Solid Mechanics, Mathematics

Course Objectives:

1.	The objective of this course is to introduce the students to the principles and basic mechanism of three phase soil system.
2.	To understand methods of evaluation of Physical and engineering properties of soil and can classify the soils for engineering use and constructions
3.	To evaluate the earth pressure on retaing structures and can calculate bearing capacity of soil strata by laboratory and field methods
4.	To apply these principles to plan and execute soil exploration programmes, design foundations, and to improve deficient soils.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Classify soil types and their Engineering properties using IS code	2	Understand
2	Solve field problems on Permeability and Seepage of Soil	3	Apply
3	Test for Compaction Parameters of soil for field compaction control.	4	Analyse
4	Analyze the shear strength parameters of various types of soil	4	Analyse
5	Illustrate concepts of Lateral earth pressure and stability of slopes	2	Understand
6	Analyze Bearing capacity of soil using IS code provisions.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & 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	-	-	-	-	-	-	3	-
CO2	3	3	-	3	-	3	-	-	-	-	-	-	3	-
CO3	3	3	-	3	-	3	-	-	-	-	-	-	3	-
CO4	3	3	-	3	-	3	-	-	-	-	-	-	3	-
CO5	3	3	-	3	-	3	-	-	-	-	-	-	3	-
CO6	3	3	-	3	-	3	-	-	-	-	-	-	3	-

Course Contents

Unit No	Topics	No of Hrs	COs
I	**Properties of Soil:** Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil. Soil structures and clay mineralogy	08	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.	08	2
III	**Compaction:** Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship. Zero air voids 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. Soil Improvement Techniques.	08	3
IV	**Shear Strength of Soil:** Concept of Shear strength, Mohr's circle, Mohr-coulomb failure criteria, Effective stress concept. Peak and residual shear strength. Factors affecting shear strength. Thixotrophy and Sensitivity, Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test.	08	4
V	**a) Lateral Earth Pressure:** Earth pressure on vertical wall, effect of wall movement on earth pressure, 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, Factors affecting slope stability.	08	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: Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity, and allowable bearing pressure,	08	6

	Introduction to Terzaghi's analysis and assumptions made, the effect of water table on bearing capacity.		

Text Books:

1. Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications pvt. Ltd
2. Knappett, J.A. and Craig, R.F., "Craig's Soil Mechanics", 8th edition, Spon Press, 2012.
3. V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B.S.Publications (3rd Edition)
4. B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi.
5. B. J. Kasmalkar ,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference Books:

1. Atkinson, J.H "The mechanics of soils and foundations.2nd Edition Taylor & Francis.
2. Joseph E Bowles, "Engineering Properties of Soils And Their Measurements", McGraw Hill Publications (2001)
3. Lambe and Whitman ,"Soil Mechanics", S. Chand publications(SI Version),(1969).
4. Donald P Coduto, Man-chu Ronald Yeung and William A. Kitch "Geotechnical Engineering Principle and practice", McMillan Press (PHI) (2010)
5. Karl Terzaghi, "Soil Mechanics in Engineering Practice" A Wiley Interscience Publication.

e – Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel

PCC: (CE214): Analysis of Structures

Teaching Scheme	Evaluation Scheme
Lectures: 03 Hrs. / Week **Tutorial: 01 Hrs./ Week**	**CIA : 40 Marks** **End Sem Exam: 60 Marks**
Credits : 04	**Total Marks: 100 Mark**

Prerequisite Course: **Engineering Mechanics, Mechanics of Solids**

Course Objectives:

Sr. No	Course Objectives
1	To impart knowledge about Fundamental concept and various methods involved in the analysis of determinate structures.
2	To apply the Castigliano's theorems to find deflection of determinate and Indeterminate trusses.
3	To solve the problem of the influence line diagrams for the analysis of beam under moving load.
4	To solve the problem of the influence line diagrams for the analysis of truss under moving load.
5	To analyze three hinged and two hinged arches.
6	To analyze the problems in plastic analysis for determinate structures.

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

COs No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Demonstrate the fundamental concepts of Structural Analysis; Apply the concept of moment area method, conjugate beam method and Castigliano's first theorem to determine slope and deflection of determinate beams.	**3**	**Apply**
CO2	Apply the Castigliano's theorems to find deflection of determinate and Indeterminate trusses.	**3**	**Apply**
CO3	Apply unit load on beam and draw the influence line diagrams under moving Loads.	**3**	**Apply**
CO4	Apply unit load and draw the influence line diagrams under moving loads for Trusses.	**3**	**Apply**
CO5	Analyse arches for horizontal thrust, radial shear and normal thrust.	**4**	**Analyze**
CO6	Analyze determinate structural elements by plastic analysis.	**4**	**Analyze**

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

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

COURSE CONTENTS

Unit No.	Topic	Hrs.	COs
I	**Introduction, Slope and Deflection of Determinate Structures** 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 and its application (Only concept and Standard cases). Strain energy, Castigliano's first theorem, application to determine slope and deflection of determinate beams and frames.(Numerical on Strain energy method only)	6	CO1
II	**Analysis of pin jointed plane Trusses**: a) Joint displacement of determinate trusses by Castigliano's first theorem. b) Analysis of redundant trusses by Castigliano's second theorem, lack of fit, sinking of support, temperature changes (indeterminacy up to second degrees).	6	CO2
III	**Influence Line Diagram for Beams:** Basic concept, Muller: Breslau's principle, influence line diagram for reaction, shear and moment to simply supported and overhanging beams, application of influence line diagram to determine reaction, shear and moment in beams.	6	CO3
IV	**Influence Line Diagram for Trusses:** Influence line diagram for axial force in trusses, application of influence line diagram to determine of axial forces in the members of plane determinate trusses under dead load and Live load	6	CO4
V	**Analysis Of Arches:** **a) Analysis Of Three Hinged Arches:** Types of arches, analysis of parabolic	6	CO5

	arch with supports at same and different levels, semicircular arches with support at same level, determination of horizontal thrust, radial shear and normal thrust for parabolic and circular arch. **b) Two Hinged Arches:** Analysis of parabolic and semicircular arches with supports at same level, determination of horizontal thrust, radial shear and normal thrust.		
VI	**Plastic Analysis Of Structures:** True and idealized stress-strain curve for mild steel in tension, stress distribution in elastic, elasto-plastic and plastic stage, concept of plastic hinge and collapse mechanism, Static and kinematical method of analysis, uniqueness theorem. Plastic analysis of beams and frames.	6	CO6

Text Books:

1. B.C. Punmia, Ashokkumar Jain and Arunkumar Jain , "Theory of Structures", Thirteenth Edition, Laxmi Publication, 2017. ISBN: 81-7008-618-3.
2. S. Ramamrutham and N. Narayan, "Theory of Structures", 9th Edition, DhanpatRai, New Delhi,2014. ISBN: 978-93-5216-553-7.
3. H. J. Shah and S.B.Junnarkar, "Mechanics of Structure", Vol. I & II, Seventeenth edition, Charotar publication,1981. ISBN 8185594678.
4. S. S. Bhavikatti, "Structural Analysis Vol-1", Fourth edition, Vikas publishing House Pvt. Ltd,2010. ISBN: 13: 978-8125942696.

References Books:

1. R.C. Hibbeler, "Structural Analysis", Sixth Edition, Pearson Education,2006.ISBN 13 978-0131470897.

2. C. S. Reddy, "Basic Structural Analysis", Third Edition, Tata McGraw Hill, 2010. ISBN: 9780070702769.

3. Devadas Menon, " Structural Analysis", Second Edition, Narosa Publishing House, New Delhi 2018.ISBN: 9788184875973.

E-Resources:

1. http://nptel.iitm.ac.in
2. https://onlinecourses.nptel.ac.in
3. https://www.udemy.com/course/staadpro-cs/

PCC: (CE215): Computer Aided Architectural Building Drawing Lab

Teaching Scheme: **Practical:** 04 Hrs./ Week	**Evaluation Scheme:** **# Oral:** 50 Marks
Credits: 02	**Total:** 50 Marks

Prerequisite Course: Engineering Graphics, Building Technology and basics of AutoCAD.

Course Objectives:

Sr. No.	Course Objectives
1	To identify plans of different types of structures considering futuristic need of a building.
2	To develop submission drawing and working drawings for the given type of building.

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

COs	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Apply principles of planning and architectural Planning to solve issues of construction using fundamentals of Town Planning.	3	Apply
2	Develop submission drawing of G+2 building structures which includes floor plan, elevation, and section using principles of planning.	3	Apply
3	Develop working drawings of G+2 building structures which includes column positions / orientation, centre line plan of column - footing, typical section of footing, plinth beam and brick work.	3	Apply

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

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

Course Contents

Unit No	Topic	No. of Hrs.	COs
I	**Building bye laws and Building planning:** Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), Marginal distances, building line, control line, height regulations, room sizes, and Area calculations, Rules for ventilation, lighting and Parking of vehicles as National Building Code (latest). Principles of building planning.	02	1,2

II	**Legal Aspects:** Role of Plan sanctioning authority, 7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, List of documents to be submitted to local authority for sanctioning of plan, Various NOC's required.	02	2,3

List of Laboratory Assignments: -

Student should individually complete the following Laboratory / assignments / exercises.

1. **Assignment:** Student should complete the assignment consists of provisions and requirement for Town Planning, Building bye-laws and Building planning.
2. **Typical Layout Plan:** Student should draw layout plan showing plots area statements, road details, water supply and drainage line as per bye laws on and same has to print **A1 size sheet** using Drafting software with suitable scale (1:500 or 1:1000). **(Assume area (irregular shape) of land minimum 2 hectors to maximum 7 hectors).**
3. **Preparing drawings:** Student should prepare Floor Plans / Typical floor plan, Terrace floor plan, Elevation and Sectional Elevation, site plan for **G+2** building (showing reference dimensions, water supply and drainage lines) as per the bye laws with detail construction notes, schedule of openings, area statement. All to be drawn using Drafting software same has to print **A1 size sheet** using suitable scale (1:100 or 1:200). **(**The built-up area at each floor **should not be less than 150 Sq.M.)**
4. **Preparing submission documents:** Student should take blue print of **Sr. No. 3** along with the documents required to submit to Local Plan Sanctioning Authority for permission to construct new building as per the bye laws. All to be drawn and printed on **A1 size sheet** using suitable scale.
5. **Working drawings:** Student should prepare working drawings of **Sr. No. 3** which should consist of Column position and orientation, Centre line plan of column, footing, typical section of footing, plinth beam and brick work. All to be drawn using Drafting software and printed on **A1 size sheet** using suitable scale (1:100 or 1:200).

 # Oral: Oral will be based on above Assignments and exercises.

Text Books:

1. Dr. S. V. Deodhar, "Building science and planning" Khanna Publishers, ISBN-10 : 8174091998 ISBN-13 : 978-8174091994, 1972.
2. David V. Chadderton, "Building Services Engineering", sixth edition, Taylor & Francis Group London & New York, ISBN-10 : 1138628441, ISBN-13 : 978-1138628441, 2012.
3. Jan A. Van Der Westhuizen, "Drawing for Civil Engineering", Juta Legal and Academic Publishers; ISBN-10 : 0702188735, ISBN-13 : 978-0702188732, 2nd ed edition, 2014.

Reference Books:

1. National Building Code (latest).

2. M.V. Chitawadagi S.S. Bhavikatti., “Building Planning And Drawing”, Dreamtech Press, ISBN-10 : 9389307082, ISBN-13 : 978-9389307085, 2019.
3. M. G. Shah, C. M. Kale and S. Y. Patki, “Building Drawings with an integrated Approach to built-Environment”, Tata McGraw Hill, New Delhi (5th edition.), ISBN 10: 9389538122ISBN 13: 9789389538120, 2019.
4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
5. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.

e-Resources :

1. http://ncict.net/Examples/Examples1.aspx
2. http://www.igbc.in/site/igbc

HSMC HS216: Corporate Readiness

Teaching Scheme: **Practical: 02 Hrs. / Week**	**Evaluation Scheme:** **Term work: 50 Marks**
Credits: 01	**Total: 50Marks**

Prerequisite Course: Verbal and Non-verbal communication, Writing & Reading Skills)

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 improve interpersonal and communication skills.
3. To develop reading and writing skills.
4. To demonstrate the importance of team work & leadership quality.
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):

After successful completion of the course, student will be able to:

	Course Outcome (s)	**Bloom's Taxonomy**	
		Level	**Descriptor**
CO1	Understanding the concepts of grammar through various topics	**2**	**Understand**
CO2	Understanding reading skills which can improve the phonetics	**2**	**Understand**
CO3	Apply the knowledge of Verbal Ability to apply it in written form	**3**	**Apply**
CO4	Analyse and apply the critical thinking ability as required to showcase leadership skills.	**4**	**Analyse**
CO5	Examining based on communication skills	**4**	**Examine**
CO6	Judging an ideal personality that fits Industry requirement.	**5**	**Judge**

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	--	--	--	--	--	--	--	--	--	2	--	1	--	3	--	--
CO2	--	--	--	--	--	--	--	--	--	3	--	1	--	3	--	--
CO3	--	--	--	--	--	--	--	--	--	2	--	2	--	1	--	--
CO4	--	1	--	--	--	1	--	1	3	2	--	2	1	--	--	--
CO5	--	2	--	--	--	--	--	1	2	2	--	1	--	--	--	--
CO6	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--

Course Contents			
UNIT-I	Verbal English	**Hrs.**	**CO**
	Para Jumbles, Idioms and phrases, Parts of speech, Brief overview of Tense	06 Hrs.	CO 1
UNIT-II	Reading Skills	**Hrs.**	**CO**
	Reading Skills-why and how, Reading Newspaper, Reading Comprehension, Passage Reading	04 Hrs.	CO 2
UNIT-III	Writing skills	**Hrs.**	**CO**
	Story Writing, Email Writing, Content Writing, Article and Passage Writing	04 Hrs.	CO 3
UNIT-IV	Leadership and Teaming Up	**Hrs.**	**CO**
	Team work, Good team member qualities, Leadership qualities, Team work activities	06 Hrs.	CO 4
UNIT-V	Communication Skills	**Hrs.**	**CO**
	Spoken English, Phonetics, Accent and Intonation, Interpersonal Activities	06 Hrs.	C05
UNIT-VI	Body Language	**Hrs.**	**CO**
	Reveals your Inner Self and Personality, Grooming, Personal Interviews	04 Hrs.	CO 6

Text Books:

[T1]. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal.
[T2]. Reasoning verbal and Non-Verbal by B. S. Sijwali.
[T3]. Master the Group Discussion & Personal Interview - Complete Discussion on the topics asked by reputed B-schools & IIMs by Sheetal Desarda.

References:

[R1]. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical).
[R2]. Analytical Reasoning by M. K. Panday.
[R3]. Logical and analytical reasoning by K. Gupta.
[R4]. Multi-dimensional reasoning by Mishra & Kumar Dr. Lal.

E- Books:

[1].https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
[2].https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links:

[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

(CE217): Programming in Civil Engineering Lab

Teaching Scheme:	Evaluation Scheme:
Lectures: 02 Hrs. / Week	**Term work: 50 Marks**
Credits: 01	**Total: 50Marks**

Prerequisite Course: Linear Algebra and Stochastic Process, Multivariate Calculus, Vector Calculus and Differential Equation

Course Objectives:

Sr. No.	Course Objectives
1	To understand the basics of Python Programming
2	To understand the different types variables and data types.
3	To use Python data structures: lists, tuples, dictionaries.

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 Python Programming	2	Understand
CO2	To understand the different types variables and data types.	2	Understand
CO3	To use Python data structures: lists, tuples, dictionaries.	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	3	2	--	--	2	--	---	--	--	--	--	--	2	--
CO2	3	2	--	--	2	--	---	---	--	--	--	--	3	--
CO3	3	2	--	--	2	--	---	---	--	--	--	--	3	--

Term-Work: Term-work shall consist of following assignments	
1	Assignment Introduction to python programming
2	Assignment on data types and variables
3	Assignment on list, tuples, dictionaries and sets
4	Assignment on operators and access modifiers
5	Assignment on control statements
6	Assignment on OOPS in Python.

PCC: (CE218): Concrete Technology Lab

Teaching Scheme:	Evaluation Scheme:
Practical: 02 Hrs./ Week	**#Oral Exam: 50 Marks**
Credits: 01	**Total: 50 Marks**

Sr.No	Course Objectives
1	To know the properties of various ingredients of concrete.
2	To learn the behaviour and properties of fresh concrete and hardened concrete
3	To know the concrete mix design procedure and special concrete

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 and determine the physical properties of cement sand and aggregate	4	Analyze
CO2	Demonstrate fresh and hardened properties of concrete	4	Analyze
CO3	Design of various concrete mixes for different grades using admixtures to modify the properties.	5	Evaluate

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	3	2	-	3	-	3	-	3	3	1	2	2	3	-
CO2	3	2	-	3	-	3	-	3	3	1	2	2	3	-
CO3	3	2	3	3	2	3	2	3	3	1	2	2	3	-

List of Laboratory Experiments:

The laboratory work shall consist of following experiments. (Any 12 from following)

A) Tests on Cement

1. Fineness of cement and Fineness of fly ash / GGBS.
2. Standard consistency of cement.
3. Initial and final setting time and soundness of cement.
4. Compressive strength of cement.

B) Tests on fine aggregate and Coarse aggregate

5. Moisture content, silt content, density and Specific gravity of fine aggregate.

6. Fineness modulus by sieve analysis of fine aggregate.
7. Moisture content, water absorption, density and Specific gravity of coarse aggregate
8. Fineness modulus by sieve analysis of coarse aggregate.

C) Tests on fresh and Hardened concrete

9. Workability of concrete by slump test/flow test and compaction factor.
10. Workability of concrete by Vee-Bee Apparatus
11. Compressive strength test of concrete by crushing test and verification by Rebound hammer Test
12. Indirect tensile strength, Modulus of elasticity and flexural strength of hardened concrete.

D) Experiment on Concrete Mix Design

13. Concrete mix design by IS code method. **(Site visit is recommended to learn this topic)**
14. Mix design by using any suitable software / Microsoft tools

#Oral: Based on above syllabus and term work.

Text Books:

1. M. L. Gambhir, "Concrete Technology", Tata McGraw Hill Publications, ISBN 0070583749, 9780070583740. 2018.
2. M. S. Shetty, "Concrete Technology", S. Chand Publications, ISBN 978-93-525-3380-0, 2019.
3. A. R. Shantakumar, "Concrete Technology", Oxford University Press, ISBN 13: 9780199458523, 2018.
4. A. M. Neville, "Properties of Concrete", Pearson Education India, ISBN 10: 0273755803 / ISBN 13: 9780273755807, 2012.

Reference Books:

1. A. M. Neville, J. J. Brooks, "Concrete Technology" Pearson Education, India, ISBN 10: 9353436559, ISBN 13: 9789353436551, 2019.
2. P. Kumar Mehta, "Microstructure and properties of concrete", Prentice Hall.SP-26, ISBN 10: 933920476XISBN 13: 9789339204761, 2014.
3. V. M. Malhotra, "Fly ash in concrete", Canmet, ISBN 10: 097315070XISBN 13: 9780973150704, 2002.
4. **IS Codes:** IS 456, IS 383, IS 9103, IS 10262 Latest revised editions.

PCC: (CE219): Geotechnical Engineering Lab

Teaching Scheme **Practical: 02 Hrs./ Week**	Evaluation Scheme: **Practical Exam: 50 Marks**
Credits: 01	**Total: 50 Marks**

Course Objectives:

Sr. No.	Course Objectives
1	Laboratory determination of Index properties of soil and interpretation as per provisions of IS code
2	Laboratory determination of Engineering properties of soil and interpretation as per provisions of IS code

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

COs	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Determine Index properties of soil and compare with as per provisions of IS code	4	Analyze
2	Determine Engineering properties of soil and compare with as per provisions of IS code	4	Analyze

Mapping of COs with POs

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

List of Laboratory Experiments

1. Water content determination by any two methods a) Oven drying method, b) Infrared moisture method, c) calcium carbide method
2. Specific gravity determination by Pychnometer /density bottle
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of Consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) Core cutter b) Sand Replacement and c) Clod method
6. Determination of coefficient of permeability by a) Constant head and b) Variable head method.
7. Direct shear test.
8. Unconfined compression test.
9. Vane Shear test.
10. Standard Proctor test / Modified Proctor test.
11. Differential free swell test.

12. Triaxial test
13. Collection of sample soil investigation report for any construction project and write report about interpretation of index properties of soil.
14. 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.

PRJ: (CE220): Seminar / Mini Project / PBL

Teaching Scheme **Practical: 04 Hrs./ Week**	Evaluation Scheme **Oral Exam: 50 Marks**
Credits: 02	**Total: 50 Marks**

Prerequisite Course: Basic knowledge of Fundamentals in Civil Engineering

Course Objectives:

Sr. No.	Course Objectives
1	To develop skills in doing Literature Survey, Technical presentation and report preparation.
2	To enable project identification and execution to preliminary work on final year project

Course Outcomes (COs): Students able to:

COs	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Analyse a current topic of professional interest and present it before an audience	**4**	Analyzing
2	Identify an engineering problem, analyse it and prepare a work plan to solve it.	**4**	Analyzing

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO1 2	PSo 1	PSo 2
CO1	3	3	3	3	3	3	2	3	3	2	2	3	2	3
CO2	2	3	3	1	3	1	2	2	2	3	3	1	2	3

Oral examination shall be conducted based on a Seminar report to be prepared by each individual. The seminar report should contain the following.

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.

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

Internal guides may prepare a continuous evaluation sheet of each individual and refer it to the external examiner for consideration. The oral examination of each individual may then be conducted as per the practice adopted for other subjects.

MLC: (MC221): 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 of a 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-423603

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE

and

SYLLABUS- 2021 PATTERN

THIRD YEAR B. Tech

Semester-V and VI

W.e.f August 2023

Board of Studies in Civil Engineering, August 2023

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute affiliated to SPPU, Pune)

D E C L A R A T I O N

We, the Board of Studies (Civil Engineering), hereby declare that, we have designed the Curriculum of Third Year Civil Engineering Program Curriculum Structure and Syllabus for semester V & VI of Pattern 2021 w.e.f. from 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

(Dr.C.L.Jejurkar)

BoS Chairman

Approved by

Dr.A.B.Pawar
Dean Academics

Dr.A.G.Thakur
Director

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

THIRD YEAR B. TECH

Profile: Sanjivani College of Engineering was established in the year 1983. The Civil Engineering Department is a part of the institute since its inception. The Department has grown over the years with qualified teaching faculty members who are passionate to impart quality education. The department laboratories are fully equipped with latest equipment, software and with all necessary teaching aids. It is now recognized as one of the prominent departments and known for academic excellence under the Pune University. The department is having valid Accreditation by 'NBA' from 31 July 2015 to June 2025. Besides high quality teaching and instruction at UG, PG and Ph. D., the department is actively involved in basic and applied research and consultancy services. The department is providing quality technical and advisory support through consultancy to various private construction agencies, State Government, Central Government projects.

Apart from academic knowledge, we also, train our students to face the challenges in their profession by providing value added courses like Communication and Presentation skills, building of Team Sprit through field study, expert talk etc. The department also, provides an opportunity to learn software like AUTOCAD, REVIT ARCHITECTURE, STAD- PRO, ETAB, MS-PROJECT etc. to make our students more digitalized.

We arrange regular interaction of our stake holders like students, parents and faculty along with a Training and Placement cell which works full time for bright future of our students. The results are consistently above 90% and considerable number of student ranks in SPPU merit list. Students from Civil department have made incredible mark national and international levels and we are sure will continue in times to come.

The Infrastructure development in India is growing at a faster rate and there are many career paths for civil engineers. Civil engineers are essential in government sector, public and private sector and Multinational companies, to build various mega projects like highways, Industrial structures, smart cities, and reservoirs etc. The next decade will be most demanding and rewarding for Civil engineers.

Civil Engineering Department

VISION

- To become a premier source of competent Civil Engineering Professionals for providing service to the Nation.
-

MISSION

- To provide quality education in Civil Engineering profession.
- To impart knowledge to students for socio-economic growth of India.
- To promote Civil Engineering Graduates to become an entrepreneur.
- To motivate Civil Engineering Professionals towards competitive services, higher studies and research**.**

Program Educational Objectives: (PEOs)

PEO 1: Excellence in civil engineering profession by acquiring knowledge of advanced civil engineering technologies.

PEO 2:Capable to identify, analyze and design solutions for civil engineering problems in context of social, environmental , ethical and economic growth of the nation

PEO 3: To improve their technical and professional skills through value addition programs, software's to develop a long term productive career in industry, Govt Services or an entrepreneur.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes: (PSOs)

***PSO1*:** To understand experimental, analytical and advance techniques for the solution of Civil Engineering and or multidisciplinary Engineering problems.

***PSO2*:** Enhancing the employability skills of students in oral and written communications and exhibit good team work skills to have a successful career.

COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

THIRD YEAR B. TECH.

(W.e.f. Aug, 2023)

Board of Studies in Civil Engineering, Aug, 2023

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ESC	Engineering Science	HSC	Humanity Science
PCC	Professional Core	CIA	Continuous Internal Assessment
PEC	Professional Elective	OR	Oral Examination
OE	Open Elective	PR	Practical Examination
LC	Laboratory Course	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
		PRJ	Project/Seminar/Internship/Online Course

SEMESTER-V

Course			Hrs./Week			Credits	Marks					
Cat	**Code**	**Course Title**	**L**	**T**	**P**		**Theory**		**OR**	**PR**	**TW**	**Total**
							CIA	**ESE**				
PCC	CE301	Design of Steel Structures	3	1	-	4	40	60	-	-	-	100
PCC	CE302	Fluid Mechanics	4		-	4	40	60	-	-	-	100
PCC	CE303	Construction Project Management	3	-	-	3	40	60	-	-	-	100
PCC	CE304	Engineering Geology	3	-	-	3	40	60	-	-	-	100
PEC	PE305	Professional Elective- I	3	-	-	3	40	60	-	-	-	100
LC	CE306	Design of Steel Structures Lab	-	-	2	1	-	-	50	-		50
LC	CE307	Fluid Mechanics Lab	-	-	2	1	-	-	50	-	-	50
PRJ	CE308	Seminar and Technical Communication Skills	-	-	2	1	-	-	-	-	25	25
LC	CE309	Computer Aided Analysis and design of Structure Lab.	-	-	2	1	-	-	-	-	25	25
PRJ	CE310	Corporate Readiness-II	-	-	2	1	-	-	-	-	50	50
MLC	MC311	Mandatory Course-V:	1	-	-	Non Credit	-	-	-	-	-	Pass/Fail
		Total	**17**	**01**	**10**	**22**	**200**	**300**	**100**	**-**	**100**	**700**

MC310	**Mandatory Course-V**	**Field Practices in Civil Engineering**

Dr.C.L.Jejurkar
Head of Department

Dr.A.B.Pawar
Dean Academics

Dr.A.G.Thakur
Director

Professional Elective- I: (PEC305)

(PE305-a):	Analysis of Indeterminate Structures
(PE305-b):	Matrix Analysis of Structure
(PE305-c):	Infrastructure Engineering and Construction Techniques
(PE305-d):	Fire safety & Disaster Management
(PE305-e):	Sustainable Building Planning

Dr.C.L.Jejurkar	Dr.A.B.Pawar	Dr.A.G.Thakur
Head of Department	**Dean Academics**	**Director**

COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

THIRD YEAR B. TECH. Sem-II

(W.e.f. Jan, 2024)

Board of Studies in Civil Engineering, Jan, 2024

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ESC	Engineering Science	HSC	Humanity Science
PCC	Professional Core	CIA	Continuous Internal Assessment
PEC	Professional Elective	OR	Oral Examination
OE	Open Elective	PR	Practical Examination
LC	Laboratory Course	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
		PRJ	Project/Seminar/Internship/Online Course

SEMESTER-VI

Course			Hrs./Week			Credits	Marks					
Cat	Code	Course Title	L	T	P		Theory		OR	PR	TW	Total
							CIA	ESE				
PCC	CE312	Water Resources Engineering	3	-	-	3	40	60	-	-	-	100
PCC	CE313	Design of Reinforced Concrete Structures	3	1	-	4	40	60	-	-	-	100
PCC	CE314	Substructure Engineering	3	-	-	3	40	60	-	-	-	100
PEC	PE315	Professional Elective- II	3	-	-	3	40	60	-	-	-	100
PRJ	PR316	IPR and EDP	2	-	-	2	20	30	-	-	-	50
LC	CE317	Water Resources Engineering Lab	-	-	2	1	-	-	50	-	-	50
LC	CE318	Computer Aided RCC Design Lab	-	-	4	2	-	-	50	-	-	50
PRJ	CE319	Project Based Learning	-	-	2	1	-	-	-		25	25
PRJ	CE320	Creational Activity	-	-	2	1	-	-	-	-	25	25
MLC	MC321	Mandatory Course-VI(Formwork in Constructions)	1	-	-	Non Credits	-	-	-	-	-	Pass/Fail
		Total	**15**	**01**	**10**	**20**	**180**	**270**	**100**	**-**	**50**	**600**

Dr.C.L.Jejurkar
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PEC-Professional Elective- II: (PE314)

(PE315-a):	Water Treatment and Distribution
(PE315-b):	Modern Surveying
(PE315-c):	Rural and Urban Town Planning
(PE315-d):	Ground Improvement Techniques
(PE314-e):	Introduction to Finite Element Method

PCC (CE301): Design of Steel Structure

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week **Tutorial : 01 Hrs/Week**	**CIA : 40 Marks** **End Sem. Exam : 60 Marks**
Credits: 04	**Total: 100 Marks**

Prerequisite Course: **Engineering Mechanics, Solid Mechanics, Analysis of Structures**

Course Objectives:

1	Student will able to know use of the Limit state philosophy in design of steel structures and relevant material properties, steel grades and types of steel available in market.
2	Students will able to design different types of connections, tension, flexural, compression members with bracings and bases using relevant code.
3	Course will equip the students with necessary modern tools to design different types of industrial roof trusses.

Course Outcomes (COs): **This course will enable students to:**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the fundamental concepts of design of bolted and welded connections using relevant I.S.Codal provisions.	2	Understand
CO2	Make use of I.S.code procedure to design the tension members.	3	Apply
CO3	Apply the criteria to identify the buckling class of compression members and design it using angles and channel sections	3	Apply
CO4	Analyze and design the bracing systems with suitable bases as per the field requirements	4	Analyse
CO5	Analyze and design the flexural members with and without lateral support	4	Analyse
CO6	Compare the different loads acting on industrial roof trusses and design of various industrial sheds as per I.S.code procedure and using suitable software.	4	Analyse

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

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

Course Contents

Unit No.	Topic	No. of Hours	Cos
I	**Introduction to steel structure and Design of Connection:** Grades, properties and use of structural steel, Types of steel structures, Role of the designer, Introduction and use of IS: 800-2007, IS: 808-1989, IS: 875 Parts I, II, III. Introduction to rolled steel sections, Limit state philosophy in design for strength and serviceability. Partial safety factor for load and resistance, Load combinations, Classification of cross section such as plastic, compact, semi-compact and slender. Design of Bolted connections, Bolt grade and types of Bolts, Design of staggered bolting, Welding, Types of welding, Design of welded Connections, Introduction to eccentric connections.	08	1
II	**Design of Tension Member**: Introduction to Tension members, Practical utility, Modes of failure, Cross sections used, Limit strength due to yielding, rupture and block shear. Design of tension member using single and double angle sections. Design of connection with gusset plate by bolting and welding. Introduction to different tensile structures.	08	2
III	**Design of Compression Members:** Introduction to compression members, Common cross sections, Effective length, Slenderness ratio, causes of failure, Buckling classification as per geometry of cross section, Buckling curves, Compression members in trusses and its design with single and double angles, 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 Bracing systems and Bases:** Introduction to lacing and battening, Necessity, Design of built-up column, Design of lacing and battening, Connection of lacing / battening with bolting and welding. Design of column bases such as slab base and gusseted base. Introduction to moment resistant bases (concept only).	08	4
V	**Design of Flexural members:** Introduction to flexural members, Types flexural members, Modes of failure, Design of laterally supported beams, Concept of low and high shear, check for web buckling and web crippling. Design of laterally unsupported beams, Introduction to Plate girder and Gantry Girder (Concept only) , Component parts and Uses	08	5
VI	**Design of Industrial roof trusses:** Types of industrial trusses, Uses, Components parts, Assessment of dead load, live load and wind load using relevant I.S. codes, Various loads in combination, External and internal wind pressure coefficients, Design of purlin, Spacing of Purlins, Plan area, Design of different types of trusses used in industrial building, Drawing including the detailing of all the joints and supports. Introduction to light gauge structures, Introduction to trusses using box or hollow sections, Introduction to Pre-	08	6

	Engineering Building (PEB) structures. Introduction to tubular structure.		

Text Books:

1. Design of Steel Structure by Limit State Method, by S.S. Bhavikatti, I.K. International Publishing House, 5th Edition, New Delhi.
2. Limit state design of Steel Structure by Ramchandra and V. Gehlot, 7th edition, Scientific Publishers, Pune.
3. Limit state design in Structural Steel by M.R. Shiyekar, 3rdEdition, PHI Publications, Delhi.

Reference Books:

1. Design of Steel Structure by N. Subramanian, Oxford University Press, 2nd Edition, 2016, New Edi. New Delhi.
2. Limit state design of steel structures by S. K. Duggal, Tata McGraw Hill, 3rd Edition, New Delhi.
3. Structural Design in Steel by Sarwar AlamRaz, New Age International Publishers. Ltd. 3rd Edition, 2019
4. Fundamentals of structural steel design M. L. Gambhir, Tata McGraw Hill Education Private limited, First Edition, New Delhi.
5. Design of Steel Structures by K. S. Sai Ram, Pearson Publication, 3rd Edition, New Delhi.
6. Limit State Design of Steel Structures by S. Kanthimathina - WILEY, Dream tech Press, 1st Edition, New Delhi

Indian Standard Codes:

1. I.S.800:2007, "Code for general construction in steel structures," Bureau of Indian Standards, New Delhi.
2. I.S.875 (Part I, II, III), "Code of Practice for Design Loads," Bureau of Indian Standards, New Delhi.
3. I.S.808:1989, "Code for Classification of Hot Rolled Steel," BIS, India, New Delhi. (Steel Table).
4. Special issues like SP: 6(1), SP: 6(6), SP38 and IS: 4000- 1992.

e – Resources:

1. http://www.steel-insdag.org/
2. https://www.sail.co.in/
3. https://www.services.bis.gov.in:8071/php/BIS_2.0/dgdashboard/Published_Standards
4. NPTEL Courses on Design of steel structures conducted by IITs.

PCC (CE302): Fluid Mechanics

Teaching Scheme	Examination Scheme
Lectures: 04 Hrs. / Week	**CIA : 40 Marks** **End Sem. Exam : 60 Marks**
Credits: 04	**Total : 100Marks**

Prerequisite Courses: **Engineering Physics, Engineering Mechanics and Mathematics**

Course Objectives:

1	To understand the fundamentals of fluid properties, fluid statics, manometers, and the hydrostatic forces on flat and curved surfaces.
2	To learn and understand the concept of buoyancy, its application and dimensional analysis for design of models.
3	To study principles of continuity, momentum and energy as applied to fluid motion.
4	To learn and understand the fundamental knowledge of laminar flow in pipe flow and describe the development of boundary layer.
5	To learn and understand the fundamental design of pipe and pipe network analysis in terms of flow and losses.
6	To learn and understand about open channel flow and hydraulic machinery.

Course Outcomes (COs): Student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe the fundamental knowledge of fluid properties, fluid statics, manometers, and hydrostatic forces on plane and curved surfaces required for the design of engineering structures against to hydrostatic forces.	2	Understand
CO2	Apply the Archimedes Principles to determine the buoyancy and stability of floating bodies, and also the principles of dimensional analysis for model studies.	3	Apply
CO3	Apply the Continuity, Bernoulli's and Momentum equations to solve fluid flow problems	3	Apply
CO4	Apply the fundamentals of laminar flow in pipe flow and to explain the boundary layer theory	3	Apply
CO5	Estimate the major and minor losses in pipe flow, and water distribution networks	4	Analyze
CO6	Describe the fundamentals of open channel and to comprehend the operation and performance of hydraulic machinery.	2	Understand

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

Course Contents

Unit No	Topics	No. of Hrs.	COs
I	**a) Fluid Properties:** Introduction to fluid mechanics, Scope and importance, Fluid as a continuum, Physical properties of fluids, Newton's law of viscosity, Classification of fluids, Rheological diagram. **b) Fluid Statics:** Pressure at a point, Equation of hydrostatics, Pascal's law, Types of pressure, Hydrostatic paradox, Introduction to pressure measuring devices and their applications, pressure transducers and its applications. **c) Hydrostatic forces on surfaces** - Concept of total pressure and centre of pressure, Total pressure on a horizontal, vertical and inclined plane surface, Total pressure on curved surfaces.	08	1
II	**a) Buoyancy:** Principle of floatation and buoyancy, Archimede's principle, Concept of buoyancy, Metacenter, Equilibrium of floating and submerged bodies, Determination of metacentric height by analytical and experimental method. **b) Dimensional Analysis and Model Studies:** Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using Buckingham's π theorem method, Geometric, Kinematic and Dynamic similarity, Dimensionless parameters, Model studies - Distorted and undistorted models, Model laws (Reynold's law and Froude's law), Dimensional analysis applications to fluid flow problems.	08	2
III	**a) Fluid Kinematics:** Velocity and total acceleration of a fluid particle, Streamline, Path lines, Streak lines and Stream tubes, Open system and control volume analysis, Classification of fluid flow, Continuity equation for 3D flow in cartesian coordinates, Velocity potential, Stream function, Concept of flow net. **b) Fluid Dynamics:** Forces acting on the fluid in motion, Euler's equation of motion along the stream line, Bernoulli's equation (or energy equation) by integration of Euler's equation, Modified Bernoulli's equation, Measurement of discharge and velocity: Venturimeter, Orifice meter, Rotameter and Pitot tube.	08	3

IV	**a) Laminar Flow:** Reynolds' Experiment, Laminar flow through a circular pipe-Hagen Poiseuille pipe, Flow between two fixed parallel plates, Couette flow, Stoke's law, Darcy's law. **b) Boundary Layer Theory:** Concept and development of laminar and turbulent boundary layers over flat plates, Boundary layer thickness, displacement thickness, momentum thickness, energy thickness, Application of the integral momentum equation, Boundary layer on rough surfaces, boundary layer separation and their control, Concept of drag and lift.	08	4
V	**a) Flow-through Pipes:** Major and Minor losses in pipe flow, Darcy – Weisbach equation for head loss due to friction in a pipe, TEL and HGL, Variation of friction factor for laminar flow and turbulent flow, parallel and compound pipe lines, Equivalent pipe, branching of pipe lines and Pipe network analysis, Introduction to syphon, Water hammer in pipes. **b) Discharge measurements:** Orifices, mouth pieces, rectangular notch, Triangular notch, Cipolletti notch, Ogee weir and Broad crested weir, Numerical, Velocity of Approach.	08	5
VI	**a) Open Channel Flow:** Introduction, Types of open channel flow, Open channel formulae for uniform flow- Chezy's and Manning Formulae, Most economical channel section, specific energy and specific force, Introduction to hydraulic jump. **b) Introduction to Hydraulic Machinery:** Elements of hydropower plant, Hydraulic turbines (Impulse and Reaction Turbine), Pumps: Centrifugal pumps, reciprocating pumps, power house, classification.	08	6

Text Books:

1. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications (P) Ltd., New Delhi, 2019. ISBN – 10: 8131808157.
2. R. K. Rajput, "A Textbook of Fluid Mechanics and Hydraulic Machines", 3rd Revision, 2006 edition S. Chand Publishing, New Delhi, ISBN – 10: 9789385401374.
3. Munson, B.R., young, D.F. and Okiishi, T.H., "Fundamentals of Fluid Mechanics", 9th Edition, John Wiley & Sons, 2020.
4. Bernard Massey and John Ward Smith, " Mechanics of Fluids", Taylor and Francis, 8th Edition, 2006, London and New York.

Reference Books:

1. V. L. Streeter and E. B. Wylie, "Fluid Mechanics", 9th Edition, McGraw Hill Publications, New York, 2010. (ISBN – 10: 0070625379)
2. P.N. Modi and S.M. Seth, "Hydraulics & Fluid Mechanics" 22nd Edition, Standard Book House, Unit of Rajsons Publications Pvt Ltd., 2019.
3. D. S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S. K. Katariya and Sons, New Delhi, 8th Edition, 2013. (ISBN-13: 978-9350143926)
4. Y. Cengel and J. Cimbala, "Fluid Mechanics", Tata McGraw Hill, New Delhi, 3rd edition,

2017. (ISBN-13: 978-9339204655)
5. Franzini, J.B. and Finnemore, E.J., “Fluid Mechanics with Engineering Applications”, 10th Edition, McGraw-Hill, 2002.
6. V. Gupta and S. K. Gupta, “Fluid Mechanics and Applications”, New-Age International Pvt. Ltd., 2015. (ISBN -13: 978-8122439977)

e – Resources:

1. https://nptel.ac.in/courses/105/103/105103095/
2. https://nptel.ac.in/courses/105/103/105103192/

PCC (CE303): Construction Project Management

Teaching scheme	Evaluation scheme
Lectures: 3 hours/week	**CIA : 40 Marks** **End Sem Exam : 60 Marks**
Credits: 03	**Total: 100 Marks**

Prerequisite Course: **-Nil**

Course Objectives:

Sr. No.	Course Objectives
1	To understand basics of construction project management
2	To learn importance of project planning and scheduling
3	To impart knowledge about various techniques of construction resource management, project monitoring and quality control
4	To enhance knowledge about construction equipment management on site

Course Outcomes (COs): Student will be able to:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand role of construction project management in civil engineering projects.	2	Understand
2	Plan construction project using various scheduling techniques.	3	Apply
3	Prepare construction resource management plan	3	Apply
4	Use various project monitoring & control methods	3	Apply
5	Analyze construction equipment's as per their use, output and efficiency.	4	Analyze
6	Analyze the projects by Project cost account management techniques	4	Analyze

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

Course Contents

Unit No.	Unit Title	No. of Hours	COs
I	**Construction Project Management Framework** Project, Project management, Objectives of a project, Scientific way of managing of objectives, Phases of a construction project, Importance of construction and Indian construction industry, Construction project management and its relevance, Role of project management, Participants/Stakeholders of a construction project, Main causes of project failure.	06	1
II	**Construction Project Planning and Scheduling** Types of project plans, Work breakdown structure, Planning techniques, Event and Activity, Dummy activity, Network logic, Forward and backward pass, Float or slack time, Critical path, Preparation of network diagram, Critical Path Method (CPM), Precedence Network Analysis (PNA), Program Evaluation and Review Technique (PERT), Methods of scheduling: Bar chart/Gantt Chart and Line-of-Balance (LOB),Application of MS-Project and Primavera for project planning and scheduling.	06	2
III	**Project Resource Management** Resource Allocation: resource levelling and resource smoothening, Material Procurement Process in construction organization, Materials management functions, Inventory Management, ABC analysis of construction resources, EOQ analysis, Management Information System (MIS),PMI / PMBOK for efficient management of construction projects.	06	3
IV	**Project Monitoring &Quality Control** Project Updating, Project control, Network crashing and Cost-Time trade-off, Schedule/time/progress control, Cost control, Control of schedule, Quality control: concept of quality, Inspection, Quality control Quality assurance in construction projects, Supervision, Use of manuals and checklists for quality control, Construction safety and prevention of Accidents.	06	4
V	**Construction Equipment Management** Introduction, Classification of construction equipment, factors behind the selection of construction equipment, Earthwork equipment, Concreting equipment, Plant and equipment acquisition, Depreciation, Depreciation and taxation, Methods of calculating depreciation: Straight-line Method, Sum of years digit method, Declining balance method, sinking fund method, Effect of depreciation and tax on selection of alternatives, Evaluating replacement alternatives,	06	5

VI	**Project Cost Account Management** Principles of accounting, Accounting Process, Construction contract revenue recognition, Construction contract status report, Limitations of accounting, Balance Sheet Profit and loss account, working capital Ratio analysis, Funds flow statement, Project cost management, Collection of Cost-related Information, Cost Codes, Cost Statement Cost and technical performance, Earned Value method, Illustrations of cost control system, Application of BIM in construction project management.	06	6

Text Books:

1. Kumar N. Jha, "Construction Projects Management (Theory and Practice)", 2nd edition, Pearson Education India. (ISBN9332542015)
2. K. K. Chitkara, "Construction Project Management", 3rd edition, TMH Publication (ISBN 9789339205447)
3. B. Sengupta and H. Guha, "Construction Management and Planning", TMH Publication

Reference Books:

1. Sandra C. Weber, "Scheduling construction projects (Principle and Practices)", Pearson Publication
2. R L Peurifoy, "Construction Planning, Equipment, and Methods", TMH Publication.
3. K.Nagarjun, "Project Management", New Age International Publication.
4. K.K. Khandelwal and Dr. B.C.Punmia, "PERT and CPM", Laxmi Publication.
5. A guide to project management body of knowledge, Fifth edition, PMI Publication.

E- Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ce30/preview
2. https://www.coursera.org/learn/construction-project-management
3. https://www.pmi.org/pmbok-guide-standards/
4. https://www.youtube.com/channel/UC35NsIdqUF3RPCM_J7djCYg

PCC (CE-304): Engineering Geology

Teaching Scheme	Evaluation Scheme:
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam : 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: Engineering physics, Engineering Chemistry, Basics civil engineering

Course Objectives:

1.	To understand the basic principles of Engineering Geology
2.	To learn the basic aspects of structural features like fold ,faults in foundation rocks
3.	To acquire and apply knowledge of Preliminary geological investigations essential for civil engineering projects.
4.	To learn the application of geological site investigations in various infrastructure projects like Dams, tunnels& bridges.
5.	To learn geomorphic and dynamic processes on the Earth.
6	To study the effects of groundwater and geological hazards.

Course Outcomes (COs): Student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the fundamental principles of the Earth; Rocks and minerals	2	Understand
2	Identify the structural defects in the rocks for the application in civil Engineering.	3	Apply
3	Apply various surface and subsurface exploration methods to interpret geological nature of present rock.	3	Apply
4	Analyze the geological nature of site for the various civil engineering projects.	4	Analyze
5	Explain the effects of different Geomorphological processes & application of G.I.S. & RS in Civil Engineering	3	Apply
6	Analyse the geological hazards and influence of Geohydrological properties of rocks for safety & suitability of foundation rocks	4	Analyze

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

Course Contents

Unit No.	Topics	No of Hrs.	COs
I	**Mineralogy and Petrology** **Mineralogy** Introduction to subject, scope and sub divisions, rock forming minerals and their properties. silicate & non silicate minerals Primary and secondary minerals. Felsic and mafic minerals. Essential and accessory minerals. **Petrology-** Rock cycle and main divisions of rock. **Igneous rocks-** Mineral composition, texture and structure of plutonic, hypabyssal and volcanic rocks. Classification of igneous rock, study of common rocks. **Sedimentary rocks-** Rock weathering, decomposition, disintegration, classification and grain size classification. Texture of secondary rocks, Features of shallow marine deposits, study of common rocks and their engineering applications. **Metamorphic rocks:** Agents and types of metamorphism, Texture and Structure, study of common rocks and their engineering applications.	06	1
II	**Structural Geology and Tectonics** **Structural geology**: Out crop, Dip, Strike, Conformable and unconformable series and overlap. **Fault** and their types, Inliers and outlier. **Fold** and their types, Structural features resulted due to igneous intrusions. Concordant and Discordant igneous intrusions, joints and their types. stratification and lamination. **Introduction to plate tectonics.** Plate boundaries and its Types. Geological Maps, its interpretation and its applications in solving of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges.	06	2
III	**Preliminary Geological Studies.** **Preliminary geological Investigations:** reconnaissance survey, Desk Study, surface and subsurface geological investigation: methods, significance and limitations. Techniques of correlation for surface and subsurface exploration, engineering significance of geological structures and relevant case studies. **Geophysical Techniques:** Importance of geophysical methods, classification, principles of geophysical method by, Gravity, Magnetic, Electrical, and Seismic methods in prospecting economic ores, minerals and locating groundwater potential zones and thickness of overburden.	06	3

IV	**Role of Geology in Reservoirs, Dams, Tunnelling & Bridges** **Geology of Dam site**, Preliminary geological work on dam sites ,case studies, and types of dam. **Geology of Reservoir sites**, Physical properties and rock structure Condition likely to cause leakage through reservoir rim. **Tunnelling,** Preliminary geological investigation for tunnels, Important geological consideration while choosing alignment. Suitability of common rock types for excavation and tunnelling, unlined tunnels and case studies. **Bridges:** Geological site investigations for design & construction of bridges.	06	4
V	**Geomorphology and Remote Sensing** **Geomorphology:** Definition & Scope, Basic concepts, Internal & external processes, Geomprphological classification, weathering and erosion. Geological action of river, Rejuvenation, land forms resulted due to river erosion , land forms resulted due to river deposition. **Remote Sensing** :Application of Remote Sensing and GIS Techniques in Civil Engineering Projects G.P.S. (Global Positioning System) and its uses,	06	5
VI	**Geological Hazards & Geohydrology** **Geological hazards**: Volcanism, earthquakes and seismic zones of India, landslides and stability of hill slopes and preventive measures. **Geohydrology** Geological work of groundwater, types of aquifers, groundwater investigations, conservation and groundwater development & management, Techniques of groundwater recharge, Environmental aspects of geology, Artificial groundwater recharge and introduction to watershed management.	06	6

Text Books:

1. K.V.G.K. Gokhale and D. M. Rao, "Geology and Engineering" 4thedition, Tata McGraw-Hill.2017
2. R.B. Gupte "Text Book of Engineering Geology" 7thEdition, P.V.G. Publications, Pune. 2015, ISBN 10: 0471034363.
3. N. Chenna Kesavulu "A Text Book of Engineering Geology" 2ndEdition, Millan
a. India, 2010. ISBN 0333927079.
4. Panda B.C. Principles of Remote Sensing, Viva books Private Ltd.

References Books

1. F.G.H.BlythandM.H.deFreitas,"AGeologyforEngineers"7thEdition Elsevier Science, 2018 ISBN 9780415502917
2. F.G. Bell, "Fundamentals of Engineering Geology", 2nd edition,BSPublications,2005.ISBN 9780408011693,
3. D. P. Krynine & W. R. Judd "Principles of Engineering Geology and Geotechniques", 4thEdition,CBS Publishers, New Delhi. 2013 ISBN 9780070355606
4. F.G.H Blyth and DeFrietus "PWD Handbook" Ch. No. 6 Part II: published By Govt. of Maharashtra 1980
5. AICTE handbook "An Introduction to Earthquake Hazards":AICTE handbook 14 IRC Sec.2400.

e – Resources:

1. www.nptel.iitm.ac.in
2. Free online course-swayam-https//swayam.gov.in

IS Codes of References:

1. IS 1123:1998 Method of identification of Natural building stone.
2. IS 4078:1967 Code of Practice for Indexing and Storage of drill cores
3. IS 4453: 1967 Code of Practice for exploration by Pits, Trenches, Shafts and Drafts
4. IS 5313: 1969 Guide lines for core drilling observations
5. IS 6926: 1973 Code of Practice for diamond core drilling for investigations for river Projects.

Professional Elective- I: (PEC305)

(PE305-a):	Analysis of Indeterminate Structures
(PE305-b):	Matrix Analysis of Structure
(PE305-c):	Infrastructure Engineering and Construction Techniques
(PE305-d):	Fire safety & Disaster Management
(PE305-e):	Sustainable Building Planning

PEC (PE 305 –a): Analysis of Indeterminate Structures

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End - Sem Exam : 60 Marks**
Credits: 03	**Total : 100Marks**

Prerequisite Course: **Mathematics, Engineering Mechanics, Solid Mechanics & Analysis of structures.**

Course Objectives:

Sr. No.	Course Objectives
1	To understand Strain Energy, Clapeyron theorem, Castigliano's second theorem methods for analyzing the indeterminate structures.
2	To impart knowledge about Slope deflection equation methods in the analysis of indeterminate Structures.
3	To understand Moment distribution methods for analyzing the indeterminate structures.
4	To impart knowledge about Flexibility methods in the analysis of indeterminate Structures.
5	To apply Stiffness methods for analyzing the indeterminate structures.
6	To analyze the multistoried frame subjected to lateral load using approximate methods and to know software in Structural Analysis.

Course Outcomes (COs): student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Apply the Strain Energy, Clapeyron theorem, Castigliano's second theorem to sketch Shear force and bending moment of statically Indeterminate Structures.	3	Apply
2	Utilize slope deflection method to sketch Shear force and bending moment of statically Indeterminate Structures.	3	Apply
3	To make use of moment distribution method to sketch Shear force and bending moment of statically Indeterminate Structures.	3	Apply
4	Apply Flexibility method to sketch Shear force and bending moment of statically Indeterminate Structures	3	Apply
5	Apply stiffness method to sketch Shear force and bending moment of statically Indeterminate Structures	3	Apply
6	Analyze the multi-storeyed building frames by approximate methods.	4	Analyze

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

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

Course Contents

Unit No	Topics	No of Hrs	COs
I	**Analysis of Indeterminate Beams and Frames:** Introduction and types of statically indeterminate beams, Computation of fixed-end actions for various types of loads, Fixed beams by strain energy method, Analysis of continuous beams by three moment theorem (Clapeyron theorem), analysis of beams and frame by Castigliano's second theorem.	06	1
II	**Slope-Deflection Method:** a) Slope-deflection equations, equilibrium equation of Slope-deflection method, application of Slope deflection method to beams with yielding of support, shear force and bending moment diagram. b) Sway and non sway analysis of rigid joint rectangular single bay single storey portal frames using Slope- deflection method.	06	2
III	**Moment Distribution Method:** a) Introduction, Stiffness factor, carry over factor, distribution factor, application of Moment distribution method of analysis to beams with yielding of support, shear force and bending moment diagram. b) Sway and non sway analysis of rigid jointed rectangular single bay single storey portal frames using Moment distribution method	06	3
IV	**Flexibility Method:** a) Introduction, Fundamental concepts of flexibility method of analysis, Formulation of flexibility matrix. Application to beams with and without support settlement. b) Application to rigid jointed rectangular portal frames with and without sway. Shear force and bending moment diagram.	06	4

V	**Stiffness Method:** a) Introduction, Fundamental concepts of flexibility and stiffness, relation between them. Application to beams with yielding of support, shear force and bending moment diagram by Structure approach only. b) Application of Stiffness structure approach to rigid jointed rectangular portal frames.	06	5
VI	**Approximate Methods of Analysis:** Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed frames by substitute frame method, cantilever method and portal method. Introduction to Gabel frame. **Computer Applications in Structural Engg. :** Use of suitable software for analysis of beams and frames of the topics related to this course.	06	6

Text Books:

1. S. Ramamrutham and N. Narayan, "Theory of Structures", 9th Edition, DhanpatRai, New Delhi.(2014),ISBN: 978-93-5216-553-7.
2. G. S. Pandit& S.P. Gupta (1998), "Structural Analysis (A matrix approach)", 2nd edition Tata McGraw Hill Publishing Ltd.(2008),ISBN: 13:978-0070667358.
3. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures", 13th Edition, Laxmi Publication. (2017), ISBN : 81-7008-618-3

Reference Books:

1. S.P. Timoshenko and Young D.H., "Theory of Structures", 2nd Edition Tata McGraw Hill. (2002) ISBN: 978-0070648685.
2. C K Wang, "Intermediate Structural Analysis", Tata McGraw-Hill Education Pvt. Ltd., (2014), ISBN 13: 9780070702493.
3. Gere and Weaver, "Matrix Analysis of Framed Structures", 2nd Edition CBS Publication Delhi,(1998) ,ISBN No. ISBN-13. 978-8123911519
4. C. S. Reddy, "Basic Structural Analysis", 3rd Edition, Tata McGraw Hill. (2010). ISBN: 9780070702769.
5. Devdas Menon, "Structural Analysis", 2nd Edition, Narosa Publishing House, New Delhi. (2018), ISBN: 13: 9781842653371.
6. A. K. Jain, "Advanced Structural Analysis",3rd Edition, Nem Chand & Bros, Roorkee(2015), ISBN: 9788185240817.

e – Resources:

1. http://nptel.iitm.ac.in
2. https://onlinecourses.nptel.ac.in
3. https://www.udemy.com/course/staadpro-cs

PEC (PE305-b): Matrix Method of Structural Analysis

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem. Exam : 60 Marks**
Credits: 03	**Total : 100Marks**

Prerequisite Course: **Mathematics, Engineering Mechanics, Solid Mechanics and Analysis of structures.**

Course Objectives:

1. To analyze the statically Determinate and Indeterminate structures by Flexibility Matrix method.
2. To analyze the statically Determinate and Indeterminate structures by Stiffness Matrix method.
3. To understand the effect of temperature change and lack of fits.

Course Outcomes (COs): student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the concepts of matrix algebra, basic concepts of structural analysis for statically Determinate and Indeterminate structures.	2	Understand
CO2	Apply flexibility matrix method for analyzing statically Determinate and Indeterminate structures.	3	Apply
CO3	Apply stiffness matrix method for analyzing statically Determinate and Indeterminate structures.	3	Apply
CO4	Apply concepts of temperature variation on structural analysis and lack of mis fits during analysis.	3	Apply
CO5	Analyze structures by direct stiffness method.	4	Analyze
CO6	Evaluate the stability of structures by using latest tools of software.	5	Evaluate

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

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

Course Contents

Unit No	Topics	No. of Hrs	COs
I	**Introduction**: matrix algebra, basic concepts of structural analysis.	03	1
II	**Flexibility matrix method:** Introduction to flexibility approach, derivation of flexibility matrix for bar, truss, beam, and frame structures, analysis of determinate and indeterminate structures using flexibility matrix method.	08	2
III	**Stiffness matrix method:** Introduction to stiffness approach, derivation of stiffness matrix for bar, truss, beam, and frame structures, analysis of determinate and indeterminate structures using stiffness matrix method.	08	3
IV	**Effects of Temperature Changes and Lack of Fit:** Formulation of temperature variation in the derivative results of determinate and indeterminate structures.	05	4
V	**Direct stiffness method:** Use of direct stiffness method for analysis of bar, truss, beam, and frame structures of determinate and indeterminate ones.	07	5
VI	**Analysis & evaluation:** Analyzing structures using STAAD or ETABS to evaluate multistorey building (G+10 or more).	05	6

Text Books:

1. M. F. Rubinstein, Matrix Computer Analysis of Structures, Prentice Hall, Inc. ISBN-10 0135654815
2. H. C. Martin, Introduction to Matrix Methods of Structural Analysis, McGraw-Hill Book Company
3. William McGuire, Richard H Gallagher & Ronald D Ziemian. “Matrix Structural Analysis”, Second Edition.
4. Staad Pro V8I For Beginners:With Indian Examples by T S SHARMA.
5. ETABS Training manuals Created by Jessica Napier, last modified on Jul 09, 2014.

Reference Books:

1. M. B. Kanchi, Matrix Methods of Structural Analysis, New Age International
2. G. S. Pandit and S. P. Gupta, Structural Analysis: A Matrix Approach, Tata McGraw-Hiil
3. Weaver W and Gere J H, “Matrix Analysis of Framed Structures”, CBS publications, New Delhi.
4. Rajasekaran S, “Computational Structural Mechanics”, PHI, New Delhi.
5. MadhujitMukhopadhay and Abdul Hamid Sheikh, “Matrix and Finite Element Analysis of Structures”, Ane Pvt. Ltd.

e – Resources:
http://nptel.iitm.ac.in https://onlinecourses.nptel.ac.in https://www.udemy.com/course/staadpro-cs/

PEC (PE305-c): Infrastructure Engineering & Construction Techniques

Teaching Scheme **Lectures: 03 Hrs. / Week**	Evaluation Scheme: **CIA : 40 Marks** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: Basic Civil Engineering

Course Objectives:

1.	The objective of this course is to familiarize students with a variety of aspects of infrastructure.
2.	To learn modern methods of underwater construction.
3.	To become knowledgeable about a variety of construction techniques and equipment.
4.	To learn basic components of Railway, construction and operation of Railway.
5.	To learn Tunneling and various methods of construction of tunnel including TBM.
6.	To be aware of the concepts of a dock, and a harbor.

Course Outcomes (COs): student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Summarize the basic components of infrastructure, necessity and development of different infrastructure projects.	2	Understand
2	Extend modern methods for underwater construction.	2	Understand
3	Identify advancements in construction equipment and the methods used to maintain it.	3	Apply
4	Interpret the basic concepts of the railway construction project's conception and operation.	2	Understand
5	Outline many different aspects of tunnel design and construction.	2	Understand
6	Make a use of methods of construction and guidelines for design for ports and harbors.	3	Apply

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

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

Course Contents

Unit No.	Topics	No of Hrs.	COs
I	**Infrastructure:** Definitions of Infrastructure and Basic Terminologies, Governing Features, Infrastructure organizations & Systems, scope of Infrastructure Engineering in national and global development, Types of Infrastructure, Indian Scenario in respect of adequacy and quality, Forthcoming infrastructure projects at national and global level, Necessity, advantages and disadvantages of PPP (Public Private Partnership) and BOT projects, Infrastructure elements of Smart city.	06	1
II	**Construction Techniques:** Dredging technique, Barges, Types and uses of Barges, Dewatering techniques - Well point system, Vacuum dewatering, and electro-osmosis. Purpose and construction of diaphragm wall. Underwater construction techniques- Cofferdam, Caissons, underwater concreting using Tremie method. Modular Construction, Modular System Building, Limitation and Advantages of Modular Construction. Construction Techniques of High-Rise Buildings.	06	2
III	**Construction Equipment's**: Introduction, applications and performance of dozers, excavators, graders, compactors, pavers, haulers, power shovels, Cranes, drilling, blasting equipment and concrete pumps. Economic Maintenance and repair of construction Equipment, Application of Integrated GPS and GIS technology for construction equipment's.	06	3
IV	**Railway:** Permanent way, Requirements and functions of basic components viz. Rails, Sleepers, Ballast, Formation. Super elevation, Equilibrium cant, Equilibrium speed, Maximum permissible limits for cant, Cant deficiency, Cant excess, Concept of Negative cant, Points, crossings and turnouts- functions, Components, elements of points, Types of crossings and turnouts. Signaling and interlocking Objectives, Classification, and Interlocking. Modern development in railways- metro rails, mono rails, bullet train.	06	4
V	**Tunneling-** Definition and types, processes involved, concepts of pilot tunnel, shaft, Adit, portals, twin tunnels etc., Tunneling methods in hard and soft strata, hauling of muck, Tunnel Boring Machine (TBM), Lining and Grouting methods, Ventilation, dust control and drainage in tunneling.	06	5
VI	**Docks & Harbors-** Introduction, Requirements of good port and harbour, Harbour classification, site selection and planning of harbour, Harbour size, depth and turning basin. **Harbour works:** Breakwater, Docks-types and uses, Quay wall, Wharves, Jetty, Mole, Dolphins, fenders, Moorings for ships.	06	6

Text Books:	
1	Satish Chandra and M. M. Agrawal, "Railway Engineering", Oxford University Press, 2nd edition, 2013.
2	S.C. Sharma, "Construction Equipment & its Management", Khanna Publication. 1st edition, 2014.
3	R. Srinivasan, "Harbour, Dock & Tunnel Engineering "28th edition, 2016.
Reference Books:	
1	Puerifoy, "Construction Planning Methods & Equipment", Tata McGraw Hill. 7th edition, 2010.
2	J.S.Mundrey , " Railway Track Engineering" , Tata McGraw Hill, 5th edition, 2007
3	Hasmukh P. Oza & Gautam H. Oza , " Dock & Harbour Engineering" , Charoter Book Stall, 8th edition, 2016.
e-Resources:	https://nptel.ac.in/courses/105/105/105105108/ https://onlinecourses.nptel.ac.in/noc21_ce21/

PEC: (PE305-d): Fire Safety & Disaster Management

Teaching Scheme	Examination scheme
Lectures: 3 hours/week	**CIA : 40 Marks** **End Sem Exam : 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: Geology, Geotechnical Engineering, Concrete Technology.

Course Objectives:

Sr. No.	Course Objectives
1	To provide students with the knowledge and skills necessary to prevent and manage fires and other disasters.
2	To familiarize students with the relevant Indian legislation and regulations.
3	To develop students' ability to apply fire safety and disaster management principles in a variety of settings.

Course Outcomes: student will be able to:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Students will be able to explain the different classes of fires and the appropriate extinguishing agents for each class.	2	Understand
2	Students will be able to conduct a fire hazard analysis and identify potential fire hazards.	3	Apply
3	Students will be able to use portable fire extinguishers to extinguish fires.	3	Apply
4	Students will be able to develop a disaster plan for a particular setting.	3	Apply
5	Students will be able to explain the liability and insurance implications of fire safety and disaster management.	2	Understand
6	Students will be able to create a fire protection plan for a particular setting.	6	Create

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

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

Course Contents

Unit No.	Unit Title	No. of Hours	COs
I	**Unit 1: Basics of Fire Science** Fire triangle and fire tetrahedron: Three elements that are necessary for fire to occur (fuel, oxygen, and heat) and the fourth element (chemical chain reaction) that is sometimes added to the fire tetrahedron. Classification of fires (including Indian codes): Different classes of fires and the appropriate extinguishing agents for each class, as specified by Indian codes such as IS 1893:2016 and IS 2157:2008.Fire dynamics: Factors that affect the spread of fire, such as heat transfer, combustion, and smoke production. Fire detection and alarm systems: Different types of fire detection and alarm systems and how they work.	06	1
II	**Unit 2: Fire Prevention** Fire prevention principles: Principles of fire prevention, such as fire hazard analysis, fire protection planning, and fire safety regulations. Fire hazard analysis: Process of identifying and assessing fire hazards in a particular setting, Fire protection planning: Process of developing a fire protection plan for a particular setting, Fire safety regulations (including Indian codes): Relevant Indian legislation and regulations related to fire safety, such as the Fire Prevention and Fire Safety Act, 2012 and the National Building Code of India, 2016.	06	2
III	**Unit 3: Fire Fighting** Portable fire extinguishers: Different types of portable fire extinguishers and how to use them, Fixed fire suppression systems: Different types of fixed fire suppression systems and how they work, Fire brigade operations: Role of the fire brigade in fire fighting and emergency response, Emergency medical services: Role of emergency medical services in providing medical care to fire victims.	06	3
IV	**Unit 4: Disaster Management** Types of disasters: Different types of disasters that can occur, such as natural disasters, technological disasters, and human-made disasters, Disaster preparedness: Steps that can be taken to prepare for a disaster, such as developing a disaster plan and conducting disaster drills, Disaster response: Steps that need to be taken to respond to a disaster, such as search and rescue, emergency medical care, and damage assessment, Disaster recovery: Steps that need to be taken to recover from a disaster, such as rebuilding infrastructure, restoring services, and providing psychological support.	06	4
V	**Unit 5: Legal Aspects of Fire Safety and Disaster Management** Indian legislation and regulations: Relevant Indian legislation and regulations related to fire safety and disaster management, such as the Fire Prevention and Fire Safety Act, 2012 and the National Disaster Management Act, 2005, Liability and insurance: Liability and insurance implications of fire safety and disaster management.	06	5
VI	**Unit 6: Case Studies** Fire disasters in India: Some of the major fire disasters that have occurred in	06	6

	India, such as the Uphaar Cinema fire in 1997 and the National Museum fire in 2016, Disaster management exercises: Some of the disaster management exercises that have been conducted in India, such as the National Disaster Management Exercise in 2016.		

Text Books –

1. Fire Safety Engineering by John D. Hall
2. Fire Protection Systems by John L. Bryan
3. Disaster Management by David Alexander
4. Fire Safety Management in India by B. K. Agarwal
5. Disaster Management: Principles and Practices by T. K. Nayak
6. Disaster Management in India by S. K. Srivastava

References

1. Indian Fire Service Directorate
2. National Disaster Management Authority
3. Ministry of Home Affairs, Government of India
4. IS 1893:2016 - Code of Practice for Fire Safety in Buildings
5. IS 2157:2008 - Fire Extinguishers
6. IS 3024:2014 - Fire Detection and Alarm Systems
7. IS 456:2000 - Plain and Reinforced Concrete - Code of Practice
8. IS 9001:2015 - Quality Management Systems - Requirements

e-Resources: :

1. National Fire Protection Association: https://www.nfpa.org/
2. International Association of Fire Chiefs: https://www.iafc.org/
3. World Fire Protection Association: https://www.wfpa.org/

PEC (PE305-e): Sustainable Building Planning

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100Marks**

Prerequisite Course: Building technology and materials, Computer aided building drawings.

Course Objectives:

1. Understand the concept of sustainable building construction and their environmental impact.
2. Know the need and importance of low cost housing.
3. Understand the roll of green building in sustainable building planning.

Course Outcomes (COs): Student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Explain environmental impact on buildings and its assessment.	2	Understand
2	Interpret sustainable building planning policies for implementation.	2	Understand
3	Apply modern architecture, green building concept and global practices.	3	Apply
4	Evaluate impact of urbanization on sustainability.	4	Analyzing
5	Apply modern eco-friendly material practices for national rating systems.	3	Apply
6	Explain energy conservation and its importance for urban sustainability.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & 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	--	--	--	--	--	2	--
CO2	--	--	3	--	2	2	2	--	--	--	--	--	2	--
CO3	--	1	2	--	2	--	3	--	--	--	1	1	2	1
CO4	1	--	3	1	2	2	2	--	--	--	--	--	2	--
CO5	2	--	1	--	2	1	--	--	--	--	--	--	2	--
CO6	1	--	2	--	--	--	3	--	--	--	--	--	--	1

Course Contents

Unit No	Topics	No of Hrs	COs
I	**Sustainable Development and Design:** Concept, perspectives, need, importance, Environmental impact. Concept of sustainable planning for building industry, past perspectives on planning, Planners role in sustainable building design.	06	1
II	**Ssustainable Building Policies:** Introduction to sustainable building policies, exploring implementation gaps, Environment protection, site planning, energy conservation concept, water use reduction, Rain water harvesting, solar system, indoor air quality, barriers to implementation of sustainable building measures, checklist for sustainability.	06	2
III	**Innovative Low Cost Building Material:** Innovative building material for rural and urban areas, Low Cost Infrastructure in rural Areas, Cost Cutting of housing Infrastructure, Green materials.	06	3
IV	**Urban Housing And Infrastructure:** Vernacular Architecture; Urban climate, effect of built environment, Impact of urbanization on sustainability, growth, issues related to sustainability.	06	4
V	**Green Buildings:** Concept, need, design principles, benefits, construction techniques, planning, and case studies of residential, commercial, and industrial buildings. Green building Evaluation Systems, LEED Certification, Green Globe .Certification. Case study on Indira paryavaran bhavan(MoEF).	06	5
VI	**Building Performance Assessment:** Concept, tools at internationall-national level, process of green building certification, comparison of different tools like USGBC, LEED INDIA, GRIHA, IGBC, SB Tool etc. Recent researches on sustainable building development, assessment tools and case study.	06	6

Text Books:

1. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, wiley publication, Third Edition,US, 2012
2. GuttilaYuganthaJayasinghe, Towards to the sustainable construction, LAP Lambert Academic Publishing, Republic of maldova, 2018.
3. 3.A.K. Lal, Handbook of Low Cost Housing, New age international Publisher, New Delhi,1995

Reference Books:

1. S M Wheeler, Planning for Sustainability: Creating Liveable, Equitable and Ecological Communities, Routledge, Taylor and Francis group, New York, 2004.
2. Sustainable building design manual: Sustainable building design practices, The Energy and Resources Institute, New Delhi, 2009.
3. T Hasegawa, Environmentally sustainable buildings: challenges and policies, Organization for economic cooperation and development (OECD) publications, Paris, 2003.

e – Resources:

1. www.nptel.iitm.ac.in/courses

PCC (CE306): Design of Steel Structure Lab.

Teaching Scheme	Examination Scheme
Practical: 02 Hrs./ Week	**Oral Exam : 50 Marks**
Credits: 01	**Total: 50 Marks**

Prerequisite Course: **Engineering Mechanics, Solid Mechanics, Analysis of Structures**

Course Outcomes (COs): **Student will be able to:**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
1	Draw detailed sketches of different steel structure components with suitable scales and software	3	Understand
2	Analyze and design of industrial building for different load combinations using relevant I.S.code specifications in a group of students and check the design using suitable software.	4	Analyse
3	Inspect and visit the undergoing steel construction sites, steel manufacturing industry, Fabrication shops, etc.	4	Analyse
4	Prepare and create the scaled model of roof truss with suitable material in a project group.	5	Create

Mapping of Course Outcomes to Program Outcomes (POs) & 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
CO2	3	3	3	2	3	-	-	-	3	-	-	2	3	1
CO3	3	1	1	2	-	-	-	-	-	-	-	-	3	1
CO4	3	3	3	2	1	1	1	2	3	2	-	1	3	1

Laboratory Work:

During the laboratory hours students will complete the following assign work.

1. Drawing on two-full imperial drawing sheets (A-1 size) showing structural detailing of different components of steel structures. (1 Sheets Hand drawn and 1sheet using Auto Cad)
2. Design of industrial building including roof truss, purlin, columns & column bases, bracings and connections. Detailed drawing and detailing of all the design elements. (2 Sheets Hand drawn and 1 using Auto Cad)
3. One site visit is recommended. Visit to undergoing steel projects, steel manufacturing industry, Steel Fabrication workshops or any suitable construction site. Write a visit report including site and structural details with different sketches.
4. Prepare the scaled model of roof truss designed in Sr.No.2, using any suitable material. (It is mandatory part of term work)

Note 1: Analysis and design of industrial building using suitable software like **STAAD-Pro, E-Tabs,** etc.(mentioned in Sr.No.2), with valid output and relevant drawings. (The students who will complete the design using software will be excused from term work part mentioned in Sr. No. 4).

Note 2: For the project work, in the group students be should be 3-5.

(CE307): Fluid Mechanics Lab

Teaching Scheme **Practical: 02 Hrs./ Week**	Evaluation Scheme **Oral: 50 Marks**
Credits: 01	**Total: 50 Marks**

Prerequisite Course: Physics, Engineering Mechanics and Mathematics

Course Objectives:

1. Understand the physical properties of fluids, as well as the use of pressure measuring devices and the concept of fluid statics.
2. To study the fluid dynamics and use of various flow measuring devices.
3. To examine different losses in a pipe flow
4. To impart knowledge of open channel flow and hydraulic machines.

Course Outcomes (COs): This course will enable students to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Explain the concept of viscosity as a fluid property, measure the fluid pressure, and use various devices to measure fluid pressure.	3	Apply
CO2	Apply the buoyancy principle to determine the stability of a floating body using ship model.	3	Apply
CO3	Apply Bernoulli's equation to fluid flow problems and discover the basic concepts of discharge determination employing flow measuring devices.	3	Apply
CO4	Classify different types of flow based on Reynold's number, Determining the major/minor losses in a pipe flow experimentally, Analyse velocity distribution and uniform flow in open channel	4	Analyze

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

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

Term work will consist of the detailed report on **Lab experiments and Assignment** performed.

A. List of Experiments (Any **eight** of the following)

1. Measurement of viscosity by Redwood viscometer.
2. Measurement of pressures using different pressure measuring devices.
3. Determination of stability of floating bodies using ship models.
4. Experimental verification of Bernoulli's theorem with reference to loss of energy.
5. Calibration of Venturimeter/Orifice meter.
6. Drawing flow net by electrical analogy for flow below weir (with and without sheet pile).
7. Calibration of rectangular/triangular notches.
8. Determination of minor loss/friction factor in pipe for given pipe section.
9. Study of uniform flow formulae for open channel flow.
10. Velocity distribution in open Channel Flow.

B. Assignments (Any ***Two*** of following)

1. Solution for pipe flow problems using any simulation tool or programming language.
2. Determination of friction factor for a pipe using any programming language.
3. Developing a demonstration model for any fluid flow phenomenon (physical model/soft model).

Text Books:

1. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications (P) Ltd., New Delhi, 2019. ISBN – 10: 8131808157.
2. R. K. Rajput, "A Textbook of Fluid Mechanics and Hydraulic Machines", 3rd Revision, 2006 edition S. Chand Publishing, New Delhi, ISBN – 10: 9789385401374.

Reference Books:

1. V. L. Streeter and E. B. Wylie, "Fluid Mechanics", 9th Edition, McGraw Hill Publications, New York, 2010. (ISBN – 10: 0070625379)
2. P.N. Modi and S.M. Seth, "Hydraulics & Fluid Mechanics" 22nd Edition, Standard Book House, Unit of Rajsons Publications Pvt Ltd., 2019.
3. Y. Cengel and J. Cimbala, "Fluid Mechanics", Tata McGraw Hill, New Delhi, 3rd edition, 2017. (ISBN-13: 978-9339204655)
4. S K Som, GautamBiswas, S Chakraborty, "Introduction to Fluid Mechanics & Fluid Machines", 3rd Edition, McGraw Hill Publications, 2011.

e – Resources:

1. https://nptel.ac.in/courses/105/103/105103095/
2. https://nptel.ac.in/courses/105/103/105103192/

PRJ: (CE308): Seminar and Technical Communication Skills

Teaching Scheme **Practical: 02 Hrs./ Week**	Examination Scheme **Term Work : 25 Marks**
Credits: 02	**Total : 25 Marks**

Prerequisite Course: Basic knowledge of Fundamentals in Civil Engineering

Course Objectives:

Sr. No.	Course Objectives
1	To develop skills in doing Literature Survey, Technical presentation and report preparation.
2	To enable project identification and execution to preliminary work on final year project

Course Outcomes (COs): This course will enable students to:

COs	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Analyse a current topic of professional interest and present it before an audience	4	Analyzing
2	Identify an engineering problem, analyse it and prepare a work plan to solve it.	4	Analyzing

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	3	3	3	3	3	3	2	3	3	2	2	3	2	3
CO2	2	3	3	1	3	1	2	2	2	3	3	1	2	3

Term Work should be prepared based on a Seminar report as per the guidelines.

The seminar report should contain the following.

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 eight 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.

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

required above. Internal guides may prepare a continuous evaluation sheet of each individual and refer it to the external examiner for consideration. The oral examination of each individual may then be conducted as per the practice adopted for other subjects.

PCC (CE309): Computer Aided Analysis and Design of Structure lab

Teaching Scheme	Examination Scheme
Practical: 02 Hrs./ Week	**Term Work : 25 Marks**
Credits: 01	**Total : 25 Marks**

Prerequisite Course: **Solid Mechanics, Analysis of Structures, Design of Steel Structures.**

Course Outcomes (COs): **This course will enable students to:**

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Draw models and elements of structures using recent software tools.	3	Apply
CO2	Calculate load combinations and various patterns of BMDs and SFDs.	4	Analyse
CO3	Analyze & Design segments industrial building.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & 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	1
CO2	3	1	3	1	3	-	-	-	-	-	-	1	3	1
CO3	3	3	3	1	3	-	-	-	-	-	-	1	3	1

Course Contents

Unit No	Topics	No of Hrs	COs
1	Introduction to Recent Software Drafting/Designing Tools in Civil Engineering.	4	CO1
2	Modelling of Structural Components using Software Tools.	4	CO1
3	Drawing SFDs and BMDs using recent tools for various supports.	4	CO2
4	Assigning of various load combinations on structural elements as per BIS	4	CO2
5	Analysis of a high-rise steel structure.	4	CO3
6	Design of industrial building (Steel Composited)	4	CO3

Reference Books:

1. IS 800 and IS 875
2. Staad Pro V8I For Beginners: With Indian Examples by T S SHARMA
3. ETABS Training manuals Created by Jessica Napier, last modified on Jul 09, 2014.

e – Resources:

1. For online courses- SWAYAM –https://swayam.gov.in
2. www..iitb.ac.in/nptel
3. https://www.udemy.com/course/staadpro-cs/

(HS316): Corporate Readiness-II

Teaching Scheme	Examination Scheme
Practical: 02 Hrs. / Week	**Term work : 50 Marks**
Credits: 02	**Total : 50 Marks**

Prerequisite Course: Quantitative aptitude, Verbal and non verbal communication

Course Objectives:

Sr. No	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): student will be able to:

COs	Course Outcome(s)	Blooms Technology	
		Level	Descriptor
1	Remember placement processes of various organizations and modern job search approach.	2	Create
2	Understand Industry Specific skill set with a view to design an Ideal Resume.	2	Apply
3	Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.	2	Understand
4	Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests.	4	Analyse
5	Evaluate Technical/General Dataset to interpret insights in it.	4	Analyse
6	Create an ideal personality that fits Industry requirement.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & 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
CO2	-	-	-	-	-	-	-	-	3	3	-	3	2	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3	2	3
CO4	-	-	-	-	-	-	-	-	3	3	-	3	2	3
CO5	-	-	-	-	-	-	-	-	3	3	-	3	2	3
CO6	-	-	-	-	-	-	-	-	3	3	-	3	2	3

Course Contents

Unit No	Topics	No. of Hrs.	COs
I	**Placement Awareness** Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	06	CO 1
II	**Resume Writing** Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	05	CO2
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	CO3
IV	**Logical Reasoning, I** Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic.	05	CO4
V	**Logical Reasoning II** Data Interpretation, Data Sufficiency	04	CO5
VI	**Logical Reasoning III** Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle.	05	CO6

Learning Resources :

Text Books:

1. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal
2. Reasoning verbal and non verbal by B. S. Sijwali.

Reference Books:

1 Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)
2 Analytical Reasoning by M. K. Panday
3Logical and analytical reasoning by K. Gupta
4Multi dimensional reasoning by Mishra & Kumar Dr. Lal

E- Books :

https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links:
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

MLC (MC310): Field Practices in Civil Engineering

Teaching Scheme	Examination Scheme
Lectures: 01 Hrs. / Week	**Audit Course- No credits**

Prerequisite Course: Basic civil Engineering, Building Technology and Materials.

Nos.	Course Objectives
1	To study the qualities of different construction materials in the field.
2	To evaluate the qualities of various items of building construction during execution in the field

Course Outcomes (COs): student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1.	Identify the qualities of different construction materials in the field.	2	Understand
2.	Survey qualities of various items of building construction during execution in the field	4	Analyse

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

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

Course Contents

Module No.	Module Title	No. of Hrs.	COs
I	**Site clearance and plinth construction:** Clearing the site considering sustainability, Plot demarcation, Stacking of materials on site. Excavation for foundation trenches considering site conditions, foundation, and refilling and plinth construction.(Note: Site visit is recommended).	03	1,2
II	**RCC Elements and Formwork:** Footing, Column, Beam and Slab- quality check of materials such as steel, cement, sand and Aggregates (only field tests), along with quality of Concrete and workmanship. **Form work:** Types, component parts and installation as per design and specifications. Scaffolding and types. (Note: Site visit is recommended)	03	1,2
III	**Masonry and Flooring work:** Brick and block masonry- quality check and workmanship, Requirements of a good partition wall, Composite masonry, **Flooring-** Materials, Types and construction. (Note: Site visit is recommended)	03	1,2

IV	**Finishing works:** Plastering- Types, ground work and methods of execution. Coloring - Types, surface preparation and methods of application.(Note: Site visit is recommended)	03	1,2

Reference Books:

1. Practical Handbook on Building Construction (English, Paperback, Er. M.K. Gupta , Roorkee), Nabhi Publication, Edition: 9th, 2019.
2. Karen Lee Hansen and Kent E Zenobia, "Civil Engineer's Handbook of Professional Practice", John Wiley & Sons, Inc., edition 2011.

(CE312): Water Resources Engineering

Teaching Scheme Lectures: 03 Hrs. / Week	Evaluation Scheme: CIA : 40 Marks End - Sem Exam : 60 Marks
Credits : 03	Total Marks : 100 Marks

Prerequisite Course: Basic Sciences, Fluid Mechanics.

Course Objectives:

Sr. No.	Course Objectives
1	To learn the precipitation, evaporation, infiltration its abstractions.
2	To compute runoff, stream flow and develop hydrographs.
3	To estimate peak flood, explain hydrologic routing and use of Q-GIS software in hydrology.
4	To learn the reservoir planning and evaluate the capacity of reservoir.
5	To analyze crop water requirement and determine design discharge of canal.
6	To study ground water hydrology, water logging, and drainage.

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

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	State and demonstrate precipitation, evaporation, infiltration its abstractions.	2	Understand
2	Compute runoff, stream flow and develop hydrographs.	4	Analyze
3	Estimate peak flood, explain hydrologic routing and use of Q-GIS software in hydrology.	3	Apply
4	Explain the concept of reservoir planning and evaluate the capacity of reservoir	4	Analyze
5	Analyze crop water requirement and determine design discharge of canal.	4	Analyze
6	Explain the concept of ground water hydrology, water logging, and drainage.	2	Understand

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	2	-	-	-	-	-	3	2
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	-	3	1	-	-	-	1	-	-	3	2
CO4	3	2	3	2	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	No. of Hrs	COs
I	**Introduction to Hydrology:** Hydrological cycle, practical applications. Hydrological data- classification of data and sources. Introduction to various government organizations. Climate change. **Precipitation:** Types, measurement, rain gauge network and consistency test. Presentation of rainfall data. Mean precipitation over an area: various methods. **Abstractions of Precipitation:** Interception, Depression storage, Evaporation: Concept, Factors affecting, measurement. Transpiration and Evapotranspiration: Process, measurement, Modified Penman method. Infiltration: Concept, Technical terms, Factors affecting, Measurement of infiltration, Horton's infiltration model, Intensity capacity curve, and Infiltration indices.	06	1
II	**Run-off:** concept of watershed, catchment and basin. Catchment characteristics- affecting the runoff, Rainfall-Runoff estimation using-empirical methods-Strange's table. **Runoff hydrograph:** Introduction, Factors affecting flood hydrograph, Components of hydrograph, Base flow separation- Effective rainfall. **Unit hydrograph:** Uses and Limitations of unit hydrograph, S-curve hydrograph, Concept of Synthetic unit hydrograph, and Instantaneous unit hydrograph (IUH). **Stream Gauging:** Selection of site, Stage discharge relationship- flow measurements.	06	2
III	**Floods and droughts:** Concepts of probable and design flood, 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. Q-GIS concept and application in hydrologic studies.	06	3
IV	**Reservoir Planning:** Introduction, Term related to reservoir planning, Investigation for reservoir planning, Significance and applications of mass and	06	4

	demand curves, Fixation of capacity from annual inflow and outflow, Reservoir losses. Reservoir sedimentation- Phenomenon, Measurement, Measures to control reservoir sedimentation, Density of sediment and Significance of trap efficiency. Watershed delineation. **Water Management:** Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Co-operative water distribution systems- Water Users Association (WUA). RWH in rural and urban areas.		
V	**Introduction to Irrigation:** Definition, Necessity and Advantages. Methods of Irrigation. Piped distribution network for irrigation (PDN) **Water Requirements of Crops:** Soil moisture and Crop water relationship, Classes and availability of soil water, Factors governing Consumptive use of water, Principal Indian crops, Duty and delta. Irrigation water requirement: Design discharge of canal and Storage capacity of reservoir based on irrigation requirement. **Assessment of Canal Revenue:** Introduction, Various methods of assessment.	06	5
VI	**Ground Water Hydrology:** Occurrence and distribution of ground water. Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well and Numerical on design of well. **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. **Hydraulic structures:** Necessity, location and types of dams, spillways, energy dissipation structures, and canal falls, cross regulators, head regulators, canal escapes, and canal outlets, cross drainage works. Important aspects of design of hydraulic structures.	06	6

Text Books:

1. Irrigation Engineering and Hydraulic Structures- S. K. Garg, Khanna Publishers, New Delhi, 2011. (36th Edition). ISBN – 13: 978-81-7409-047-8.
2. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Laxmi Publications, 2021, (17th Edition), ISBN: 9788131807637.
3. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House, New Delhi, 2020. ISBN: 978-81-87401-29-0.
4. Engineering hydrology-K. Subramanya, Tata McGraw Hill, 2020, (5th Edition). ISBN–10: 9390177502.
5. Introduction to Hydrology- Warren Viessman, Jr. and Gary L. Lewis, Pearson Singapore, 2012, (5th Edition). ISBN-13: 978-0673991652.
6. Water Resources Engineering, R.K. Linsley, and J.B. Franzini, McGraw Hill International Book Company, 1995.

Reference Books:

1. Elementary Engineering Hydrology- M.J. Deodhar-Pearson Education, New Delhi, 2008, (3rd

Edition).
2. Irrigation Engineering, H. M. Raghunath, Wiley Publication, 2011, ISBN: 9788126528813.
3. A Textbook of Hydrology by Dr. P. Jaya Rami Reddy, USP Publisher. 2016 (3rd Edition).
4. A Guide to Prepare Chapter on Irrigation Planning Aspects of Detailed Project Report by Central Water Commission (Irrigation Management Organization), September 2018. pp. 1-64.
5. A Guide for Estimating Irrigation Water Requirements by Govt. of India, Ministry of Irrigation (Water Management Division), May 1984. pp. 1-115.
6. Engineering Hydrology, E.M. Wilson, Palgrave Macmillan, 1990, (4th Edition), ISBN-13: 978-0333517178.
7. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
8. Applied Hydrology, Ven Te Chow, D.R. Maidment, and L.W Mays, McGraw Hill International Book Company, 1998.

e – Resources:

For online courses- SWAYAM –https://swayam.gov.in

www.iitb.ac.in/nptel

https://nptel.ac.in/courses/105/104/105104029/

(CE313): Design of Reinforced Concrete Structures

Teaching Scheme	Evaluation Scheme:
Lectures: 03 Hrs. / Week	**CIA : 40 Marks**
Tutorial : 01 Hrs./ Week	**End Sem Exam : 60 Marks**
Credits: 04	**Total : 100 Marks**

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

Course Objectives:

Sr. No.	Course Objectives
1	To learn basic fundamental philosophies used in the design of RCC structures using IS 456:2000 specifications.
2	To learn design of two-dimensional flexural elements like slab and staircase.
3	To analyse and design flexural elements in bending, shear and torsion.
4	To analyse and design axial, uni-axial and bi-axial column and its footing.
5	To learn ductile detailing of RCC elements as per IS 13920.
6	To develop their carrier in design of RCC structure.

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the various design philosophies, aware of different standards and use the fundamental concept of limit state method.	2	Understand
2	Design the different types of slabs.	4	Analyze
3	Design the stairs and beams for flexure.	4	Analyze
4	Design of beam subjected to bending, shear and torsion.	4	Analyze
5	Design of columns and its footing subjected to axial force and bending moments.	4	Analyze
6	Perform ductile detailing of various structural elements.	3	Apply

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

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

Course Contents

Unit No	Topics	No of Hrs	COs
I	**a) Introduction to design philosophies**: Historical development, Concept of working stress method, stress block parameters, Moment of Resistance (M.R.) of singly and doubly reinforced rectangular section. **b) Limit state method:** Concept of partial safety factors, load factors, stress-strain relationship, stress block parameters, failure criteria, Use of I.S. 456-2000, M.R. of singly, doubly reinforced rectangular section and flanged section.	06	1
II	**a) Design of One-way slab:** Simply supported, cantilever and continuous slabs. **b) Design of Two-way slab**: Simply supported, continuous and restrained. C) **Introduction to grid slab**: Types, methods of analysis, IS 456 Guidelines, Applications.	06	2
III	**a) Design of staircase:** Dog legged, open well and concept of stringer beam. **b) Design of rectangular beam sections only for flexure:** Cantilever, simply supported, continuous beams (singly reinforced, doubly reinforced section).	06	3
IV	**a) Design of flanged beam sections only for flexure:** Cantilever, simply supported, continuous beams (Flanged section). **b) Design of secondary reinforcement in beams:** Concept of Shear, Bond and torsion.	06	4
V	**a) Design of axially loaded short Column:** Introduction, strain and stress variation diagrams, minimum eccentricity requirements. Lateral ties, helical reinforcement, Design of short column for axial load. **b) Design of short Column subjected to bending:** effect of uni-axial and bi-axial bending, interaction curves, SP 16 guidelines, Design of column for uni-axial and bi-axial bending.	06	5

VI	**a) Design of isolated footing:** Critical section for B.M., Single and double shear, design of isolated pad footing and slopped footing. **b) Introduction to Ductile detailing**: Guidelines for ductile detailing of slab, staircase, beam, column and footing as per IS 13920, SP34. Introduction to earthquake resistant design.	06	6

Text Books:

1. Dr. V. L. Shah and Dr. S. R. Karve, "Illustrated Reinforced Concrete Design", 9th edition, Structures Publications, 2021, ISBN: 978819037172.
2. N. Krishna Raju and R.N. Pranesh, "Design of Reinforced Concrete Structures: Principles and Practice" 1st edition, New Age International Pvt Ltd Publishers 2018, ISBN: 978-8122414608.
3. S. Ramamrutham and N. Narayan, "Design of Reinforced Concrete Structures", 17st edition, 2013, ISBN: 978-0198086949.
4. B. C. Punmia, Ashok kumar Jain and Arun kumar Jain, "Comprehensive Design of R.C. Structures", 10th edition, Standard Book House, 2015, ISBN: 978-8131809426.

Reference Books:

1. S. U. Pillai and D. Menon, "Reinforced Concrete Design", 3rd edition, Tata Mc Graw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnram, "Limit State Analysis and Design", 5th edition, Wheeler Publishing company, New Delhi, 2017, ISBN: 978-9386479785.
3. N. Subramanian, "Design of Reinforced Concrete Structures", 1st edition, Oxford University Press, 2013, ISBN: 978-0198086949.
4. Dr. V. L. Shah and Dr. S. R. Karve, "Illustrated Design of Reinforced Concrete Buildings (G+3)", 9th edition, Structures Publications, 2021, ISBN: 978819037172.

I.S. Codes:

1. I.S.456: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS 875 Part I and Part II : Code of practice for design load, Bureau of Indian Standards, New Delhi.
3. IS 13920 Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
4. S.P. 16: Design aids for reinforced concrete. (Interaction Charts Only) Bureau of Indian Standards, New Delhi.
5. SP 34: Hand book on concrete reinforcement and detailing, Bureau of Indian Standards, New Delhi.

 # Latest Revision of Code book and SP shall be used.

e – Resources:

www.nptel.iitk.ac.in/courses/iitkharagpur

(CE314): Substructure Engineering

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem. Exam: 60 Marks**
Credits: 03	**Total : 100Marks**

Prerequisite Courses: Geotechnical Engineering

Course Objectives:

1	To study the various soil exploration techniques.
2	To study load transfer mechanism and evaluate bearing capacity of soil.
3	To study consolidation and settlement analysis of foundations.
4	To learn design of shallow foundations and to provide solutions for all types of soils.
5	To learn design of deep foundations and to provide solutions for foundations on problematic soils.
6	To study the problems and construction techniques related with black cotton soil and Machine foundation.

Course Outcomes (COs): Student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Interpret subsurface exploration for foundations using various methods.	2	Understand
2	Compute the soil bearing capacity by various analytical and field methods.	3	Apply
3	Illustrate the consolidation and settlement analysis of foundations.	3	Apply
4	Examine the soil condition and steps in geotechnical design of shallow foundation system.	3	Apply
5	Analyse the design criteria of deep foundations as per the prevailing site conditions.	4	Analyze
6	Demonstrate design principles for black cotton soil and design of Machine foundation.	3	Apply

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

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

Course Contents

Unit No	Topics	No of Hrs	COs
I	**a) Foundation perspective:** Role of civil engineer in the selection, design and construction of foundation of civil engineering structures. Types of foundations. **b) Subsurface Investigations:** objective, Methods of Investigation: Soil boring and sampling, Geophysical methods- Seismic refraction and Electrical resistivity method. penetration tests, correlations between penetration resistance and soil design parameters, Pressure meter test.	06	1
II	**Bearing capacity approaches:** Introduction, basic definitions, Modes of shear failure, bearing capacity theory- Terzaghi's, Meyerhof's, Hanson's, Skempton's, Vesic's, and IS code method. Bearing capacity of layered soil, bearing capacity evaluation: plate load test and SPT, Effect of water table on bearing capacity, Effect of eccentricity, Presumptive bearing capacity, bearing capacity of raft foundation, sheeting and bracing of foundation excavation.	06	2
III	**a) Consolidation** - Introduction, spring analogy, Terzaghi 's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- square root of time fitting method and logarithm of time fitting method. Time factor. Introduction of Normal consolidation, over consolidation and Pre consolidation pressure. **b) Settlement Analysis** -Introduction, Causes of settlement. Pressure bulb, Contact pressure, Significant Depth of foundation, Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, Consolidation settlement. Significance of plate Load test and standard penetration test in settlement analysis.	06	3
IV	**Shallow foundations:** Shallow foundation- Types and Applications. Floating foundation, Depth of Footing, Foundation loading, Principle of design of footings, Proportioning footings for equal settlement, Design of simple footing, combined footings, mat foundation, Numerical examples with codal provisions for safety and serviceability.	06	4
V	**Deep foundations**: Introduction, Pile classification, Pile Installation-Cast in-situ, driven and bored pile, Load carrying capacity of pile by static method, Dynamic Methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action- Feld rule. Rigid Blocks method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition, Types and uses. Well foundation: components, Sand Island method.	06	5
VI	**Foundation on Black Cotton Soils:** Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction	06	6

	techniques in B.C soils, under reamed Piles-Design principles and its construction Techniques. Stone Columns prefabricated vertical Drains, Preloading technique, and vibro flotation technique. **Machine Foundations:** Types of machine foundations, mathematical models, response of foundation – soil system to machine excitation, cyclic plate load test, block resonance test, criteria for design.		

Text Books:

1. K R Arora, Soil Mechanics and Foundation Engineering (Geotechnical Engineering), Standard Publishers Distributors, Nai Sarak, Delhi, 2008.
2. Gopal Ranjan and A. S. Rao, ―Basic and Applied Soil Mechanics‖, New Age International Publishers, (2010)
3. Dr. B. C. Punmia, ―Soil Mechanics and Foundation Engineering‖, Laxmi Publications.

Reference Books:

1. J E Bowles, Foundation Analysis and Design, McGraw-hill, New Delhi, 1997.
2. B M Das, N Sivakugan, Principles of Foundation Engineering, Cengage learning, Boston, 2018.
3. D P Coduto, M R Yeung, W A Kitch, Foundation Design: Principles and Practices, 3rd Ed, Pearson Education, USA, 2016.
4. S R Kaniraj, Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill Education Private Limited, New Delhi, 2009.
5. Foundation Design Manual: N V Nayak, Dhanpat Rai Publications.
6. Practical Handbook of Grouting: Soil-Rock and Structures---James Warner-- Wiley 15. IS 1892, 1893, 2911, 6403, SP36 (PART-II).

e – Resources:

3. https://onlinecourses.nptel.ac.in/noc24_ce01/preview
4. https://onlinecourses.nptel.ac.in/noc24_ce19/preview
5. https://onlinecourses.nptel.ac.in/noc24_ce30/preview

(PR316): Intellectual Property Rights and Entrepreneurship development
IPR and EDP

Teaching Scheme	Evaluation Scheme:
Lectures: 02 Hrs. / Week	**CIA : 20 Marks** **End Sem Exam: 30 Marks**
Credits: 02	**Total : 50 Marks**

Prerequisite Course: **Nil**

Course Objectives:

Sr. No.	Course Objectives
1	To introduce student with IPR
2	To explain IPR procedure in India such as Patents, Designs and Trademarks
3	To make aware economic importance of IPRs.
4	To develop ability to search and analyse the IPRs.
5	To Instill a spirit of entrepreneurship among the student participants.
6	To give insights into the Management of Small Family Business.

Course Outcomes (COs): **After the learning this course, the student will be able to;**

CO's	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Understand patenting system	2	Create
CO2	Understand the procedure to file patent in India	2	Apply
CO3	Understanding of financial importance of IPR	2	Understand
CO4	Search and analyse the patents, designs and Trademarks	4	Analyse
CO5	Identify the Skill sets required to be an entrepreneur.	4	Analyse
CO6	Understand the Role of supporting agencies and governmental initiatives to promote Entrepreneurship.	4	Analyse

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

Course Contents

Unit No	Topics	No of Hrs	COs
1	**Introduction to IPR** • Concepts of IPR • The history behind development of IPR • Necessity of IPR and steps to create awareness of IPR • Concept of IP Management • Intellectual Property and Marketing • IP asset valuation Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO.	4	1
2	**Patents** • Introduction to Patents • Procedure for obtaining a Patent • Licensing and Assignment of Patents i. Software Licensing ii. General public Licensing iii. Compulsory Licensing • Infringement of Patents • Software patent and Indian scenario	4	2
3	**Designs** • Registrable and non-Registrable Designs • Novelty & Originality • Procedure for Registration of Design • Copyright under Design • Assignment, Transmission, License • Procedure for Cancellation of Design • Infringement • Remedies	4	3
4	**Trademarks and Copy Rights** **A) Trademarks** • Concept of trademarks • Importance of brands and the generation of "goodwill" • Trademark registration procedure • Infringement of trademarks and Remedies available • Assignment and Licensing of Trademarks	4	4

	B) Copyright Right • Concept of Copyright Right • Assignment of Copyrights • Registration procedure of Copyrights • Infringement (piracy) of Copyrights and Remedies • Copyrights over software and hardware		
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	5
6	**Resources for Entrepreneurship** **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	6

Text Books:

1. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, New Delhi
2. The Indian Patent act 1970.
3. The copy right act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. Intellectual Property Rights- A Primer, R. Anita Rao & Bhanoji, Rao, Eastern BookCo.
9. The Dynamics of Entrepreneurial Development & Management by Desai, Vasant, Himalaya Publishing House, Delhi.
10. Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition.
11. Cases in Entrepreneurship by Morse and Mitchell, Sage South Asia Edition.
12. Entrepreneurship – Indian Cases on Change Agents by K Ramchandran, TMGH.

Reference Books :

1. Handbook of Indian Patent Law and Practice.
2. Entrepreneurship: New Venture Creation by David H. Holt.
3. Entrepreneurship Development New Venture Creation by Satish Taneja, S. L. Gupta.
4. Project management by K. Nagarajan.

e – Resources:

https://onlinecourses.nptel.ac.in/noc22_hs59/preview

(CE317): Water Resources Engineering Lab

Teaching Scheme	Evaluation Scheme:
Practical: 02 Hrs./Week	**Oral Exam : 50 Marks**
Credits: 01	**Total Marks : 50 Marks**

Prerequisite Course: Physics, Fluid Mechanics

Course Objectives:

Sr. No.	Course Objectives
1	To study and apply method to determine the precipitation, infiltration using various methods.
2	To develop a hydrograph, analyze and estimate the flood, and evaluate the reservoir capacity.
3	To introduce and apply Q-GIS software in hydrology.
4	To understand the working process of meteorological station/government organization/irrigation project.

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

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Estimate the rainfall data, and determine the precipitation/infiltration using various methods.	3	Apply
2	Develop a hydrograph, analyze the data, estimate the flood, and evaluate the reservoir capacity.	4	Analyze
3	Apply Q-GIS software in hydrology to draw the watershed structures.	3	Apply
4	State and understand the working process of meteorological station/government organization/irrigation project.	2	Understand

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	3	2	-	2	2	2	2	-	-	-	-	-	3	2
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	-	3	1	-	-	-	1	-	-	3	2
CO4	3	2	-	-	-	2	2	-	2	2	2	1	1	1

Term work will consist of the detailed report on assignments/practical performed (any 8).

List of Laboratory Experiments

Term work shall consist of a journal giving the detailed report on assignments/experiments performed and visit report.

1. Analysis of Rainfall Data –Double Mass Curve Technique.
2. Field Measurement of infiltration using double ring infiltrometer
3. Modeling the infiltration process using Horton Model
4. Delineation of Watershed- Q-GIS approach
5. Marking catchment area on toposheet and working out average annual precipitation and determining yield by various methods
6. Estimation of design storm using Gumbel's extreme value distribution
7. Determination of peak flood discharge in a basin using unit hydrograph method
8. Determination of storage capacity of reservoir using mass curve of inflow and outflow.
9. Site visit to meteorological station.
10. Field visit to any Irrigation Project- Canal/Reservoir.

Text Books:

1. Irrigation Engineering and Hydraulic Structures- S. K. Garg, Khanna Publishers, New Delhi, 2011. (36th Edition). ISBN – 13: 978-81-7409-047-8.
2. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Laxmi Publications, 2021, (17th Edition), ISBN: 9788131807637.
3. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House, New Delhi, 2020. ISBN: 978-81-87401-29-0.
4. Engineering hydrology-K. Subramanya, Tata McGraw Hill, 2020, (5th Edition). ISBN–10: 9390177502.
5. Introduction to Hydrology- Warren Viessman, Jr. and Gary L. Lewis, Pearson Singapore, 2012, (5th Edition). ISBN-13: 978-0673991652.
6. Water Resources Engineering, R.K. Linsley, and J.B. Franzini, McGraw Hill International Book Company, 1995.

Reference Books:

1. Elementary Engineering Hydrology- M.J. Deodhar-Pearson Education, New Delhi, 2008, (3rd Edition).
2. Irrigation Engineering, H. M. Raghunath, Wiley Publication, 2011, ISBN: 9788126528813.
3. A Textbook of Hydrology by Dr. P. Jaya Rami Reddy, USP Publisher. 2016 (3rd Edition).
4. A Guide to Prepare Chapter on Irrigation Planning Aspects of Detailed Project Report by Central

Water Commission (Irrigation Management Organization), September 2018. pp. 1-64.
5. A Guide for Estimating Irrigation Water Requirements by Govt. of India, Ministry of Irrigation (Water Management Division), May 1984. pp. 1-115.
6. Engineering Hydrology, E.M. Wilson, Palgrave Macmillan, 1990, (4th Edition), ISBN-13: 978-0333517178.
7. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
8. Applied Hydrology, Ven Te Chow, D.R. Maidment, and L.W Mays, McGraw Hill International Book Company, 1998.

e – Resources:

For online courses- SWAYAM –https://swayam.gov.in

www.iitb.ac.in/nptel

https://nptel.ac.in/courses/105/104/105104029/

(CE318): Computer Aided RCC Design Lab

Teaching Scheme	Evaluation Scheme:
Practical: 04 Hrs./ Week	**Oral Exam : 50 Marks**
Credits: 2	**Total : 50 Marks**

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

Course Objectives:

Sr. No.	Course Objectives
1	Analysis and design of various RCC structural elements for G + 2 building as per guidelines given in IS: 456-2000.
2	To understand basics of structural design and detailing for various RCC elements.
3	Design and detailing specifications for design documentation and use of design software.

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

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Apply basic guidelines of IS 456:2000 specifications.	3	Apply
2	Design and detailing of various RCC elements using LSM.	4	Analyze
3	Design documentation aspects of RCC structural elements through suitable software and site visit.	4	Analyze

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	3	2	3	---	---	---	---	---	---	---	---	---	3	3
CO2	3	2	3	---	2	---	---	2	2	2	2	---	3	3
CO3	3	2	3	---	2	3	---	2	2	2	2	---	3	3

List of Laboratory Work:

1. Assignment on IS 456-2000-guidelines for design of RCC elements.
2. Design of G + 2 (Residential/Commercial/Public) building covering all types of Slabs, Beams, Columns, Footings and Staircase. Slab area per floor should be greater than 200m^2.
3. To study the RCC structural drawing (Case study).
4. Detailing of serial No. 2, as per SP-34 & IS 13920. (Full imperial drawing sheets in four numbers, out of which only structural plan drawing sheet shall be drawn by using any drafting software).
5. Design any one structural element (slab/beam/column/footing) using any suitable design software like ETABS.
6. Design of slabs and beams using spread sheet/excel sheet.
7. Minimum two site visits of building under construction and study the reinforcement details learn in theory and actually provided on site and also ductile detailing. Write complete report including

cover, type of section, type of reinforcement, bent up bars, its location, lap splicing (location of lap joints, length), development length, shear reinforcement (stirrups, its location) lateral ties, dowel bars, etc.

Note: Maximum number of students for projects not more than four.

Text Books:

1. Dr. V. L. Shah and Dr. S. R. Karve, "Illustrated Reinforced Concrete Design", 9th edition, Structures Publications, 2021, ISBN: 978819037172.
2. N. Krishna Raju and R.N. Pranesh, "Design of Reinforced Concrete Structures: Principles and Practice" 1st edition, New Age International Pvt Ltd Publishers 2018, ISBN: 978-8122414608.
3. S. Ramamrutham and N. Narayan, "Design of Reinforced Concrete Structures", 17st edition, 2013, ISBN: 978-0198086949.
4. B. C. Punmia, Ashok kumar Jain and Arun kumar Jain, "Comprehensive Design of R.C. Structures", 10th edition, Standard Book House, 2015, ISBN: 978-8131809426

Reference Books:

1. S. U. Pillai and D. Menon, "Reinforced Concrete Design", 3rd edition, Tata Mc Graw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnram, "Limit State Analysis and Design" 5th edition, Wheeler Publishing company, Delhi, 2017, ISBN: 978-9386479785.
3. N. Subramanian, "Design of Reinforced Concrete Structures", 1st edition, Oxford University Press, 2013, ISBN: 978-0198086949.
4. Dr. V. L. Shah and Dr. S. R. Karve, "Illustrated Design of Reinforced Concrete Buildings (G+3)", 9th edition, Structures Publications, 2021, ISBN: 978819037172.

I.S. Codes:

1. I.S.456: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS 875 Part I and Part II: Code of practice for design load, Bureau of Indian Standards, New Delhi.
3. IS 13920: Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
4. S.P. 16: Design aids for reinforced concrete. (Interaction Charts Only) Bureau of Indian Standards, New Delhi.
5. SP 34: Hand book on concrete reinforcement and detailing, Bureau of Indian Standards, New Delhi.

 # Latest Revision of Code book and SP shall be used.

e – Resources:

1. www.nptel.iitk.ac.in/courses/iitkharagpur

(CE319): Project Based Learning

Teaching Scheme	Evaluation Scheme:
Practical: 02 Hrs./ Week	**Term Work : 25 Marks**
Credits: 1	**Total : 25 Marks**

Preamble

- For better learning experience, along with traditional classroom teaching and laboratory learning, project-based learning has been introduced to motivate students to learn by working in a group cooperatively to solve a problem. Project-Based Learning (PBL) is a student-centered and experimental approach to education promoting 'deeper learning' through active exploration of real-world problems and challenges.
- A central goal of PBL is to facilitate the deeper learning process and support students' acquisition of complex cognitive competencies., rigorous content knowledge and critical thinking skills. The PBL engages students in the problem definition, design process, contextual understanding, and systems thinking approaches. In the PBL approach, learning based on memorization is de-emphasized and more emphasis is given on understanding and application of engineering design principles. Because of frequent assessments throughout the course, plagiarism can be more easily controlled.

Course Objectives:

Sr. No.	Course Objectives
1	Impart technical knowledge and skills, and develop deeper understanding to integrate knowledge and skills from various areas.
2	Build critical thinking, problem-solving, communication, collaboration and creativity, and innovation amongst students
3	Make students aware of their own academic, personal, and social developments.
4	Develop habits of self-evaluation and self-criticism, against self-competency and trying to see beyond own ideas and knowledge

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

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Identify, learn, and study the project problem.	2	Understand
2	Apply knowledge of mathematics, basic sciences, and Civil engineering fundamentals to develop solutions for the project.	3	Apply
3	Learn to work in teams, and to plan and carry out different tasks that are required during a project.	2	Understand
4	Understand their own and their team-mate's strengths and skills.	2	Understand
5	Draw information from a variety of sources and be able to filter and summarize the relevant points.	2	Understand
6	Communicate to different audiences in oral, visual, and written forms.	2	Understand

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

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

Course Contents

PROCEDURE:

- From each batch, a group of 4-5 students will be assigned to a faculty member called a mentor. Based on the engineering knowledge of a group and societal and industry problems, the mentor has to guide a group to identify project problems and plan the work schedule. Here, the expected outcomes of the project must be noted.
- The complete work-plan should be divided in the form of the individual tasks to be accomplished with targets. Weekly review of the completed task should be taken and further guidelines are to be given to a group. The final activity will be presenting the work completed and submitting the report.
- A group should be promoted to participate in a competition or write a paper. A problem needs to refer back to a particularly practical, scientific, social, and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry. There are no commonly shared criteria for what constitutes an acceptable project.
- Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and the structure of the activity.
- It may have

  ✓ A few hands-on activities that may or may not be multidisciplinary.

  ✓ Use of technology in meaningful ways to help them investigate, collaborate, analyse, synthesize, and present their learning.

  ✓ Activities on solving real-life problems, investigation /study, and writing reports of in-depth study, fieldwork.

ASSESSMENT

- The department/mentor is committed to assess and evaluate both students' performance and course effectiveness. The progress of PBL is monitored regularly every week.
- During the process of monitoring, continuous assessment and evaluation the individual and team performances are to be measured by supervisor/mentor and authorities.
- Students must maintain an institutional culture of authentic collaboration, self-motivation, peer

learning, and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and students must actively participate in the assessment and evaluation processes. Groups may demonstrate their knowledge and skills by developing a solution to the problem, public product, and/or report and/or presentation.

✓ Individual assessment for each student (Understanding individual capacity, role, and involvement in the project)

✓ Group assessment (roles defined, distribution of work, intra-team communication and togetherness)

✓ Documentation and presentation

EVALUATION AND CONTINUOUS ASSESSMENT:

- It is recommended that all activities are to be recorded in a PBL workbook regularly, regular assessment of work to be done and proper documents are to be maintained at the department level by both students as well as a mentor. Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department. Recommended parameters for assessment, evaluation, and weightage are as follows.

  ✓ Idea Inception (**5%**)

  ✓ Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (**50%**) (Individual assessment and team assessment)

  ✓ Documentation (Gathering requirements, design and modelling, implementation/execution, use of technology and final report, other documents) (**25%**)

  ✓ Demonstration (Presentation, User Interface, Usability, etc.) (**10%**)

  ✓ Contest Participation/ publication (**5%**)

  ✓ Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (**5%**)

- PBL workbook will serve the purpose and facilitate the job of students, mentors, and project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken

Reference Books:

Sr. No.	Title of Book	Authors	Publication House	Accession No
1.	The essential guide to doing your research projects	Zina O'Leary	SAGE	
2.	Research Methodology	C R Kothari	New Age International Publishers	

(CE320): Creational Activity

Teaching Scheme	Evaluation Scheme:
Practical: 02 Hrs./ Week	**Term Work : 25 Marks**
Credits: 1	**Total : 25 Marks**

Prerequisite Course: Nil

Course Objectives:

Sr. No.	Course Objectives
1	To expose students to real-time life challenges
2	To provide the opportunity to gather data, analyze data, propose solutions and implement solutions.
3	To make students ready to take up projects having a social impact and creating digital awareness.

Course Outcomes (COs): student will be able to:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Students personal development and creative mind as an engineer who are proud volunteers with a sense of achievement	2	Understand
2	To helps the students to strengthen their soft skills, leadership qualities and team spirit.	2	Understand
3	To inculcate entrepreneurial mindset and societal commit.	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	3	---	---	---	---	---	2	---	2	---	---	---	3	3
CO2	3	---	2	---	---	---	2	---	2	---	---	---	3	3
CO3	3	---	2	---	---	---	2	---	2	---	---	---	3	3

Course Contents

The objectives of AICTE student activity are to expose students to real-time life challenges, to provide the opportunity to gather data, analyze data, propose solutions and implement solutions. Also, it paves the way for personal development and creative engineers who are proud volunteers with a sense of achievement and ready to take up projects having a social impact and creating digital awareness. Besides, it helps the students to strengthen their soft skills, leadership qualities and team spirit. Moreover, these activities inculcate entrepreneurial mindset and societal commit. Following are the various activities conducted by the institution to enable AICTE creational activity

1. Swachh Bharat Abhiyan
2. Awareness programme on the importance of education

3. Digital awareness programme
4. Rainwater Harvesting Awareness programme
5. Street Play on Road Safety, Water Conservation, Family relationships, social media Addiction

Activity No.	Name of the Activity	Guidelines for the activities
1	Swachh Bharat Abhiyan	As part of All India Council for Technical Education (AICTE) creational activity programme, the students Civil Engineering will visit nearby village to contribute to Swatch Bharat a national level of initiative of Government of India. The swatch Bharath campaign will hold at the nearby village. Swatch Bharath Abhiyana is one of the most significant and popular mission to have taken place in India. Swatch Bharath Abhiyana is a great step towards the Clean India. Student teams will collect waste plastics, plastic bottles and many unwanted plastic materials from nearby village & clean the environment to create awareness in the local residents. They will also spread the awareness on disposal of plastic & how plastic affect the human life & environment. Students team will motivate the locals towards clean India This campaign is important for overall development of the citizens in terms of health & wellbeing.
2	Awareness programme on the importance of education	To spread awareness about the importance of education in villages through AICTE creational Activity Programme to be conducted. Aim of this programme is to create awareness toward the higher education for the student and the Parents. A group of students will visit nearby Government schools of Kopargaon and will guide the students toward the Quality education, how to prepare a Board exam and the importance of education and its impact. Students will be given proper guidance about the evolving technologies their quarries regarding the career opportunities will be discuss during this awareness program. It will be a fruitful interaction which is blissful in terms of exchange of knowledge, ideologies between the engineering graduated & young budding talents. The village students will also provide with other information on career opportunities available in field other than that related to technical ones, like Army Administrative services, IAS, IPS etc. Students will

		conduct this activity in each school & help village students to understand how education is important for their life & society.
3	Digital awareness programme	Digital Awareness Program, which was made compulsory by All India Council for Technical Studies (AICTE) for technical education and to promote development in the country in a coordinated and integrated manner by the upcoming generation. Door to door "Digital awareness in nearby village. and make them aware about the various necessities of our country nowadays. It includes Aadhar card, Passport, CBSE education, EPFO, Pay Income tax, PMAY, Pan card and Bharat gas. ALSO to aware them about the various necessities of our country like pan card, Aadhar card, passport, google pay, Digi locker, online gas booking etc.
4	Rainwater Harvesting Awareness programme	Students to be made aware about the water scarcity problem in tour area and shared different economically feasible options like rainwater harvesting. water usages are increasing day by day, but awareness of water management for the people in the world are insufficient. Rainwater harvesting is the process of augmenting the natural filtration of rainwater into the underground formation by some artificial methods Students will aware the villagers about the Rooftop rainwater harvesting (RTRWH) that it is the most common technique of rainwater harvesting (RWH) for domestic consumption in rural areas and this is most often done at small-scale. It is a simple, low-cost technique that requires minimum specific expertise or knowledge and offers many benefits
5	Street Play on Road Safety, Water Conservation, Family relationships, social media	Students will do street play on the topic how road safety is impotent in avoiding accidents and will make the people aware about road safety., Also what safety measures to be done for minimizing road accident
6.	Civil Construction material related Market survey, Cost analysis	Construction material related Market survey, Cost analysis to be done by visiting the vendors who are selling the construction material. Also, students are expected to do the cost analysis
7.	Model Making related to low-cost housing, green building, Net Zero Carbon, Ecofriendly construction material, & energy conservation	Making of models by students related to low-cost housing, green building, Net Zero Carbon Ecofriendly construction material, & energy conservation

References:

1. AICTE guidelines for Activity Chapter Six
2. AICTE Activity Point Program Report by PES College of Engineering, Mandy Karnataka

(MC321): Mandatory Course VI-Formwork in Constructions

Teaching Scheme	Evaluation Scheme
Lectures: 01 Hrs./ Week	**Continuous Assessment**
Credits: 00	**00**

Prerequisite Course: Building Construction, Concrete Technology.

Course Objectives:

Sr. No.	Course Objectives
1	To demonstrate the purpose of formwork and its application.
2	To select the proper formwork for various RCC elements.
3	To know the safety standard in formwork construction.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Demonstrate the importance of formwork, types and their applications.	2	Understand
2	Analyze and design formwork for various RCC elements.	4	Analyze
3	Apply safety standard in formwork construction.	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	3	---	---	---	---	---	2	---	2	---	---	---	3	3
CO2	3	---	2	---	---	---	2	---	2	---	---	---	3	3
CO3	2	---	---	---	---	---	2	---	1	---	---	---	2	2

Course Contents

Unit No.	Topic	No. of Hrs.	COs
I	**Introduction:** Purpose, materials, historical development and current trends, requirements of good formwork and technical terms. **Types of formworks based on materials:** Timber, steel, plywood, aluminium, plastics, Slip form technology (Alluform). Properties and suitability. **Types of Formworks Based on Structural Member:** Formwork for slab, beams, columns, walls, staircase, foundations. (case studies)	04	1
II	**Formwork design consideration:** prime requirements, important parameters for formwork design, IS 14687 specifications. **Design of formwork:** Load calculation, effect of rate of concrete pouring, design of steel and timber formwork.	04	2
III	**Removing the formwork**: Stripping time, procedure to remove formwork of slab, beam, column, footings, staircase, arches, IS 456 recommendations, safety consideration during erection and dismantling. Checklist, (Recommended site visit and case studies).	04	3

Text Books:

1. Kumar Neeraj Jha, "Formwork for Concrete Structures" McGraw Hill Education, 4th edition, 2019.
2. David W Johnston, "Formwork for Concrete" ACI Manual SP-4,8th edition, 2014.
3. Punmia B. C. and Arunkumar Jain, "Building Construction", Laxmi Publishers Pvt. Ltd, New Delhi, 2000.

Reference Books:

1. Leonard Koel, "Concrete Formwork", Amer technical publication, 5th edition, 2015.
2. Austin C. K., "Formwork Work for Concrete", Cleaver-Hume Press Ltd., London, 1996.
3. P.S. McAdam and G.W.Lee, "Formwork-A practical guide", Taylor and Francis, 1st edition, 2010.

I.S. Codes:

1. IS: 14687-1999: Guidelines for false work for concrete structures.
2. I.S.456-2000: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.

e – Resources:

www.nptel.iitk.ac.in/courses/iitdelhi/formwork in constructions

(PE315): Professional Elective-II

(PE315-a): Water Treatment and Distribution

Teaching Scheme **Lectures: 03 Hrs. / Week**	**Evaluation Scheme:** **End-Sem Exam: 60 Marks** **CIA : 40 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: Chemistry, 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 acquire the knowledge of aeration and sedimentation of water.
3	To learn coagulation and flocculation process for removal of turbidity
4	To study filtration mechanism, filter media and types of filters
5	To acquire the knowledge of advanced treatment techniques and disinfection
6	To learn the various distribution systems, plumbing fixtures and government initiative in water infrastructure development

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 and characteristics of water	2	Understand
2	Apply the knowledge for hydraulic design of aeration and sedimentation units	3	Apply
3	Implement coagulation and flocculation process for removal of turbidity.	3	Apply
4	Interpret filtration mechanism, types of filters and design of rapid sand filter	3	Apply
5	Demonstrate the advance treatment techniques and disinfection of water.	3	Apply
6	Make use of various techniques in distribution of water and water infrastructure.	3	Apply

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

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

Course Contents

Unit No.	Topic	No. of Hrs.	COs
I	**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). Characteristics of water for different sources like *i.e.* dug-well, bore-well, river, streams, lakes etc. **Water Demand:** Types of demand, factors affecting rate of demand, water system losses, population forecasting.	06	1
II	**Water Treatment:** Necessity and objectives, principles of water treatment operations and processes, water treatment plant flow sheet, criteria for site selection for WTP. **Aeration:** Process details and design consideration of aeration unit. **Sedimentation:** Types of sedimentation, efficiency of an ideal settling basin, types of sedimentation tanks, design of sedimentation tank, introduction of tube settlers.	06	2
III	**Coagulation and flocculation:** Principle of coagulation, common coagulants, other coagulant aids like bentonite clay, lime stone, silicates and polyelectrolytes and natural coagulants, jar test for optimum dose of coagulant. flocculation, factors affecting, mean velocity gradient and power consumption, 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, dual and multimedia filters, deep granular filters. Tertiary treatments methods.	06	4

V	**Disinfection:** Mechanism, factors affecting disinfection, methods of disinfection, chlorination- types and methods, bleaching powder estimation, non-chemical methods of disinfection- Ozonation and UV radiations, other methods of disinfection at household level. **Advanced water treatments-** Water softening, base exchange or zeolite process, demineralization, desalination, membrane filtration and reverse osmosis, adsorption, and use of Nano technology in water treatment.	06	5
VI	**Water distribution system and government initiatives for water infrastructure:** Continuous and intermittent system, different types of distribution network and their limitations, ESR- Design of ESR capacity, packaged treatment plants, introduction to SCADA system, 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.	06	6

Text Books:

1. Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai 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:

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).
5. **IS 1172:1993, IS 2065:1983, IS 7208:1992, IS 8419(Part 1):1977, IS 10261:1982, IS10553(Part 1):1983, IS 10500(2012)**

(PE315-b): Advanced Surveying

Teaching Scheme **Lectures: 03 Hrs. / Week**	**Evaluation Scheme:** **End-Sem Exam: 60 Marks** **CIA : 40 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: Surveying

Course Objectives:

Sr. No.	Objectives
1	To learn the concepts of geodetic and aerial surveying
2	To understand methods of advanced surveying and their application over ground, water and air surveying
3	To understand the principles and usage of modern surveying instruments
4	To summarize the applications of remote sensing, GPS and GIS in survey works
5	To know the various measurement devices related to drone surveying
6	To draw the topographic map using LIDAR survey.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the geodetic and aerial surveying principles	2	Understand
2	Apply the sounding techniques in hydrographic surveying and to know the theory related to astronomical surveying.	3	Apply
3	To understand the principles and various uses of modern surveying instruments.	2	Understand
4	Evaluate ground data using satellite images, GIS processing and remote sensing techniques.	4	Analyze
5	Analyze the drone surveying data with different software.	4	Analyze
6	Draw the topographic maps using LIDAR surveying.	4	Analyze

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

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

Course Contents

Unit No.	Topic	No. of 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. **Aerial Surveying:** Introduction, classification, Applications, comparison of map and aerial photograph, Types of photographs, Scale and Relief displacement in vertical photograph.	6	1
II	**Field Astronomy and hydrographic surveying** Introduction, Instruments and purpose, Astronomical terms, Time and conversion of time, Abbreviations, Determination of azimuth, Latitude and longitude **Hydrographic Surveying:** Introduction, application, Shore line survey, Establishing horizontal and vertical controls. Sounding and its measurements using various equipment.	6	**2**
III	**Modern Survey Instruments – Principles and working** Introduction, Digital levels, Electromagnetic Distance Measurement Instruments, Electronics Theodolite, Total station, LiDAR Scanners for Topographical survey, Digital Planimeter, Hand held and geodetic receivers, LDM (Laser Distance meter), GPS and DGPS.	06	3
IV	**Remote Sensing and Geographical Information System** Introduction, principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation, Digital image processing, Image enhancement, Information extraction. Global positioning system – Principles – Receivers- Errors – Measurement Techniques – GPS modernization. GNSS – Segments, IRNSS, GAGAN, Application of NDVI technique.	06	4
V	**Drone Technology** Historical development of drone vehicles, guidelines of drone flying in India, different drone parts and their contribution for successful flight operation in surveying, concepts of drone data processing systems,	06	5

	measuring devices and metrological aspects in drone engineering and applications of various software.		
VI	**Topographic Mapping with LIDAR** Introduction to the capabilities of lidar sensors and platforms, data processing systems, and derived digital data products. Broad range of applications, topographic mapping, flood inundation studies, vegetation analysis, and 3D modeling of urban infrastructure.	06	6

Text Books:

1. Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi
2. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune Vidhyarthi Griha.
3. Advanced Surveying: Total Station, GPS, GIS & Remote Sensing, Gopi Satheesh, R. Sathiskumar, N Madhu, Pearson Education, 2017, 2nd Edition.
4. Remote Sensing and image interpretation by Lillesand T.M. and Kiefer R.W.
5. Engineering Surveying: Theory and Examination Problems for Students by W. Schofield, Butterworth, Heinemann, Oxford.

Reference Books:

1. Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi
2. Basak, N.N., Surveying and Levelling, Tata McGraw Hill, New Delhi.
3. Agor, R., Surveying and Levelling, Khanna Publishers, New Delhi.

e – Resources:

https://onlinecourses.nptel.ac.in/noc20_ce16/preview
https://nptel.ac.in/courses/105107121
https://archive.nptel.ac.in/courses/105/104/105104100/#
http://nptel.iitm.ac.in
http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT- ROORKEE/SURVEYING/home.htm

(PE315-c): Rural and Urban Town Planning

Teaching Scheme:	Evaluation Scheme:
Lectures: 03 Hrs./ Week	**CIA : 40 Marks** **End Sem Exam : 60 Marks**
Credits: 03	**Total: 100 Marks**

Prerequisite Course: Fundamentals of Building and Architectural Planning

Course Objectives:

Sr. No.	Course Objectives
1	To allow the students for study a subject of their interest and develop theoretical as well as practical understanding of the same.
2	To introduce the fundamental concepts, theories and departments involved for preparation of various plans for rural and urban planning.
3	To know the quantitative and qualitative aspects of assessing Housing.
4	To know the different Authorities involved and their regulations in rural and urban planning.
5	To study the techniques of Planning and design criteria for modern neighbourhoods.
6	To Understand the Housing Development Process and role of Financing Organizations.

Course Outcomes (COs): On successful completion of this course, the learner will be able to

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Know the principles of Rural and Urban Town Planning for improving quality of life	2	Understand
2	To understand and demonstrate planning strategy with reference to guidelines, acts, regulations and norms lay down by Authorities.	3	Apply
3	To apply planning guidelines, acts, regulations and norms in infrastructure networks and services planning.	3	Apply
4	To apply planning guidelines, acts, regulations and norms for development plan preparation.	3	Apply
5	To apply various methodology and Planning Techniques for sustainable planning.	3	Apply
6	To understand the housing development process and its other related components.	2	Understand

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

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

Course Contents

Unit No.	Topic	No. of Hrs.	Cos
I	**History of Human Settlement & Planning Principles:** Historic determinants, settlement types: ancient, medieval, renaissance and industrial age. Origin and evolution, Impacts of Industrial revolution, categories of urban and rural settlement in terms of size and function, post-Independence rural and urban development; government initiatives, categories of urban structures and growth, rural-urban migration.	06	**02**
II	**Development Authorities:** Fundamental problems of the city; technological, social and other changes in size and scale. Organizations for rural and Urban Development and management, development authorities and their jurisdictions; HUDCO, TCPO, CPWD, SRA, MMRDA, PMRDA, CIDCO, MHADA, functions, organization structure and resources. **Development Regulations:** Bye-laws; Requirements for grant of building permissions; Streamlining the development control regulations; URDPFI and AMRUT Guidelines, National Building Code (NBC 2005:2016) provisions and implementation. Land acquisition rehabilitation and resettlement Act, 2013, MAHA-RERA.	06	**02**
III	**Infrastructure Networks and Services Planning:** Assessing Housing; Housing Need, Housing Demand - Understanding current methods of demand assessment; Data required for provision & planning of urban and rural infrastructure, Types, significance, urban services, classification and significance, concepts and theories for design and operation, components, requirements of appropriate technology, cost recovery. Norms and policies water supply, sewerage, storm water network, solid waste management, street lighting, health, education, fire protection, recreation & open space.	06	**03**

IV	**Development Plan Preparation:** Objectives, contents and procedures for preparation & implementation of Regional Plans, development plans, town planning schemes. Significance of Land Development Control, evaluation of Zoning, sub- division regulations, Types of development plans: master plan, city development plan, structure plan, district plan, action area plan, subject plan, town planning scheme, regional plan, sub-regional plan; development control regulations, SEZ and CRZ, Implications of violations of development control regulations, Definition and explanation of the concepts of density, FAR, land use and zoning.	06	**03**
V	**Planning Techniques:** Methodologies for preparation of urban / regional development plans, types of development control; Role of Urban planners and architect in sustainable planning, concept of green residential cluster, Concept of Eco-city; provision of green belt, Eco-friendly industrial location and planning, development of existing water bodies, Concept of Smart City. **Landscaping:** Purpose of landscape, Landscaping impacts on the environment, planning landscape area in rural and urban areas. Plan landscape area and green roof design.	06	**03**
VI	**Housing Development Process:** Housing demand models. Inner city housing, Low-cost housing. Slums and cluster development, Squatter housing, Unauthorized Housing; Public and private sector housing; Housing policies and finance, role of co-operative housing, Housing Boards - NHB, HFIs, central, state, urban and local bodies, Pradhan Mantri Awas Yojana (PMAY) housing finance; HDFC, LIC, GRUH, Private developers, co-operatives. Role of different institutions in housing; International agencies, NGOs.	06	**02**

HUDCO- Housing and Urban Development Corporation.
TCPO-Town & Country Planning Organisation
CPWD- Central Public Works Department
SRA-Slum Rehabilitation Authority
MMRDA- Mumbai Metropolitan Region Development Authority
CIDCO - City and Industrial Development Corporation of Maharashtra Ltd.
MIDC - Maharashtra Industrial Development Corporation Ltd.
MHADA - Maharashtra Housing Development Corporation Ltd.
AMRUT – Atal Mission for Rejuvenation and Urban Transformation
LACRRIS – Land Acquisition Compensation Rehabilitation Resettlement Information System
MRTP – Maharashtra Regional and Town Planning Act
URDPFI – Urban and Regional Development Plans Formulation and Implementation.
CPHEEO – Central Public Health and Environmental Engineering Organization.
IRC – Indian Road Congress.
IRDP- Integrated Rural Development Program
PMAY - Pradhan Mantri Awas Yojana
MAHA-RERA: Maharashtra Real Estate Regulatory Act (Authority)
SEZ - Special Economic Zone

CRZ - Coastal Regulation Zone
GRUH - Gujarat Rural Housing Finance Corporation
NGO - Non-Governmental Organization

Text Books:

1. S. C. Rangwala, Town Planning, Charotar Publishing House Pvt. Ltd.
2. G. K. Bandyopadhyay, Textbook of Town Planning,
3. Modak N.V., Ambedkar V.N., Town and Country Planning and Housing, Orient Longman Limited.
4. Gupta R.G., Planning and Development of Towns, New Delhi.
5. Dwivedi R. M. (2007), "Urban development and housing in India 1947-2007" New Century Publications, New Delhi.
6. Fredrick Gibberd:" Town Design", Architectural Press, London.
7. Michael Laurie, Correa, Charles. An Introduction to Landscape Architecture, American Elsevier Publishing Company.
8. Thames and Hudson, Housing and Urbanisation. London: 2000.
9. T.M. Vinodkumar, "Networks and services", ITPI Reading Manuals.

Reference Books:

1. MRTP Act 1966: The director, government printing, stationary and publications, Maharashtra state, Mumbai.
2. URDPFI & AMRUT Guidelines: Ministry of housing and urban affairs, Government of India.
3. LARR Act 2013: Ministry of law and justice, Government of India.
4. CPHEEO, "CPHEEO Manuals on water supply, sewerage, drainage and solid waste management.
5. TCPO and Ministry of Works and Housing, "Norms and Standards for Urban Water Supply and Sewerage Services", New Delhi.
6. G. K. Hiraskar, Town Planning, Dhanpat Rai Publications.
7. Mohanty, Swati. Slum in India. New Delhi: APH Publishing Corporation, 2005.
8. D. Heggade and F. Cherunilam, "Housing in India", Himalaya Publishing House, Bombay.
9. McLoughlin, J. B., Faber and Faber, London, Urban and Regional Planning: A systems approach,
10. Gallion, Arthur, The Urban Pattern. New Delhi: CBS Publishers and Disrtibuters, 2003.
11. Tan Yigitcanlar," sustainable urban and regional infrastructure development: technologies, application and management, 2010 IGI Global publishing company.
12. Charles Abrahms, "Housing in the Modern World", Faber and Faber, London.
13. Indian Road Congress 2009: Guidelines on Landscaping and Tree Plantation.

e-resources:

https://onlinecourses.nptel.ac.in/noc23_ar15/preview
https://onlinecourses.nptel.ac.in/noc23_ar12/preview
https://onlinecourses.nptel.ac.in/noc23_ar08/preview
https://dtp.maharashtra.gov.in/en/e-services

(PE315-d): Ground Improvement Techniques

Teaching Scheme	Evaluation Scheme:
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam: 60 Mark**
Credits: 03	**Total Marks: 100**

Prerequisite Course: Geotechnical Engineering

Course Objectives:

Sr. No.	Course Objectives
1	To develop an awareness of problematic soils and ground improvement techniques based on soil conditions.
2	To make capable of choosing and designing the appropriate method of Ground Improvement according to site conditions and requirement.
3	To understand compaction, stabilization, grouting technique, use of Geosynthetics in ground improvement and reinforced earth.
4	The mechanical methods and suitable equipment to proliferate the ground for making the soil to withstand all the loads acting on it.
5	The physical, chemical and hydraulic modification methods and its applications for strengthen the soil.
6	The applications of modern methods in civil construction alteration works, short creating, soil reinforcement, soil nailing, bolting involved in inclusion and confinement process.

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

CO. No.	Course Outcomes (COs)	Blooms Taxonomy	
		Level	**Descriptor**
1	Identify the issues concerning problematic soil and appropriate ground-improvement techniques to get the best construction site for long-lasting structures.	3	Apply
2	Demonstrate the process of mechanical compaction in effect to produce fully dense soil.	2	Understand
3	Identify the importance, chemical types used as admixtures, and design techniques of them.	3	Apply
4	Demonstrate the various grouting techniques along with the way they may be used to improve the capacity of subsurface soils to support pressure.	2	Understand
5	Apply a variety of kinds of Geosynthetics and the manner in which they are used in various civil engineering contexts.	3	Apply
6	Apply soil reinforcement, grid reinforcement, ground anchors, rock bolts, and soil nails are used in practice to strengthen and preserve soil.	3	Apply

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

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

Course Contents

Unit No	Unit Title	No. of Hours	COs
I	**Introduction to Ground Improvement**: Need for Ground Improvement, Different types of problematic soils, classification of ground improvement techniques, Emerging trends in ground Improvement techniques, economic, sustainable considerations and suitability. Soil distribution in India- Reclaimed soils.	06	1
II	**Mechanical Techniques:** Introduction, Shallow surface compaction - Methods of compaction, Principles of compaction, Moisture Density relationship, Properties of compacted soil, Compaction Control Tests, Dynamic compaction, Deep Compaction – Explosion- heavy tamping-vibro-compaction and vibro-replacement, Liquefaction of soils and its remedial measures, Expansive soil and its Remedy.	06	2
III	**Soil Stabilization:** Introduction, Methods of stabilization, Shallow Stabilization with Additives: Lime, fly ash, cement and other chemicals and bitumen; Deep Stabilization: sand column, stone column, sand drains, prefabricated drains, electro osmosis, lime column. Soil-lime column. Recent Case study.	06	3
IV	**Modification by Grouting:** Grouting technology, Categories of grouting, Grout materials, physical and chemical properties, strength, Rheological aspects of course and fine grouts, penetrability and performance aspect of course and fine grouts, Suspension grouts and solution grouts, Various application of grouting.	06	4
V	**Geosynthetics:** Introduction, Functions of Geosynthetics, Selection of Geosynthetics, Application areas, Design of Geotextiles, Geogrids, Geonets and Geomembranes.	06	5

	Geosynthetics Application: Geosynthetics in roads and railways; separations, drainage and filtering in road pavements and railway tracks; overlay design and construction; AASHTO and other relevant guidelines; French drains.		
VI	**Reinforced Earth and Anchors:** Necessity of reinforced earth, theory of reinforced earth, materials and method, application, Design of Reinforced Earth Wall, characteristics of reinforced earth masses. Introduction to soil nailing and ground anchors; Applications, types and components, Anchor tests. Rock bolts – Applications and types- Rock bolt action around an excavation. Capacity of shallow horizontal and vertical strip anchors by using Mononobe-Okabe method, Soil Nailing – construction sequence – analysis of nailed soil.	06	6

Text Books:

1. M. R. Haussmann; Engineering Principles of Ground Modification; Tata McGraw-Hill Inc., USA.ISBN:
2. G.L. Sivakumar Babu, "An Introduction to Soil Reinforcement and Geosynthetics", Universities Press (India) Pvt. Ltd, ISBN:
3. P. Purushothama Raj, "Ground Improvement Technique"; Laxmi Publications (P) Ltd.
4. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing house.

Reference Books:

1. M. P. Mooseley and K. Kirsch; Ground Improvement; 2nd Edition, Spon Press, Taylor and Francis Group, London, United Kingdom, ISBN:
2. Robert M. Koerner and Josoph P. Welsh, "Construction and Geotechnical Engineering using Synthetic Fabrics", John Willey and Sons, New York.
3. Robert M. Koerner, "Designing with Geosynthetics", Prentice Hall, New Jersey, UAS,1989

(PE315-e): Introduction to Finite Element Method

Teaching Scheme	Evaluation Scheme:
Lectures: 03 Hrs. / Week	**CIA : 40 Marks** **End Sem Exam: 60 Mark**
Credits: 03	**Total Marks: 100**

Prerequisite Course: Engineering Mathematics, Solid Mechanics and Analysis of structures

Course Objectives:

Sr. No.	Course Objectives
1	To impart knowledge about fundamental concepts of the finite element method.
2	To understand fundamentals of finite element method of analysis.
3	To solve the problems of 1D analysis using FEM..
4	To solve the problems of 2D analysis using FEM
5	To solve the problems of 3D analysis using FEM
6	To know the different software in FEM.

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

CO. No.	Course Outcomes (COs)	Blooms Taxonomy	
		Level	Descriptor
1	Demonstrate the fundamentals of finite element method.	2	Understand
2	Understand the various fundamentals concept of the finite element method.	2	Understand
3	Apply finite element method of analysis for bar and truss elements.	3	Apply
4	Apply finite element method of analysis for beam elements.	3	Apply
5	Apply finite element method of analysis for plane stress and plane strain problems.	3	Apply
6	Apply finite element method of analysis for three-Dimensional element problems.	3	Apply

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	--	2	--	---	--	---	--	--	--	--	--	3	--
CO2	3	2	2	--	--	--	---	---	--	--	--	--	3	2
CO3	3	--	3	--	--	--	---	---	--	--	--	--	3	--
CO4	3	2	3	--	--	--	---		--	--	--	--	3	2
CO5	3	2	--	--	--	--	---	--	--	--	--	--	3	2
CO6	3	2	--	2	--	--	---	--		3	--	1	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	No. of Hours	Cos
I	**Introduction to Finite Element Method:** Introduction, history and applications of the Finite element Method, Advantages and disadvantages of Finite element method over conventional methods, Principle of Virtual work, Principle of minimum potential energy, Rayleigh-Ritz method.	06	1
II	**General Description and Analysis Procedure:** Basic equations in elasticity, Linear constitutive laws, concept of element and node, element aspect ratio, nodal degree of freedom, coordinate systems, generalized co-ordinate form of displacement, displacement functions or fields, convergence requirements and compatibility conditions, 2D and 3D Pascal's triangle.	06	2
III	**One dimensional element (Axial Force):** Bar element, nodal equilibrium equations, element stiffness matrix, element load vector, strain and stress, element transformation, assembly of global stiffness matrix, boundary conditions, application to trusses.	06	3
IV	**One dimensional element (Beam Element):** DOF for beam element, stiffness matrix for beam element, global stiffness matrix, boundary conditions, reduced stiffness matrix, element nodal load vector, equivalent load vector.	06	4
V	**Two dimensional elements (Plane Stress and Plane Strain):** triangular elements, rectangular elements, quadrilateral elements, isoperimetric formulation, numerical integration by Gaussian quadrature rule.	06	5
VI	**Three Dimensional Elements:** Introduction to 3D elements such as tetrahedron and hexahedron. Jacobian matrix, Iso-parametric elements in 3D analysis. Exposure of different FEM software.	06	6

Text Books:

1. A first course in the finite element method-Daryl L. Logon, Thomson Publication. ISBN-13: 978-0495668251.
2. Nonlinear finite element analysis by Reddy- Oxford University Press.ISBN-13: 978-0199641758.
3. Introduction to the Finite Element Method – Desai & Abel, CBS Publishers & Distributors, Delhi ISBN-13: 978-8123908953.
4. Introduction to Finite Elements in Engineering – T.R. Chandrupatla& A.D. Belegundu Prentice Hall of India Pvt. Ltd. ISBN: 9780273763680
5. Finite Element Analysis – S.S. Bhavikatti, New Age International (P) Ltd.ISBN-13: 978-8122436716.

Reference Books:

1. Matrix, Finite Element, Computer & Structural Analysis – M. Mukhopadhyay, Oxford IBH Publishing Co. Pvt. Ltd. ISBN-13: 978-8180520754.
2. Finite Element Analysis – Theory & Programming – C.S. Krishnamoorthy, TATA McGraw Hill Publishing Co. Ltd. ISBN 13: 9780074622100.
3. An Introduction to the Finite Element Method – J.N. Reddy, TATA Mc Graw Hill Publishing Co. Ltd. ISBN: 978007060741.
4. S.S. Rao, "The Finite Element Method in Engineering", 6th Edition, Butterworth Heinemann, 2018.
5. Reddy, J. N. "Introduction to the Finite Element Method", 4th Edition, Tata McGraw Hill, 2018.

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603

(An Autonomous Institute Affiliated to SPPU Pune)

121 DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE

and

SYLLABUS- 2021 PATTERN

FINAL YEAR B. Tech

Semester-VII and VIII

W.e.f July 2024

Board of Studies in Civil Engineering, July 2024

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute affiliated to SPPU, Pune)

D E C L A R A T I O N

We, the Board of Studies (Civil Engineering), hereby declare that, we have designed the Curriculum of Final Year Civil Engineering Program Curriculum Structure and Syllabus for semester VII & VIII of Pattern 2021 w.e.f. from A.Y 2024-25 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

(Dr. C.L.Jejurkar)

BoS Chairman

Approved by

Dr.A.B.Pawar
Dean Academics

Dr.A.G.Thakur
Director

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF CIVIL ENGINEERING

COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

FINAL YEAR B. TECH

Profile: Sanjivani College of Engineering was established in the year 1983. The Civil Engineering Department is a part of the institute since its inception. The Department has grown over the years with qualified teaching faculty members who are passionate to impart quality education. The department laboratories are fully equipped with latest equipment, software and with all necessary teaching aids. It is now recognized as one of the prominent departments and known for academic excellence under the Pune University. The department is having valid Accreditation by 'NBA' from 31 July 2015 to 31 June 2025. Besides high quality teaching and instruction at UG, PG and Ph. D., the department is actively involved in basic and applied research and consultancy services. The department is providing quality technical and advisory support through consultancy to various private construction agencies, State Government, Central Government projects.

Apart from academic knowledge, we also, train our students to face the challenges in their profession by providing value added courses like Communication and Presentation skills, building of Team Sprit through field study, expert talk etc. The department also, provides an opportunity to learn software like AUTOCAD, REVIT ARCHITECTURE, STAD- PRO, ETAB, MS-PROJECT etc. to make our students more digitalized.

We arrange regular interaction of our stake holders like students, parents and faculty along with a Training and Placement cell which works full time for bright future of our students. The results are consistently above 90% and considerable number of student ranks in SPPU merit list. Students from Civil department have made incredible mark national and international levels and we are sure will continue in times to come.

The infrastructure development in India is growing at a faster rate and there are many career paths for civil engineers. Civil engineers are essential in government sector, public and private sector and Multinational companies, to build various mega projects like highways, Industrial structures, smart cities, and reservoirs etc. The next decade will be most demanding and rewarding for Civil engineers.

Civil Engineering Department

VISION

- To become a premier source of competent Civil Engineering Professionals for providing service to the Nation.

MISSION

- To provide quality education in Civil Engineering profession.
- To impart knowledge to students for socio-economic growth of India.
- To promote Civil Engineering Graduates to become an entrepreneur.
- To motivate Civil Engineering Professionals towards competitive services, higher studies and research**.**

Program Educational Objectives: (PEOs)

PEO 1: Excellence in civil engineering profession by acquiring knowledge of advanced civil engineering technologies.

PEO 2:Capable to identify, analyze and design solutions for civil engineering problems in context of social, environmental , ethical and economic growth of the nation

PEO 3: To improve their technical and professional skills through value addition programs, software's to develop a long term productive career in industry, Govt Services or an entrepreneur.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes: (PSOs)

***PSO1*:** To understand experimental, analytical and advance techniques for the solution of Civil Engineering and or multidisciplinary Engineering problems.

***PSO2*:** Enhancing the employability skills of students in oral and written communications and exhibit good team work skills to have a successful career

Sanjivani College of Engineering Kopargaon-423603
Department of Civil Engineering
COURSE STRUCTURE and SYLLABUS- 2021 PATTERN

FINAL YEAR B. TECH.

(W.e.f July 2024)

Board of Studies in Civil Engineering, July 2024

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ESC	Engineering Science	HSC	Humanity Science
PCC	Professional Core	CA	Continuous Assessment
PEC	Professional Elective	OR	Oral Examination
OEC	Open Elective	PR	Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
		PRJ	Project/Seminar/Internship/Online Course

SEMESTER-VII

Course		Course Title	Teaching Scheme				Evaluation Scheme / Marks						
Cat	Code		Hrs /Week			Credits	Theory			OR	PR	TW	Total
			L	T	P		CIA	ISE	ESE				
PCC	CE401	Waste Water Treatment, Disposal and Recycling	3	-	-	3	40	-	60	-	-	-	100
PCC	CE402	Transportation Engineering	3	-	-	3	40	-	60	-	-	-	100
PCC	CE403	Quantity Survey, Contracts & Tenders	3	-	-	3	40	-	60	-	-	-	100
PEC	PE404	Professional Elective - III	3	-	-	3	40	-	60	-	-	-	100
PEC	PE405	Professional Elective - IV	3	-	-	3	40	-	60	-	-	-	100
LC	CE406	Characterization of Wastewater Lab	-	-	2	1	-	-	-	50	-	-	50
LC	CE407	Transportation Engineering Lab	-	-	2	1	-	-	-	-	-	25	25
LC	CE408	Professional Practice Lab	-	-	2	1	-	-	-	50	-	-	50
LC	CE409	Professional Elective-III Lab	-	-	2	1	-	-	-	25	-	-	25
PROJ	CE410	Project Stage-I	-	-	6	3	-	-	-	50	-	100	150
MLC	MC411	Mandatory Learning Course-VII (Financially Smart)	1	-	-	Non-Credit	-	-	-	-	-	-	Pass/ Fail
		Total	**16**	**-**	**14**	**22**	**200**	**-**	**300**	**175**	**-**	**125**	**800**

Dr. C.L. Jejurkar
Head of Department

Dr. A. B. Pawar
Dean Academics

Dr. A.G. Thakur
Director

FINAL YEAR B. TECH. SEM-I Electives

PEC- Professional Elective-3: (PE404)		PEC- Professional Elective-4: (PE405)	
PE404-a	Design of Reinforced and Prestressed Concrete Structures	**PE405-a**	Dams & Hydraulic Structures
PE404-b	Air & Noise Pollution Control	**PE405-b**	Foundation Engineering
PE404-c	Advanced Concrete Technology	**PE405-c**	Solid Waste Management
PE404-d	Structural Audits & Retrofitting	**PE405-d**	Formwork Technology & Plumbing Systems
PE404-e	Construction Safety Management	**PE405-e**	Smart Cities Planning & Management

Dr. C.L. Jejurkar
Head of Department

Dr. A. B. Pawar
Dean Academics

Dr. A.G. Thakur
Director

DEPARTMENT OF CIVIL ENGINEERING

FINAL YEAR B. TECH. SEM-II

(W.e.f. Jan 2025)

Board of Studies in Civil Engineering, Jan 2025

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ESC	Engineering Science	HSC	Humanity Science
PCC	Professional Core	CA	Continuous Assessment
PEC	Professional Elective	OR	Oral Examination
OEC	Open Elective	PR	Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
		PRJ	Project/Seminar/Internship/Online Course

SEMESTER-VIII

Course		**Course Title**	**Teaching Scheme**				**Evaluation Scheme / Marks**						
Cat	**Code**		**Hrs /Week**			**Credits**	**Theory**			**OR**	**PR**	**TW**	**Total**
			L	**T**	**P**		**CIA**	**ISE**	**ESE**				
OEC	OE412	Open Elective -1	3	-	-	3	25	-	75	-	-	-	100
OEC	OE413	Open Elective -2	3	-	-	3	25	-	75	-	-	-	100
OEC	OE414	Open Elective -3	2	-	-	2	25	-	75	-	-	-	100
PRJ	CE415	Professional Internship	-	-	12	6	-	-	-	50	-	100	150
PRJ	CE416	Project Stage-II	-	-	4	2	-	-	-	50	-	-	50
		Total	**08**	**-**	**16**	**16**	**75**	**--**	**225**	**100**	**-**	**100**	**500**

Dr. C.L. Jejurkar
BOS Chairman

Dr. A.B. Pawar
Dean Academics

Dr. A.G. Thakur
Director

OEC-OE412- Open Elective- 1 through NPTEL

OEC-OE413- Open Elective- 2 through NPTEL

OEC-OE414- Open Elective- 3 through NPTEL

Sr.No.	Name of NPTEL Courses	Duration
	OEC-OE412-Open Elective-I	
1)	Optimization methods for Civil Engineering	12 Weeks
2)	Waste water treatment and recycling	12 Weeks
3)	Advance concrete technology	12 Weeks
4)	Ground Improvement	12 Weeks
	OEC-OE413-Open Elective-II	
1)	Bridge Engineering	12 Weeks
2)	Sustainable transportation systems	12 Weeks
3)	Pavement materials	12 Weeks
4)	Railway Engineering	12 Weeks
	OEC-OE414-Open Elective-III	
1)	Principals of construction management	8 Weeks
2)	Remote sensing and GIS	8 Weeks
3)	Sustainable engineering construction and life cycle analysis	8 Weeks
4)	River Engineering	8 Weeks

PCC (CE401): Wastewater Treatment, Disposal and Recycling

Teaching scheme	Examination scheme
Lectures: 3 hours/week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Pre-requisites: **Basic Concepts of Engineering Sciences and Mathematics, fluid mechanics, water treatment and distribution.**

Course Objectives:

Sr. No.	Course Objectives
1	To introduce students about sources of sewage, sewage quantity, design of sewer and characteristics of wastewater.
2	To acquaint preliminary and primary techniques for sewage treatment and their design for sewage treatment plant
3	To Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process and trickling filter.
4	To attain knowledge about anaerobic treatment of sewage in septic tank as well as sludge treatment and its disposal techniques
5	To achieve knowledge of various emerging wastewater treatment techniques their principle, types, advantages and disadvantages
6	To identify various techniques for Wastewater Disposal and its Recycling as well as Self-purification of natural streams

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Recall the sources of sewage, sewage quantity, design of sewer and characteristics of wastewater.	3	Apply
2	Acquire preliminary and primary techniques for sewage treatment and their design for sewage treatment plant.	3	Apply
3	Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process and trickling filter.	3	Apply
4	Attain knowledge about anaerobic treatment of sewage in septic tank as well as sludge treatment and its disposal techniques.	3	Apply
5	Gain knowledge of various emerging wastewater treatment techniques /systems, their principle, types, advantages and disadvantages.	2	Understand
6	Identify various techniques for Wastewater Disposal and its Recycling as well as Self-purification of natural streams.	2	Understand

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

Course Contents

Unit No.	Topic	No. of Hours	COs
I	**Introduction**: Important definition related with sewage, Water carriage system, and Pattern of collection system. Factors affecting the storm water discharge, Estimation of storm water runoff, Sources of sewage, Variations in sewage flow, Hydraulic design of sewer. Significance of physical, chemical and biological characteristics of wastewater. Wastewater sampling, types of oxygen demand and Theory of BOD reaction.	**06**	**1**
II	**Classification of treatment method**- Typical flow chart for wastewater treatment. Preliminary and Primary treatment: Screens: Types of screens, design of screen chamber, disposal of screenings. Grit Chamber: Sources of grit, velocity control in grit chamber, design of grit chambers. Disposal of grit, Sources of oil and grease, Importance of removal, Methods of oil and grease removal. Primary Sedimentation: Necessity, design of PST with inlet and outlet details, Primary Sludge and its disposal. Other primary treatment such as equalization, flocculation and pre-aeration.	**06**	**2**
III	**Secondary treatment:** Concepts of Biological treatment and removal mechanism, Selection of Treatment Methods – Principles, Functions, Activated sludge process- analysis, concept of MCRT, SVI, theoretical oxygen requirement, aeration processes and their design, Trickling filters, miscellaneous methods such as oxidation ponds oxidation ditch, aerated lagoons, rotating biological contractors.	**06**	**3**
IV	**Anaerobic Treatment and sludge digestion:** Septic tanks, biological Principle, method of treatment and disposal of septic tank effluent and Design of septic tank. Up flow sludge Blanket Reactors (UASBR)- Principle, working. The quantity and characteristics of sewage sludge;	**06**	**4**

	Sludge dewatering, drying, and thickening; Anaerobic Digester, Principle of anaerobic digestion, Stages of digestion, Bio-gas production, its Characteristics and application, Factors governing anaerobic digestion, Sludge disposal methods.		
V	**Recent Advances/Emerging wastewater treatment systems:** sequencing batch reactor (SBR), membrane bio reactors (MBR), moving bed bio reactor (MBBR), fluidized membrane bio reactor (FMBR), packed bed reactor (PBR). Centralized sewage treatment systems, Consequences of centralized wastewater treatment, Objectives of small and decentralized wastewater treatment systems, Applications of decentralized wastewater management to Root zone Technology Principle, types of plants used, Constructed wastelands process description, Duckweed ponds process description.	**06**	**5**
VI	**Wastewater Disposal and Recycling:** Alternative disposal methods - Self-purification of stream - Standards for disposal alternatives, natural purification of polluted streams, Scope and demands; Types and stages of recycling; Recycling requirements; Designated reuse criteria; centralized vs decentralized recycling systems. Technology Selection and Decision Making: Research trends in wastewater treatment and recycling; Risks and challenges; Socio-economic perspectives, environmental benefits of recycling. House drainage system - traps and sanitary fitting - Low cost sanitation Systems.	**06**	**6**

Text Books

1. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.
2. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication
3. Waste Water Engg. – B.C. Punmia and Ashok Jain - Arihant Publications.
4. Water and Wastewater Technology- Hammer and Hammer, Prentice Hall Publication, 2016

Reference Books

1. Wastewater Treatment for Pollution Control and Reuse, Arceivala and Asolekar, McGraw Hill Education (India) Private Limited
2. Water Supply and Waste Water Engg. - B.S.N. Raju – TMH publication
3. Sewage Disposal and Air Pollution Engineering, S. K. Garg, Khanna Publication
4. Standard Methods for examination of water and wastewater, Mary Franson, American Public Health Association.
5. I.S. 3025 (all parts)
6. I.S. 10500: 2012 (Second Revision)

PCC (CE402) Transportation Engineering

Teaching Scheme: **Lectures:**03 Hrs. / Week	**Evaluation Scheme:** **CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisites: **Concrete Technology, Material testing knowledge**

Course Objectives:

Sr. No.	Course Objectives
1	To study the necessity of highway planning and classification of roads.
2	To study materials used in highway construction and related tests and standards.
3	To study the various geometric elements and different cross-sectional elements of highway
4	To study the design guidelines for flexible and rigid pavement.
5	To study traffic engineering, traffic flow and highway capacity.
6	To study various construction methods and maintenance required for pavement.

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

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
1.	Know in detailed about the highway planning, various types of roads, road patterns and road development in India.	2	Understand
2.	Predict the materials properties and carry out related tests on the materials used in highway construction as per standard norms.	3	Apply
3.	Use the concept of highway alignment and geometric design of highway in road designing.	3	Apply
4.	Carry out preliminary design of flexible and rigid pavement as per the site conditions using IRC and MORTH code.	4	Analyze
5.	Design and analyze the traffic systems, traffic flow and decide the traffic capacity on the basis of types of highway.	4	Analyze
6.	Apply various methods for construction and maintenance of pavement	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	3	-	2	---	---	---	---	---	---	---	2	2	2	2
CO2	3	3	3	2	---	2	2	1	2	---	---	2	2	2
CO3	3	-	2	--	---	2	---	---	---	---	---	2	2	2
CO4	3	3	3	--	1	2	2	1	2	---	---	2	2	2
CO5	3	---	2	--	1	2	---	1	1	---	1	2	2	2
CO6	3	---	2	--	1	2	---	1	1	---	2	2	2	2

Course Contents

Unit No.	Topic	No. of Hours	COs
I	**Introduction to Roads, Highway Development and Planning** Introduction, Various surveys, Necessity of Highway planning, Jaykar Committee recommendations and implementations. Road development in India Vision- 2021 and Rural development in India 2025. Highway Development and Planning: Classification of Roads, urban roads, patterns. Road development plans. Introduction to various types of pavements like flexible pavements and rigid pavements. Introduction to road development authorities like IRC, CRRI, NHAI, NHDP, MORTH, etc. Salient features of National and State Highways, Expressways in India.	06	1
II	**Pavement Materials and MORTH Standards** Materials used in highway construction and related tests: soil subgrade and CBR Test, stone aggregates, bituminous binders, bituminous paving mixes, viscosity-based gradation of bitumen, modified bitumen cutbacks, emulsions, crumbed rubber modified bitumen, polymer modified bitumen, foamed bitumen, Desirable properties of bituminous paving mixes, Marshall stability mix design and test (All 5 test parameters). Functions and applications of Geo-synthetics in roadways.	06.	2
III	**Highway Geometric Design** Introduction, factors controlling design of various geometric elements, different cross-sectional elements and road margins. Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), and overtaking zone, problems. Attainment of super elevation, radius of curves. Methods of introduction of extra widening, widening of pavement on horizontal curves, Transition Curves-shape and length of transition curves, shift of transition curves. Design of vertical alignment, gradient and its type, IRC recommendations,	06	3

	grade compensation on horizontal curve, vertical curves: crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria. Grade compensation.		
IV	**Pavement Analysis and Design** Flexible pavements: components and functions, computation of design traffic (vehicle damage factor, lane distribution factor, and traffic growth rate), flexible pavements, stresses in flexible pavements Rigid pavements: components and functions, factors affecting design, ESWL, Stresses in rigid pavements, wheel load stresses and temperature stresses, design guidelines for concrete pavements as per IRC 58-2015. Joints in CC pavements, problems, highway drainage: subsurface and surface drainage.	06	4
V	**Traffic Engineering Studies and Analysis** Traffic Studies: Volume, Spot Speed, Speed and Delay, Origin and Destination, parking on street and off-street Parking- space consideration, parking demand, parking load and duration, space demand relation. Accidents- Causes, Analysis, Measures to reduce Accident. Categories of traffic flow, uninterrupted traffic flow model, Analysis of speed, flow and density relationship. Traffic signs, Types of intersections. Smart signal systems.	06	5
VI	**Pavement Construction and Maintenance:** Investigation of material for highway construction, Construction of subgrade, subbase, base layers, bituminous courses and MORTH specifications, routine maintenance, periodic maintenance, special repairs, responsive maintenance program, reconstruction, and treatment strategies.	06	6

Text Books:

1. Highway engineering – S.K. Khanna, C.E.G. Justo & A. Veeraragavan, Nem Chand and Brothers, Roorkee.
2. Transportation engineering – N.L.Arora, New India Publishing House, New Delhi, 12th Edition.
3. Traffic Engineering (5th edition), Roger P. Roess, Elena S. Prassas & William R. McShane., Pearson Publication.
4. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi.
5. Essentials of bridge engineering, Victor D.J., Oxford and IBH publisher, Delhi
6. Bridge engineering by Rangwala, Charotar Publishing House Pvt Ltd.

Reference Books:

1. A Course in Highway Engineering – S.P. Bindra, Dhanpat Rai and Sons, Delhi.
2. Principles of Transportation Engineering – G.V. Rao Tata MacGraw Hill Publication
3. Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
4. Principles of Transportation Engineering – Partha Chakraborty, Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi.Design of bridges, N.Krishnamraju, Oxford and IBH publisher,

Delhi.

I.S. Codes:

1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I toV
2. I.R.C. 58, IRC37 3. Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.

Hand Books:

1. Handbook of Road Technology Lay M.G., Gorden Breach Science Pub.Newyork
2. Civil Engineering Handbook-Khanna S.K.

e – Resources:

1.www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel

PCC (CE403): Quantity Survey, Contracts and Tenders

Teaching Scheme:	**Evaluation Scheme:**
Lectures:03 Hrs. / Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisites: Basic Mathematics, Building Technology and Materials and Building Planning

Course Objectives:

Sr. No.	Course Objectives
1.	To study basic terminologies, principles and standards related to quantity estimation.
2.	To study the methods of estimation and procedure of taking out quantities of various items of work for load bearing and RCC framed structure.
3.	To learn the procedure of estimating road construction, estimation: road/highway works, steel roof truss, culvert, water tank (elevated storage tank).
4.	To learn the procedure of analysis of rate of items, and drafting specification of items of work.
5.	To learn the valuation and various methods for carrying out valuation.
6.	To get acquainted with tender, procedure of tendering, contract, condition of contract and arbitration.

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

Cos.	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1.	Evaluate the estimate of proposed civil Engg. Project.	4	Analyse
2.	Perform all operations leading to quantity evaluation.	4	Analyse
3.	Perform all operations leading to quantity of steel reinforcement and earthwork for road project.	4	Analyse
4.	Perform the work according to specification, analyzing rate of items of work, to fill tender and check the tender document.	4	Analyse
5.	Carry out the valuation of structure/ project.	4	Analyse
6.	Complete tendering procedures and decide the genuine contractor for particular work and arbitration	3	Apply

Mapping of COs with POs/PSOs:

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

Course Contents

Unit No.	Topic	No. of Hours	CO
I	**a) Introduction to estimates and related terms:** Definitions of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, Civil Engineering projects. Data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Units of measurement. Mode of measurement of building items/ works. 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 D. S. R. **b) Approximate Estimate:** Meaning, purpose, methods of approximate estimation of building, Other civil Engg. works projects like roads, Irrigation Water supply and Sanitary Engineering, Electrical works, Numerical on approximate estimate.	5	CO1
II	**Taking out Quantities/Working-out quantities:** -P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing structure, underground water tanks.	8	2
III	**Estimate of RCC and other construction work:** Detailed estimates of R.C.C framed structures, working out quantities of steel reinforcement and bar bending schedule of building elements and retaining walls. Earthwork for road construction, steel roof truss, culvert,	6	3
IV	**a) Specifications**: Meaning & purpose, types. 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. **b) 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. Wages act, Special rates concerning to mountainous, hilly, forest and urban areas.	5	4
V	**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. Meanings of depreciation & obsolescence. **Methods of Valuation:** Different methods of land and building valuation.	6	5
VI	**Tender Contracts and Arbitration**: **Tendering and Execution of Works:** Tenders: Definition, detailed tendering process and procedure, conditions regarding earnest money, security deposit, retention money, pre and post qualification of contractors, 3 bid, 2 bid and single bid system, qualitative and	6	CO5

	quantitative evaluation of tenders, comparative statement, pre-bid conference, acceptance/ rejection of tenders, BOT & Global Tendering, E-tendering. PWD procedure for executing, works piecework, rate list and daily labor, administrative approval and technical sanction. Introduction to registration as a contractor in PWD. **Contracts:** Definition, objectives & essentials of a valid contract as per Indian Contract Act (1872), types of contracts, conditions of contract- defective work, subletting, etc. termination of contract, defect liability period, liquidated damages, 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.		

Text Books:	
1.	Estimating and Costing, B.N.Dutta, 2002, S Dutta & Company
2.	Estimating and Costing, M Chakraborty, 1992, Published by Author
	References Books:
1.	Estimating and Costing, G S Birdie, 1988, Dhanpat Rai Publication
2.	Contract and Estimates, B.S. Patil, 7th Edition, 2019
Hand books and Indian Standards:	
1.	Standard contract clauses for domestic bidding contracts: ministry of statistics and program implementation, Government of India.
2.	Document: Federation International Des Ingenieurs Conseils (FIDIC) i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
3.	Indian Practical Civil Engineers Handbook: P. N. Khanna, UBS Publication Distri. Pvt. Ltd.
4.	Quantity Surveyor's Pocket Book by Duncan Cartlidge.
5.	IS 1200: --- (Part 1 to 25): Methods of Measurement of Building & Civil Engineering Works, Bureau of Indian Standards, New Delhi.
6.	IS 3861:1966, Method of measurement of areas and cubical contents of buildings, Bureau of Indian Standards, New Delhi.
7.	D. S. R. (District Schedule of Rates)/S.S.R. (State Schedule of Rates) for current year.
8.	PWD Redbooks, Vol. 1 & 2.
E-Resources: https://dsr.emahapwd.com	

Professional Elective-III

PEC (PE404-a): Design of Reinforced and Prestressed Concrete Structures

Teaching scheme:	Evaluation scheme:
Lectures: 3 hours/week	CIA : 40 Mark End Sem Exam: 60 Marks
Credits: 03	Total : 100 Marks

Prerequisite Course: **Analysis of Structures, Concrete Technology, Design of Reinforced Concrete Structures.**

Course Objectives:

Sr. No.	Course Objectives
1.	To understand the fundamental concepts of prestressing and estimate the losses in prestressed concrete members.
2.	To analyze and design the prestressed concrete elements.
3.	Analyze and design of prestressed concrete slab.
4.	To analyze and design of earth retaining structures.
5.	To analyze and design of Combine footings.
6.	To analyze and design of water retaining structures.

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Apply the concept of prestressing for analysis of section and estimate the initial and time-dependent losses.	3	Apply
2	Analyze and design of prestressed concrete beam.	4	Analyze
3	Analyze and design of prestressed concrete slab.	4	Analyze
4	Analyze and design of RCC cantilever retaining wall.	4	Analyze
5	Analyze and design of RCC combined footing.	4	Analyze
6	Analyze and design of RCC water tank resting on ground	4	Analyze

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

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

Course Contents

Unit No.	Unit Title	No.of Hours	COs
I	**Analysis of Prestressed concrete section:** Introduction, Basic concepts, materials, various Pre-tensioning and Post-tensioning systems, concept of losses, Stress calculations, and concept of cable profile.	06	1
II	**Design of Prestressed concrete beams:** Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block. Case study of post tensioned beams.	06	2
III	**Design of Prestressed concrete slabs:** Design of one way and two way post tensioned slabs (Single panel only), Flat slab. Case study of prestressed concrete slab.	06	3
IV	**Earth retaining structures:** Introduction, Functions and types of retaining walls. Analysis and design of RCC cantilever retaining wall for various types of backfill and loading conditions. Case study of retaining wall.	06	4
V	**Design of Combine footings:** Introduction – Types of combine footings, Rectangular and Trapezoidal pad footing, strap footing, Raft Slab. Case study of combined footing.	06	5
VI	**Liquid retaining structures:** Introduction, types, functions, code provisions, methods of analysis and design of circular, square, and rectangular water tanks resting on ground. Case study of water tank.	06	6

Note: - 1. Students should complete **minimum** one assignment on **each unit**.
2. Case study /video of RCC and PC structures can be incorporate as a CIA activity.
3. **Site visit** is recommended to explore practical knowledge in RCC structures (Retaining wall / Water tank/ combined footing/ raft slab in multi-storied building projects) and Prestressed Concrete girders/ slabs and to learn various types of projects through the site visit, how

the theories are applied in practice and also develop the skills to write and summarize the key observations of what students have learn from the site visit.

4. Application of any **suitable software** to design RCC and prestressed concrete structures Mentioned above. (advancedexcel/ ETAB/STAAD Pro, etc.)

TextBooks:

1. Dr. V. L. Shah and Dr. S. R. Karve, "Illustrated Reinforced Concrete Design", 9th edition, Structures Publications, 2021, ISBN: 978819037172.
2. S. Ramamrutham and N. Narayan, "Design of Reinforced Concrete Structures", 17th edition, 2013, ISBN: 978-0198086949.
3. B. C. Punmia, Ashok kumar Jain and Arun kumar Jain, "Comprehensive Design of R.C. Structures", 10th edition, Standard Book House, 2015, ISBN: 978-8131809426.
4. T. Y. Lin, Design of prestressed concrete Structure, Asia Public House, New Delhi, 2000.
5. N. Krishna Raju and R.N. Pranesh, "Design of Reinforced Concrete Structures: Principles and Practice" 1st edition, New Age International Pvt Ltd Publishers 2018, ISBN: 978-8122414608.

Reference Books:

1. S. U. Pillai and D. Menon, "Reinforced Concrete Design", 3rd edition, Tata Mc Graw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnram, "Limit State Analysis and Design" 5th edition, Wheeler Publishing company ', Delhi, 2017, ISBN: 978-9386479785.
3. N. Subramanian, "Design of Reinforced Concrete Structures", 1st edition, Oxford University Press, 2013, ISBN: 978-0198086949.
4. J. K. Wight, "Reinforced Concrete: Mechanics and Design", 7th edition, Pearson/Prentice Hall, 2015.
5. M. Nadim Hassoun, Akthem Al-Manaseer, "Structural Concrete: Theory and Design", 7th Edition-WILEY.
6. F. Leonhardt, "Pre stressed concrete – Design & construction", Welhelm Ernst and sohn – Munich, 2000.

I.S. Codes:

1. IS 456: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
3. IS 875 Part V: Code of practice for design load, Bureau of Indian Standards, New Delhi.
4. IS 13920: Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
5. IS 3370: Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

#Latest Revision of IS Codes should be used.

e – Resources:

1. www.nptel.iitk.ac.in/courses/iitkharagpur

PEC(PE404-b): Air and Noise Pollution and Control

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: **Basics of environmental sciences and Mathematics**

Course Objectives:

Sr. No.	Course Objectives
1	The objective of this course is to introduce the students with fundamentals of air, indoor air, odour and noise pollution
2	To understand factor affecting the extent of pollution, methods and devices for controlling the pollution.

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Demonstrate concepts of air pollution, its sources and fate of pollutants through meteorology.	2	Understand
2	Demonstrate and model the dispersion of air pollutants.	3	Apply
3	Design air pollution control devices for particulate and gaseous pollutants removal.	4	Analyze
4	Explain the concept of indoor and outdoor pollution	2	Understand
5	Demonstrate the noise pollution, its causes and characteristics	2	Understand
6	Infer the effects of noise and suggest its control methods	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	-	-	-	-	1	2	-	-	-	-	-	2	-
CO2	2	3	-	2	2	-	1	-	-	-	-	-	1	2
CO3	2	-	3	2	-	3	2	-	-	-	-	1	1	2
CO4	2	-	-	1	-	2	3	-	-	-	-	-	-	-
CO5	2	-	2	1	-	-	2	-	-	-	-	-	-	-
CO6	2	-	3	-	-	-	2	-	-	-	-	1	-	2

Course Contents

Unit No	Topics	No of Hrs	COs
I	**Air Pollution: Introduction:** Definition, Sources and classification of Air Pollutants, Photochemical smog, Effects of air pollution on health, vegetation & materials, air quality, Air Pollution Episodes. **Meteorology:** The atmosphere, zones of atmosphere, scales of meteorology, meteorological parameters, Heat, Wind, Pressure, Moisture and humidity, Rainfall and precipitation, Temperature lapse rate, Maximum mixing depth (MMD), Plume behavior, Effect of topography on pollutant dispersion, effect of air pollutants on meteorology.	06	1
II	**Modeling of Dispersion of Air Pollutants:** Air pollution modeling: Gaussian Plume model, Dispersion coefficients, Maximum ground level concentration, inversion effects, Plume rise: mathematical models like Holland equation Brigg's Equation, Rupp's equation, Smith's Formula, ASME equations. Minimum Stack heights per Central Pollution Control Management (CPCB), Design of tall stacks.	06	2
III	**Particulate Pollution Control Methods:** Dilution, Source control, Control by using equipment such as Settling chambers, Cyclones, Fabric Filters, Electrostatic precipitators, Wet Scrubbers/Wet Collectors, design and principle of these air pollution control units. **Gaseous pollution control:** Types of gaseous pollution control methods– absorption, adsorption and combustion processes. SOx Control Technology, Desulfurization of flue gas emissions, NOx Control Technology. **Air (Prevention and Control of Pollution Act 1981)**	06	3
IV	**Indoor air pollution:** Causes of air pollution, sources and effects of indoor air pollutants, factors affecting exposure to indoor air pollution, sick building syndrome. Investigation of indoor air quality problems, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Use of various plants to control indoor air pollution. Radon and its decay products in indoor air. **Odour pollution**: Theory, sources, measurement and methods of control of odour pollution. **Global effects air pollution:** Greenhouse effect, Heat Island effect, Acid rain, Ozone Depletion, Global warming **Various treaties and protocols**: Kyoto Protocol and Montreal Protocol etc	06	4
V	**Noise Pollution**: Introduction, Definition, sources of noise *i.e.*, mobile, non-mobile, indoor and outdoor sources, Measurement of noise: characteristics of noise, description of decibel scales, Noise exposure Index (NEI), Sound pressure level and propagation of noise, addition of sound level, sound pressure meter	06	5

VI	**Effects and control of noise pollution:** Effects of noise pollution: Noise induced temporary threshold shift (NITTS), Noise induced permanent threshold shift (NIPTS), Different noise control methods. Acceptable Noise levels ARE: 4954-1968, Ambient air Quality standards in respect of Noise. Noise pollution (Regulation and Control) Rules 2000.	06	6

Text Books:

1. M. N. Rao and H.V. N. Rao Air Pollution, Tata McGraw Hill Publication. 17th Edition Reprint.ISBN-13: 978-0074518717.
2. KVSG Murali Krishna. Air pollution and control, University Science Press, Delhi. 1st Edition 2015.

Reference Books:

1. H. C. Perkins, Air Pollution, McGraw Hill Higher Education, (1st Edition, 1974). ISBN-13: 978-0070855601
2. Peavy and Rowe, Environmental Engineering, Mc-Graw Hill Publication. (1stIndian Edition 2017).
3. N.D. Nevers, Air Pollution Control Engineering, Mc-Graw Hill Publication. (2nd Edition 2010).
4. C.S. Rao. Environmental Pollution Control Engineering, New Age Publication, New Delhi. (2nd Edition 2006)
5. John H. Sei,nfeld Air Pollution: Physical and Chemical Fundamental, Mc-Graw Hill book Co. (1st Edition, 1975) 1988. ISBN-13: 978-0070560420
6. P. R. Trivedi, Gurdeep Raj. Noise Pollution. Anmol Publications Pvt. Ltd. (1st 1997). ISBN-13: 978-8171582624.
7. Kenneth Wark and Cecil F Warner. Air Pollution: Its Origin and Control, Pearson (3rd Edition 1998).

E Resources: https://nptel.ac.in/courses/105/104/105104099/

PEC (PE404-c): Advanced Concrete Technology

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100Marks**

Prerequisite Course: Building Technology and Materials, Concrete Technology.

Course Objectives:

Sr. No.	Course Objectives
1	To study the ingredients of concrete.
2	To identify various admixtures and its effect on properties of concrete.
3	To study the strength characteristics of concrete through destructive and NDT.
4	To learn and design the Concrete Mixes for standard and Special Concrete.
5	To study fibre reinforced concrete and Ferro cement technique.
6	To study the concrete durability and new generation concrete.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Select and classify the basic ingredients of concrete.	2	Understand
2	Identify the effect of admixtures on properties of fresh and hardened concrete.	3	Apply
3	Identify and Analyze the strength characteristics of concrete using destructive and non-destructive testing methods.	4	Analyze
4	Examine the Mix Design of special concrete.	4	Analyze
5	Apply the Fibre Reinforced Concrete and Ferro-cement techniques in construction industries.	2	Apply
6	Inspect durability of concrete and identify new generation concrete.	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	-	-	-	-	1	1	1	-	-	-	-	3	1
CO2	2	-	-	-	-	1	1	1	-	2	-	1	3	2
CO3	2	2	1	2	2	1	2	1	2	2	-	2	3	2
CO4	2	2	2	2	2	2	2	2	2	2	1	2	3	2
CO5	2	-	3	2	2	2	2	2	2	2	1	2	3	2
CO6	2	-	2	2	2	2	3	2	2	2	-	2	3	2

Course Contents

Unit	Topic	No. of Hours	COs
I	**Ingredients of Concrete** **Cements:** Hydration of cement, water requirements for hydration, micro-structure development, secondary cementitious materials. **Aggregates:** Grading curves of aggregates, Aggregate concrete interactions, alkali aggregate reaction. **Concrete:** properties of concrete, W/C ratio, gel space ratio, Rheological modeling of fresh concrete, maturity concept, accelerated curing, steam curing.	06	1
II	**Admixtures** **Mineral Admixtures:** Fly ash, ground granulated blast furnace slag, Metakaolin, rice-husk ash and Silica fume. Chemical composition; physical characteristics; effects on properties of concrete; advantages and disadvantages. **Chemical Admixtures:** types and classification; compatibility, usage; effects on properties of concrete. IS: 456, IS 9103; requirements, provisions and specifications.	06	2
III	**Strength Characteristics and Advanced NDT** **Strength of concrete:** Aggregate to cement ratio, bond strength, Factors affecting strength, transition zone, Micro cracking and stress-strain relationship, Modulus of elasticity, Poisons ratio. **Advanced non-destructive testing methods:** ground penetration radar, probe penetration, stress wave propagation method, electrical / magnetic methods, nuclear methods and infrared thermography, dynamic resonance frequency tests.	06	3
IV	**Mix Design for Special Concrete** Statistical quality control, Design of high strength concrete, design of light weight aggregate concrete, design of cement concrete with Pozzolonic materials, design of high density concrete, Acceptance criteria for concrete strength as per IS 456, site practices, Use of Mix Design software/ tool.	06	4
V	**Fibre Reinforced Concrete (FRC) and Ferro-Cement** **Fibre reinforced Concrete:** basic concepts, Types of Fibre, aspect ratio, mechanical properties of FRC, Types of FRC, effect of fibres on properties of concrete, case study on FRC. **Ferro-cement:** Methods, Applications, weight to strength ratio, Structural behavior Ferro-cement elements, present practices in precast industries.	06	5

VI	**Durability Aspects of Concrete and New Generation Concrete** **Durability aspects of concrete:** Creep, factors affecting creep; shrinkage, factors affecting shrinkage, types of shrinkage, Electrical resistivity, permeability, Rapid chloride penetration test (RCPT). **New generation concrete**: Light weight concrete, ultra-light weight concrete, No fines concrete, Ready mixed concrete, Pumpable concrete, high volume fly ash concrete, Self-compacting concrete, Geo-polymer concrete.	06	6

Note: Minimum one site visit is recommended (related to ferrocemnt construction, multi-storied building project, etc. to study the practical aspects, do's and don'ts of standard and special concrete.

Text Books:

1. A. M. Neville, "Properties of Concrete", 5th edition, 2012, ISBN: 978-8131791073, Pearson Education India.
2. M. S. Shetty and A.K. Jain, "Concrete Technology: Theory and Practice", 8th edition, 2018, ISBN: 9789352533800, S. Chand Publications.
3. M. L. Gambhir, "Concrete Technology: Theory and Practice", 5th edition, 2013, ISBN: 9781259062551, Tata McGraw Hill Publications.

Reference Books:

1. Lea, "Chemistry of Cement and Concrete", 5th edition, 2017. Butterworth-Heinemann Ltd,
2. A. M. Neville, and J. J. Brooks, "Concrete Technology" 5th edition, 2012, ISBN: 978-8131791073, Pearson Education India.
3. P. Kumar Mehta and J.M. Monteiro, "Concrete: Micro structure, Properties and Materials", 4th edition, 2017, ISBN: 9789339204761, McGraw Hill Publications.
4. A. R. Santhakumar., "Concrete Technology", 2nd edition, 2018, ISBN: 9780199458523, Oxford Universities Press.
5. P.N.Balguru & P.N.Shah, "Fiber Reinforced Cement Composite", 1992, Mc Graw Hill International Editions.
6. Dr. Balkrishna Divekar, "Ferrocement Construction Mannual", Ferrocement society, Pune, India.
7. Water resources Department, "Ferrocement Technology Handbook Chapter-1", 1st edition, 2018, Maharashtra Engineering Research Institute, Nashik 422004, Government of Maharashtra, India
8. Dr. Hemant Sood, "Module on Special Concretes", NITTTR Chandigarh.

e-Resources: NPTEL course videos

1. https://nptel.ac.in/courses/105/106/105106202/
2. https://nptel.ac.in/courses/105/106/105106176/
3. https://nptel.ac.in/courses/105/104/105104030/

IS Codes:

IS 269: 2015 Specification for ordinary Portland cement (*sixth revision*).

IS 455: 2015 (Reaffirmed 1995) Specifications for Portland slag Cement.

IS 650: 1991 Specification for standard sand for testing of Cement.
IS 1489 (Part 1): 2015 Specification for Portland pozzolana cement-Flyash based.
IS 1489 (Part 2): 2015 Specification for Portland-pozzolana cement-Calcined clay based.
IS 1727: 1967 Methods of test for Pozzolonic Materials.
IS 383: 2016 Specification for coarse and fine aggregates for concrete (*second revision*).
IS 456: 2000 (Reaffirmed 1995) Code of practice for plain and reinforced concrete (*fourth revision*).
IS 1199 (Part 1 to 6): 2018 Fresh concrete-Methods of sampling, testing and analysis. (*first revision*).
IS 516 (Part 1 to 6): 2018 Method of test for strength of concrete.
IS 2386 (Part 1 to 8): 1963 Methods of test for aggregates for concrete.
IS 3812 (Part 1): 2013 Specification for pulverized fuel ash-For use as pozzolana in cement, cement mortar and Concrete (*third revision*).
IS 3812 (Part 2): 2013 Specification for pulverized fuel ash-For use as admixture in cement mortar and concrete (*third revision*).
IS 9103: 1999 (reaffirmed 2018) Specification for admixtures for concrete (*first revision*).
IS 15388: 2003 Specification for silica fume.
IS 16714: 2018 Ground granulated blast furnace slag for use in cement, mortar and concrete-Specification.

PEC (PE404-d): Structural Audit & Retrofitting

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: **Concrete technology**

Course Objectives:

Sr. No.	Course Objectives
1	To learn various distress and damages to concrete and masonrystructures and understand the importance of maintenance of structures.
2	To assess the damage to structures using various tests and learn the importance of maintenance of substrate preparation.
3	To learn various repair techniques of damaged structures corroded structures.

Course outcomes (Cos):At the end of the course students will be able to

CO No.	Course Outcomes (Cos):	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the uses and applications of structural assessment of structures.	2	Understand
2	Know the various distress and damages to concrete and masonry structures,	3	Apply
3	Know the types and properties of repair materials etc. assessing damage to structures and various repair techniques	3	Apply
4	To get the knowledge on various retrofitting techniques of concrete structures	4	Analyze
5	To apply the various strengthening techniques for various structural elements	4	Analyze
6	To understand the quality control of concrete structures	4	Analyze

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

Course Contents

Unit No.	Topic	No. of Hours	Cos
I	**Introduction to Structural Audit** Introduction to Structural Audit, Objectives, Bye-laws, Importance, and Various Stages involved, Visual inspection: scope, coverage, limitations, Factors to be keenly observed.	06	1
II	**Structural Health Monitoring** Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure. Structural health monitoring. Various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion. Application of piezo sensors in health monitoring.	06	2
III	**Selection of repair materials for concrete:** Ideal characteristics for selection of repair materials, premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy and epoxy systems	06	3
IV	**Repair/Rehabilitation methods:** Shortcreting and Guniting. Repair and strengthening of columns and beams using ferrocement jacketing, fiber wrap technique, Foundation Rehabilitation methods	06	4
V	**Strengthening of structures:** Retrofitting of masonry and steel structures. Retrofitting of special structures damaged due to seismic events. Retrofitting of flexural and shear, slab members. Concrete overlay for Pavement Rehabilitation, Case studies of retrofitting	06	5
VI	**Maintenance and demolition of special structures** Maintenance, water leakage-detection and mitigation, fire damage-detection and repair, demolition of concrete structures outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. – case studies of demolition techniques.	06	6

Text Books:

1. "Repair and protection of concrete structures", by Noel P.Mailvaganam,CRCPress,1991.

2. "Concrete repair and maintenance Illustrated", by Peter. H. Emmons, Galgotia publications Pvt.Ltd.,2001.

3."Earthquake resistant design of structures" by Pankaj Agarwal,Manish shrikande,PHI, 2006.

4. "Handbook on Non destrucive Testing of Concrete",by Malhotra, V. M. and Carino, N. J., CRC Press

5. ACI 440.2R-08. Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures, American Concrete Institute

6. “Maintenance, Repair & Rehabilitation & Minor Works of Building”, by P C Varghese, PHI

Reference Books:

1. FailuresandrepairofconcretestructuresbyS.Champion,JohnWileyandSons,1961.

2.DiagnosisandtreatmentofstructuresindistressbyR.N.RaikarPublishedbyR&D Centre of Structural Designers and Consultants Pvt. Ltd, Mumbai.

Handbooks & IS Codes:

1. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.

2.Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House,2010.

NPTEL courses:

https://onlinecourses.nptel.ac.in/noc22_ce20/preview

PEC (PE404-e): Construction Safety Management

Teaching scheme	Examination scheme
Lectures: 3 hours/week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Course Pre-requisites- Building Technology & Material, Infrastructure Engineering & Construction Techniques, Construction Project Management

Course Objectives:

Sr. No.	Course Objectives
1	To impart knowledge of basic principles of safety and importance of personal protective equipment.
2	To enhance knowledge about safety organization as well as Formwork safety practices that can be used effectively on construction sites.
3	To study various IS codes used for safety as well as to aware about Electrical and Fire safety practices for construction sites.
4	To understand the importance of safety management and applications of digital technology in construction safety.
5	To gain knowledge about safety implementation, safety legislation and emergency rescue equipment.
6	To aware regarding OSHA guidelines.

Course Outcomes: At the end of the course students will be able to:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand role of construction safety and importance of personal protective equipment in construction sector.	2	Understand
2	Understand the working of safety organization and apply safety measures and safety policies for formwork.	3	Apply
3	Apply safety practices for electrical and fireworks to avoid accidents at construction sites.	3	Apply
4	Inspect corporate safety plan and a site-specific safety plan for various construction activities.	4	Analyze
5	Analyze safety during project execution along with SoPs (Safe Operating Procedures) for construction equipment and tools.	4	Analyze
6	Prepare checklist for Construction safety audit using OSHA guidelines.	4	Analyze

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

Course Contents

Unit No.	Unit Title	No. of Hours	COs
I	**Overview of Construction safety** Introduction to safety, challenges in the construction sector, accident statistics , Basic principles of safety, Major causes of accidents at project site, Effects of accidents, Role of supervisor/ Engineer in ensuring safety at construction site, Introduction and importance of personal protective equipment , Indian standards , Selection factor of PPE	06	1
II	**Safety Organization** –Safety Policy, Safety Record Keeping, Safety Culture, Safety and First Line Supervisors, Middle Managers, Top Management Practices, Sub contractual obligation, Project Coordination and Safety Procedure. **Formworks Safety-** Scaffolding Assembling and dismantling and their safety, design and inspection of scaffolding, scaffolding erection procedure, safety precaution while erecting scaffolding, dismantling of scaffolding.	06	2
III	**Electrical Safety-** Electricity hazards, Indian standards, Assessment of effects of electrical parameters on human body, Available safety measures for electric works. **Fire safety in buildings** -Causes of fire hazards, Classification of fire and extinguishers, fire prevention & protection system, Fire Alarm - Principles of Operation, Fire Sensors, Smoke detectors and their types, Control devices, fire awareness and signs, First aid on site. Cost aspects of accidents on site, Study of various IS codes used for safety in different operations of construction	06	3
IV	**Construction Safety Management** Safety in construction operations, like excavation, tunneling, concreting, Roads and bridges, Demolition, Use of ladders, welding and cutting, Safety in use of construction equipment, e.g. vehicles,	06	3

	cranes, hoists and lifts, etc. General trades and their occupational hazards, Applications of digital technology in construction safety. Case study on a project consisting of a complete corporate safety plan and a site-specific safety plan containing a hazard analysis of an actual project		
V	**Accident Prevention** Training for safety awareness and implementation, Safety during project execution, Training project staff and operation staff, stages of project construction safety during receiving, unloading, shifting and storage , safety guidelines for storage, General safetyfacilities at construction sites for emergency rescue equipment and exhaust gases, SoPs (Safe Operating Procedures) for Construction equipment, materials handling, disposal & hand tools.	06	4
VI	**Statutory Obligations** Safety legislation, law & regulations - Labour license, Fitness certificate, Occupation certificate, Worker's Compensation Insurance. General OSHA Requirements, compliance with OSHA worker safety and environmental safety laws, inspection procedures, and penalties for lack of conformance to safety laws, Safety acts and, Regulations, Safety audit.	06	6

Text Books

1. "Construction Management and Planning", B. Sengupta and H. Guha, 1st Edition [2004], Tata McGraw Hill Publications.
2. "Construction Safety Management", Kumar Neeraj Jha, Dilip A Patel, Amarjit Singh ,1st Edition [1 March 2022], Paperback
3. "Construction Safety: Health", Practices and OSHA: Health, Practice and OSHA Hardcover, [28 October 2021]

Reference Books

1. Construction safety manual, National Safety Commission of India.
2. NICMAR "Safety Management in Construction Industry – A Manual for Project Managers" NICMAR, Mumbai, 1998.
3. ISI for safety in Construction, Bureau of Indian Standards.
4. Davies V. S. Thomasin K, Construction Safety Handbook, London, 1997, Thomas Telford.
5. "Fundamental of Construction Safety" , P.T. Armstrong, 1980, Nelson Thornes Ltd

E-resources

https://onlinecourses.nptel.ac.in/noc21_ce16/

Professional Electives -IV

PEC (CE405-a): Dams and Hydraulic Structures

Teaching scheme	Examination scheme
Lectures: 03 hours/week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: **Fluid Mechanics and Water Resources Engineering**

Course Objectives:

Sr. No.	Course Objectives
1	To impart knowledge of dams, arch dams, and dam safety instrumentations for the various hydraulic structures.
2	To introduce the concept of gravity dam, its stability analysis, causes of failure, design criteria.
3	To study the components of spillway, spillway gates, hydropower plant as well analyze and design of spillway.
4	To study the stability analysis and its failures of earthen dam, diversion headwork.
5	To study the canal, various types of canal structures, and design aspects of canal.
6	To study the cross drainage, types of cross-drainage structures, foundation assessment.

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

COs No.	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Classify dams and study safety considerations in dams.	2	Understand
2	Perform and analyze the stability analysis of gravity dams.	4	Analyze
3	Study components of spillway, spillway gates, hydropower plant as well analyze and design of spillway.	4	Analyze
4	Explain causes of failure, design criteria, stability analysis of earthen dam, and diversion headwork.	4	Analyze
5	Classify canals, types of canal structures, canal outlets and design of canal.	3	Apply
6	Explain cross drainage, types of cross-drainage structures, foundation assessment.	2	Understand

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

Course Contents

Unit No.	Topics	No. of Hrs	COs
I	**Dams:** Introduction, Classification based on purpose, materials, size of project, hydraulic action, structural action, Selection of site for dam. Dams and social issues, Large dams verses small dams. **Dam safety and instrumentation:** Objectives, working principles of instruments, Selection of Equipment. Various instruments using for dam safety. **Arch Dam:** Introduction, Classification: Constant angle arch dam, Constant radius arch dam Variable radius arch dam, Arch gravity dam, Double curvature arch dam. Buttress dams-advantages and limitations.	06	1
II	**Stability Analysis of Gravity Dam:** **Gravity Dam:** - Components and Forces acting on gravity dam. Stability analysis of gravity dam, Elementary profile of gravity dam, Concept of low and high gravity dams, Modes of failure of gravity dam, Middle third rule. **Construction of gravity dams:** Colgrout masonry, Roller Compacted Concrete (R.C.C.), Crack in gravity dam, construction joints, Keys, Water seal and Retrofitting. Foundation treatment.	06	2
III	**Spillways and Spillway Gates:** **Spillway:** -Location, Different key levels, Capacity, Components, Classification: Main or service spillway, Gated and ungated spillway, Straight drop spillway, Overflow or ogee spillway, Siphon spillway, Auxiliary spillway, Emergency spillway. Labyrinth and Piano-key weir. Design of Ogee spillway. Energy dissipation below spillway. Correlation between jump height and tail water depth, Correlation 1-2-3-4-5 of TWD Vs Jump depth. **Spillway gates:** Classification based on function, movement of gates, special	06	3

	features, Requirements of spillway gates, Maintenance of gates, Inspection of gates.		
IV	**Stability Analysis of Earthen Dam and Diversion Head works:** **Earthen Dam:** -Conditions favoring, Limitations and Components. Classification: based on materials, method of construction. Hydraulic (Seepage) Analysis, plotting of seepage line, Homogeneous earth dam with horizontal drainage blanket, Determination of seepage discharge using phreatic line, Determination of seepage discharge through earth dam using flow net. Forces acting on earth dam. Method of stability analysis of an earth dam, Procedure of analysis by Swedish slip circle method, Borrow pit zoning and allocations. Piping failure concept. **Diversion head works:** Introduction, Functions, Selection of site, Layout and Components of diversion head works, silt control, location of headworks.	06	4
V	**Canal and Canal Regulation Structures:** Introduction, Classification: based on alignment, soil, source of supply, discharge, lining, Selection of canal alignment, Design of stable canal in alluvial beds, Design of lined canal. Kennedy's and Lacey's theory. Canal fall: Necessity, location and types of canal falls, design aspects of Sarda type fall, functions and design aspects of head regulator and cross regulator, canal escapes, canal outlets, Eddies formation concept, Dams outlet.	06	5
VI	**Cross-Drainage Structures:** Types of cross-drainage structures, selection of suitable type, classification of aqueducts, design aspects of cross-drainage structures. **Foundation assessment:** Techniques of seepage control, drainage, and improving the in-situ strength, relative merits, control of piping and liquefaction, Applications of geotextiles.	06	6

Text Books:

1. "Irrigation Engineering and Hydraulic Structures", by Garg S.K., Khanna Publishers ISBN-13: 978- 8174090478.
2. "Irrigation, Water Resources and Water Power Engineering", Modi, P.N., Standard Book House, New Delhi, Edition: 9th, Year-2014 edition (2014).
3. "Irrigation and Water Resources Engineering", by Asawa G.L., New Age International (P) Ltd. Publishers, 1st Ed., 2005.
4. "Irrigation and water power Engineering", by Punmia B. C.,Laxmi Publications; Revised edition (2016), ISBN-13: 978-8131807637.
5. "Hydraulic Structures", by P. Novak, and C. Nalluri, Taylor & Francis. Ed. 4th, 2007.
6. "Earth and rock fill dams", by J. L. Sherard, John Wiley.

7. “Slope Analysis”, by R.N. Chowdhary and E.I. Sevier, London, 1978.
8. “Slope stability”, by M. G. Anderson and K. S. Richard, John Wiley, 1987.

Reference Books:

1. Design of Small Dams, USBR, Oxford and IBH Publishing Co.
2. Design Textbook in Civil Engineering: Volume Six: Dams, Leliavsky, Serge, Oxford and IBH Publishing Co. Pvt. Ltd., 1981.
3. Earth and Earth Rock Dams, Sherard J.L, Woodward R.J., John Wiley and Sons, inc. 1963.
4. Engineering for Dams (Volumes I, II & III) by Williams Creager, Justin & Hinds, Nem Chand & brothers-Roorkee, 2007.
5. Hydraulic Structures by P Novak, A.I.B. Moffat, C. Nalluri, R. Narayanan, CRC Press, 2006.
6. Hydraulic Design of Stilling Basins and Energy Dissipators, A.J, Peterka, USBR Engineering Monographs No. 25. 1984.
7. Foundation Design Manual, N. V. Nayak, Dhanpatirai & Sons, Delhi, 1985.

e – Resources:

https://www.routledge.com/IAHR-Design-Manual/book-series/TFIAHRHSDM

PEC (CE405-b): Foundation Engineering

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total :100 Marks**

Prerequisite Course: **Geotechnical Engineering**

Course Objectives:

Sr. No.	Course Objectives
01	To Evaluate Physical and Engineering properties of soil by laboratory and field tests
02	To evaluate bearing capacity and settlement under foundations
03	To design of shallow foundations, deep foundations and to provide solutions for foundations on problematic soils.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Classify the various physical and field soil exploration methods.	3	Apply
2	Evaluate the load carrying capacity and settlement of shallow foundation.	3	Apply
3	Evaluate settlement of shallow and deep foundations.	3	Apply
4	Design of various deep foundations as per codal provisions.	4	Apply
5	Designs the deep foundations as per the prevailing site conditions.	4	Apply
6	Understand various techniques of soil stabilization.	2	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	---	---	---	---	---	---	---	---	---	---	---
CO2	2	2	3	2	---	---	---	---	---	---	---	---	3	2
CO3	2	---	---	2	---	2	---	---	---	---	---	---	3	2
CO4	2	3	2	---	---	2	---	---	---	---	---	---	3	2
CO5	2	---	---	2	3	---	---	---	---	---	---	2	3	2
CO6	2	---	---	2	3	---	---	---	---	---	---	2	3	1

Course Contents

Unit No	Topics	No of Hrs	Cos
I	**Subsurface Investigations for Foundations:** Purpose -planning of subsurface exploration. Methods of Investigation: Trial pits, borings, depth and number of exploration holes, core recovery, RQD, Core Log. Geophysical methods– Seismic refraction and Electrical resistivity method. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field tests- SPT, N value correction and significance, Pressure meter test.	06	1
II	**Bearing capacity and Shallow Foundation:** Basic definitions, Modes of shear failure, bearing capacity analysis- Terzaghi, Hanson's, Meyerhof's, Skempton's, basics equations and IS code method - Rectangular and Circular footings. Housel's perimeter shear concept. Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Presumptive bearing capacity. Bearing Capacity from SPT and SCPT and Plate load Test data, proportioning of footing based on settlement criteria. Foundations on Problematic soils: Problems and Remedies.	06	2
III	**a) Settlement and Consolidation Settlement: -** Introduction, Causes of settlement. Pressure bulb, Contact pressure, Significant Depth of foundation, Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, Consolidation settlement. Use of Plate Load test and SPT in settlement analysis. **b) Consolidation** - Introduction, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- Square root of time fitting method and logarithm of time fitting method. Time factor. Introduction of Normal consolidation, over consolidation and Pre consolidation pressure.	06	3
IV	**Shallow foundations:** Shallow foundation- Types and Applications. Floating foundation, – Depth of Footing – Foundation loading – Principle of design of footings – Proportioning for equal settlement – Design of simple footing, combined footings, mat foundation, Numerical examples with codal Provisions for safety and serviceability.	06	4
V	**Design of Deep foundations**: Introduction, Pile classification, Pile Installation-Cast in-situ, driven and bored pile, Load carrying capacity of pile by static method, Dynamic Methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action- Feld rule. Rigid Blocks method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition, Types and uses. Well foundation: components, sand Island method.	06	5
VI	**(a) Introduction to soil stabilization:** Mechanical Stabilization Cement Stabilization – Lime Stabilization –Bituminous Stabilization – Chemical	06	6

	Stabilization– Stabilization by geosynthetics. **b) Foundation on Black Cotton Soils:** Characteristics, swelling potential and its evaluation methods, Engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed Piles-Design principles and its construction Techniques. Stone Columns prefabricated vertical Drains, Preloading technique, and vibro flotation technique.		

Text Books:

1. K R Arora, Soil Mechanics and Foundation Engineering (Geotechnical Engineering), Standard Publishers Distributors, Nai Sarak, Delhi, 2008.
2. Gopal Ranjan and A. S. Rao, ―Basic and Applied Soil Mechanics‖, New Age International Publishers, (2010)
3. Dr. B. C. Punmia, ―Soil Mechanics and Foundation Engineering‖, Laxmi Publications.

Reference Books:

1. J E Bowles, Foundation Analysis and Design, McGraw-hill, New Delhi, 1997.
2. B M Das, N Sivakugan, Principles of Foundation Engineering, Cengage learning, Boston, 2018.
3. D P Coduto, M R Yeung, W A Kitch, Foundation Design: Principles and Practices, 3rd Ed, Pearson Education, USA, 2016.
4. S R Kaniraj, Design Aids in Soil Mechanics and Foundation Engineering, Tata McGraw Hill Education Private Limited, New Delhi, 2009.
5. Foundation Design Manual: N V Nayak, Dhanpat Rai Publications.
6. Practical Handbook of Grouting: Soil-Rock and Structures---James Warner-- Wiley 15. IS 1892, 1893, 2911, 6403, SP36 (PART-II) .

PEC (PE405-c): Solid Waste Management

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs. / Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: **Environmental Engineering**

Course Objectives:

Sr. No.	Course Objectives
1.	To introduce the necessary knowledge about the functioning elements of municipal solid waste management and sanitary landfilling
2.	To learn Solid Waste Handling, Collection and Storage
3.	To learn techniques for Processing of Municipal solid waste
4.	To adopt & develop skill for safe disposal methods of solid waste
5.	To aware students about various hazardous waste & its impact on human health
6.	To enhance the knowledge of solid waste related environmental legislation and government initiatives

Course Outcomes: At the end of the course students will be able to:

COs No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Explain solid waste management systems in terms of their composition, rate of generation, sampling, and characteristics.	2	Understand
2	Select appropriate vehicle routes and sites for municipal solid waste storage and disposal.	3	Apply
3	Identify the suitable technique for processing municipal solid waste.	3	Apply
4	Identify feasible treatment and disposal options for leachate.	3	Apply
5	Select the suitable method of treatment and disposal for biomedical and hazardous waste.	4	Analyse
6	Make use of knowledge of environmental legislation and government initiatives concerning solid waste.	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	--	1	-	-	-	3		-	-	-	-	-	1	-
CO2	1	2	2	-	-	-	3	-	-	-	-	-	2	-
CO3	1	1	3	-	-	1	2	-	-	-	-	-	2	-
CO4	1	1	3	-	-	2	2	-	-	-	-	-	2	-
CO5	1	2	3	2	-	1	2	-	-	-	-	-	2	-
CO6	-	-	-	-	-	3	2	2	-	-	-	-	-	1

Course Contents

Unit No.	Topic	No. of Hours	COs
I	**Introduction to solid waste management**: Functional elements of solid waste management. Solid Waste- A consequence of life, Types, sources and Sampling and characteristics, Physical, Chemical, and Biological Properties Estimation of solid waste quantity, Factors affecting solid waste generation rate.	06	1
II	**Solid Waste Handling, Collection and Storage**: Waste handling and separation, waste storage at source, processing at source, **Collection of Solid Waste**- Primary collection, Secondary collection – Hauled container system, and stationary container system. Analysis of collection system, Collection routes, route balance. PS based VTMS **Transfer station**: Meaning, Necessity and types Location, Economic analysis, **Transportation of solid waste**: Means and Methods. Waste Transportation Model for Metropolitan cities.	06	2
III	**Processing of Municipal solid waste**: Conveying and compacting waste, Shredding, and types of shredders**,** Material separation, devices for material separation, Material recovery facilities, Recycling of materials, Chemical transformation, Incineration, Pyrolysis and Gasification, Energy recovery from solid waste, Biological transformation: Composting, Factors affecting composting, Vermicomposting, Anaerobic digestion – Types of Biogas digester.	06	3
IV	**Disposal**: Sanitary landfill- terms used in landfill, Landfilling methods, Site selection, and location criteria, Landfill process, Leachate collection and treatment, Landfill gas collection and treatment, Design of landfill, Closure, and rehabilitation of old dumps. Biomining.	06	4
V	**Special waste:** Construction and Demolition waste and its management, **Biomedical waste:** Definition, Sources, and generation of Biomedical waste, classification, and management technologies. **E-waste:** Treatment and disposal, Hazardous **waste:** Characteristics and types, Treatment and disposal methods of Hazardous waste.	06	5
VI	**Municipal Solid Waste Management Rules:** Waste Management legislation in India- Provisions of SWM Rules, 2016 and Municipal Solid Wastes (Management and Hauling) rules, 2000, Integrated Solid Waste Management (ISWM), Smart Solid Waste Management system using IOT. Role of NGOs; Awareness of Society. Case study of various initiatives of the Government of India, such as Swachh Bharat Mission Introduction to various initiatives of the Govt. of India, such as Swachh Bharat Mission, Case Study of a city.	06	6
Text Books:			

1.Matthew J. Franchetti, A System Approach, Solid Waste Analysis & Minimization, McGraw-Hill, (1st Edition, 2009), ISBN: 978-0071605243.

2.S.C. Bhatia Solid and Hazardous Waste Management, Atlantic Publishers and Distributors Ltd., (1st Edition, 2007), ISBN-13: 978-8126908141.ISBN-10: 8126908149

3.Edward A. Mcbean, Frank A. Rovers, Grahame J. Farquhar Solid Waste Landfill Engineering and Design,Prentice Hall Inc. (2nd Edition, 1995), ISBN: 0130791873.

4.Jagbir Singh and Al Ramanathan,Solid Waste Management Present And Future Challenges, Dreamtech Press, (1st Edition- Nov 2019)ISBN: 9789389447927.

Reference Books

1.George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues (Civil Engineering), McGraw- Hill, New York, 2nd Edition (Indian Edition 28 Feb1993), ISBN:978-00706323700070632375.

2.Charles A. Wentz, "Hazardous waste Management," Mc Graw Hill Book Company, 1989, ISBN 0070692912, 9780070692916.

3.Tchobanoglous, G. and Kreith, F., Handbook on Solid waste Management, McGraw Hill, 2002, 2nd Edition, ISBN: 9780071356237.

4.CPHEEO Manual on Municipal Solid Waste Management – 2000, Ministry of Housing and Urban Affairs, GOI.

E-Resources:https://onlinecourses.nptel.ac.in/noc22_ce82/course

PEC(PE405-d) Formwork Technology & Plumbing System

Teaching Scheme	Examination Scheme
Lectures: 03 Hrs./Week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total :100 Marks**

Prerequisite Course: Concrete Technology, Building technology, Water supply & Sanitation

Course Objectives:

Sr. No.	Course Objectives
1	Study different types and advance materials use for formwork construction.
2	Exposure of formwork design consideration and construction practices.
3	To know guidelines and formwork design procedure for structural elements.
4	To study advance formwork system for special structures.
5	To know types and components of plumbing.
6	To Understand the code provision of design for plumbing system.

Course outcomes (Cos): At the end of the course students will be able to:

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
1	Classify the various type of Formwork, Formwork material, Formwork properties.	2	Understand
2	Understand the various design parameters of formwork as per IS code provision.	2	Understand
3	Illustrate the design and erection of forms for various structural elements.	3	Apply
4	Demonstrate the modern formwork system for Special structure.	3	Apply
5	Understand the requirement and sustainable practices in plumbing system.	2	Understand
6	Illustrate the plumbing design aspects as per the requirement of Indian Standards.	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	-	1	-	2	-	-	-	2	-	1	-	-	1
CO2	2	-	2	-	2	-	-	-	2	-	1	-	-	1
CO3	2	-	2	-	2	-	-	-	2	-	1	-	-	1
CO4	2	-	2	-	2	1	-	-	2	-	1	-	-	1
CO5	2	-	1	-	2	1	-	-	1	-	1	-	-	1
CO6	2	-	2	-	2	1	-	-	2	-	1	-	-	1

Course Contents

Unit No.	Topic	No. of Hours	COs
I	**Introduction to Formwork** Requirements, Selection, and Classification (Types) of Formwork, Conventional formwork material like timber, plywood, steel; Advanced formwork material like aluminum, PVC, plastic form, fiber reinforced polymer (FRP) composite materials and accessories, Slip form and other moving forms, shoring towers and Scaffolds, Formwork Economy.	06	1
II	**Formwork Analysis** **Typical form**s for structural member with detailing, loading and moment of formwork, IS code provision, rate of placing, consistency of concrete, vibration, hydrostatic pressure and pressure distribution, design considerations, allowable stresses, deflection limits, common deficiencies in design. **Formwork and false work** - Temporary work systems, construction planning and site constraints; Special and proprietary forms.	06	2
III	**Formwork Design & Management** Formwork for concrete structure: Requirement, their types and Guidelines for the design, Important parameters and specification for formwork design as per IS 14687. Conventional and Proprietary formwork design: Foundation, Walls, column, Beams and Slabs formworks. Formwork Management Issues, Formwork issues in multi-story construction, Formwork Failure- causes and case studies, Construction sequence and safety use of formwork and false work.	06	3
IV	**Advance Formwork Systems** Formwork for Special Structures such as Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, tunnel. Formwork for Bridge Structures, Cases in Failure of Temporary Support Structures of Bridges, Flying Formworks such as Table Forms, Tunnel Formwork System, Column Mounted Shoring System, Gang Forms - Slip form -Formwork for Precast Concrete.	06	4
V	**Introduction to Plumbing in Buildings** History of plumbing, codes on plumbing, Study of Indian standards and plumbing by-laws (NBC), need for sustainable practices in plumbing, plumbing requirements, role of plumbing designer, role of plumber, tools and equipment used in plumbing work, maintenance of building pipe line, Sanitary Fittings, high rise building plumbing, future challenges in plumbing.	06	5

VI	**Plumbing System** Introduction to Plumbing Systems, types of plumbing systems for various buildings, components of plumbing and drainage systems, principles governing design of building drainage, plumbing hydraulics residential plumbing and drainage system design, Code provisions on pressure and velocity in plumbing systems, simultaneous demand, different methods of pipe sizing in building (fixture unit, water demand calculator, fixture value method, etc.), plumbing plans of buildings, New plumbing technologies.	06	6

Text Books:

1. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999.
2. K.N. Jha, Formwork for Concrete Structures, First Edition, McGraw Hill., New Delhi, 2012.
3. Modern Practices in Formwork for Civil Engineering Construction Works, Dr. Janardan Jha & Prof. S. K. Sinha, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.
4. Plumbing: Design and Practice, Deolalikar S. G., Tata McGraw-Hill Publication.

Reference Books:

1. Austin, C.K., Formwork for Concrete, Cleaver- Hume Press Ltd., London, 1996
2. Peurifoy, R. L., and Oberlender, G. D., 2011, Formwork for Concrete Structures, 4th edition, McGraw-Hill
3. Hurd, M. K. Formwork for Concrete. ACI 347, 6th edition, American Concrete Institute, Detroit,Michigan, 1995
4. Ratay, Robert T. Handbook of Temporary Structures in Construction. 2nd edition, McGraw Hill,New York, 1996.

Indian Standards:

1. IS 14687 (2005) Falsework for concrete structures - Guidelines, Bureau of Indian Standards, New Delhi.
2. IS 12183-1-1987, Code of practice for Plumbing in multi-storeyed buildings (Part 1 water supply), Bureau of Indian Standards, New Delhi, India.
3. National Building Code of India, Bureau of Indian Standards, 2005.
4. Uniform Illustrated Plumbing Code – India (UIPC-I), Indian Plumbing Association.

PEC (PE405-e): Smart City Planning and Management

Teaching scheme	Evaluation scheme
Lectures: 3 hours/week	**CIA : 40 Mark** **End Sem Exam: 60 Marks**
Credits: 03	**Total : 100 Marks**

Prerequisite Course: **-Nil-**

Course Objectives:

Sr. No.	Course Objectives
1	To create awareness and deepen knowledge on smart cities
2	To expand capacities on various theoretical and practical aspects of smart cities
3	To develop capacity in planning, managing and evaluation of smart cities

Course Outcomes: At the end of the course students will be able to:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Define fundamental of Smart City, including its objectives and history.	2	Understand
2	Demonstrate concept of smart city including sustainability and provisions.	2	Understand
3	Plan smart city infrastructure requirements.	3	Apply
4	Manage smart physical infrastructure using modern tools and techniques.	3	Apply
5	Describe various national and international case studies of smart city technologies, including Public Policies, Acts.	2	Understand
6	Analyze the Emerging new technologies of Smart City (India and abroad)	4	Analyze

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

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

Course Contents

Unit No.	Unit Title	No. of Hours	COs
I	**Fundamental of Smart city**: Introduction of Smart City, Objective for smart cities, History of Smart city world and India, need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment.	06	1
II	**Concept of Smart City:** Introduction, Concepts of Sustainability, Energy Efficient City, Climate Change, Resilient Cities, Livability, Inclusivity, Safety and Security in City, Organizational Setup- Governance and Administration, Basic Infrastructure Provision in City, CSR, Carbon Credits.	06	2
III	**Planning and development of Smart city infrastructure:** Introduction, Smart City Framework, Need for a regulatory framework, E Governance, Role of Smart City in Governance, Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety and security, disaster management, economy, cyber security.	06	3
IV	**Managing Smart Physical Infrastructure:** Introduction, Integrated infrastructure management systems for smart city Smart Infrastructure, Smart IT and Communications, Waste Management, Smart Transport, Automation, Green Buildings, Smart Energy, Water and Sanitation, Digital Payments, Edtech, Healthcare, Smart Heritage, Urban Freight, Environmental Pollution.	06	4
V	**Public Policies, Acts and Case studies of Smart City:** Worldwide policies for smart city, Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Public Policy, Types of public policy, Policy Principles for Smart Cities, Policies and Acts, Transportation policy, Smart Cities Mission, Digital India, AMRUT, Start-up India, Namami Gange, Swachh Bharat, Case studies of top growing Smart Cities in abroad and IndiaZurich, Oslo, Canberra, Copenhagen, Lausanne, Bhubneshwar, Pune, Jaipur, GIFT City India.	06	5
VI	**Emerging new technologies of Smart City (India and abroad)** Smart City – Worldwide techniques, Elements, Features, planning approach and strategies, policy efforts in India; Inclusive planning- Concept and components, essential dimensions of inclusive planning; growth of informal sector, characteristics, linkages with formal sector, Planning interventions, Inclusive zoning, development and building regulations. Failure in making a smart city a case study.	06	6

Text Books:

1. "Smart Cities: Foundations, Principles, and Applications," First Edition, by Houbing Song, Ravi Srinivasan, Tamim Sookoor, Sabina Jeschke, Wiley Publishing.
2. "Smart Cities: The Internet of Things, People and Systems," First Edition, by Schahram Dustdar, Stefan Nastić. Ognjen Šćekić, Springer Publishing.

Reference Books:

1. Arpan Kumar Kar et al. (2017), Advances in Smart Cities: Smarter People, Governance, And Solutions, CRC Press, Taylor & Francis Group
2. Gordon Falconer and Shane Mitchell (2012), Smart City Framework, Cisco Internet Business Solutions Group (IBSG).
3. Andrea Caragliu, Chiara F. Del Bo (2018), Smart innovative cities: The impact of Smart City policies on urban innovation, Technological Forecasting & Social Change
4. Arijita Kakati, Smart Cities: Need for a regulatory framework (2017), ENewsline, January, PSA Legal Counsellors.

E- Resources:

1. Poonam Sharma and Swati Rajput (2017), Sustainable Smart Cities in India: Challenges and Future Perspectives, Springer International Publishing Mario Weber and Ivana Podnar Zarko (2019), A Regulatory View on Smart City Services, Sensors, www.mdpi.com/journal/sensors
2. http://amrut.gov.in/content/
3. https://smartcities.gov.in/themes/habikon/files/SmartCityGuidelines.pdf
4. https://imd.cld.bz/IMD-Smart-City-Index-Report-20231/6/
5. http://164.100.161.224/content/innerpage/cities-profile-of-20-smart-cities.php

PCC (CE406): Characterization of Wastewater Lab.

Teaching scheme:	Examination scheme:
Practical: 2 hours/week	Oral Exam: 50 Marks
Credits: 01	Total : 50 Marks

Pre-requisites: Basic Concepts of Engineering Sciences and Mathematics, fluid mechanics, water treatment and distribution.

Course Objectives:

Sr. No.	Course Objectives
1	Students will be acquainted with the various tests used to assess the pollution level of wastewater.
2	Students will be conversant with the functioning of wastewater treatment plants.

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

CO's No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Use a variety of instruments and methodologies to characterize sewage/wastewater.	3	Apply
2	Compare the wastewater characteristics with the IS code/standard limits established by CPHEEO/CPCB.	4	Analyzing
3	Analyze and interpret the sewage/wastewater testing results for the design of wastewater treatment plants.	5	Evaluating

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	1	2	1	2	-	-	-	1	3	3
CO2	-	3	-	3	-	2	2	2	-	-	-	1	1	1
CO3	2	2	3	2	3	2	2	2	-	-	-	1	3	3

List of Laboratory Experiments:

The term work consists of a journal having details of at least 8 experiments. The assignment is compulsory. Oral examination will be based on term work

List of experiments (Any eight from 12)

01. Determination of dissolved oxygen in a given wastewater sample
02. Determination of Bio-Chemical Oxygen Demand in a given wastewater sample
03. Determination of Chemical Oxygen Demand in a given wastewater sample
04. Determination of solids -Total solids, suspended solids, volatile solids, settle able solids and non-settle able solids in a given wastewater sample
05. Determination of Sludge Volume Index in a given wastewater sample
06. Determination of Electrical Conductivity in a given wastewater sample

07. Determination of Phosphates by spectrophotometer in a given wastewater sample
08. Determination of Nitrates by spectrophotometer in a given wastewater sample
09. Determination of heavy metals like Cr^{6+} or Zn or Ni or Cd in a given wastewater sample
10. Determination of Kjeldahl nitrogen in a given wastewater sample
11. Visit to domestic / Industrial wastewater treatment plant & its detailed report
12. Computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment Plant (ETP) of Sugar/ Dairy/Distillery Industry using suitable software (e.g., ASIM, STOAT) or excel sheets

Assignment

01. Brief report on sewer materials, choice of materials, testing of sewer pipes and sewer appurtenances.

PCC (CE407): Transportation Engineering Lab

Teaching scheme	Evaluation scheme
Practical: 2 hours/week	**Term Work :** 25 Marks
Credits: 01	**Total :** 25 Marks

Prerequisite Course: Concrete Technology and material testing procedures

Course Objectives:

Sr. No.	Course Objectives
1.	To learn the principles and procedures of testing of coarse aggregates.
2.	To learn the principles and procedures of testing of bitumen bituminous mixes.
3.	To know the I.S. requirements and MORTH requirement.

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

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Classify, differentiate and tests the different types of road aggregates.	2	Understand
2	Perform the various tests and identify the suitability of bitumen for the road construction purposes.	3	Apply
3	Suggest the good quality materials like aggregate, bitumen and various mixes used for road constructions with sustainable solutions.	4	Analyze

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	3	2	2	2	-	1	1	2	3	2	1	2	2	2
CO2	3	2	3	2	-	1	1	2	3	2	2	2	2	2
CO3	3	2	3	2	1	1	1	2	3	2	2	2	2	2

List of Laboratory Experiments

Expt. No. List of Experiment (Conduct any 12 experiment)

A) TEST ON AGGREGATES

1 Aggregate Impact Value and Crushing value Test

2 Los Angeles Abrasion Test

3 Shape Test (Flakiness Index and Elongation Index

4 Specific Gravity and Water Absorption Test by basket method

B) TEST ON BITUMEN

5 Penetration Test

6 Ductility Test

7 Viscosity Test (Tar Viscometer)

8 Softening Point, Flash and Fire Point

9 Specific Gravity Test

C) TESTS ON BITUMINOUS CONCRETE MIXES

10 Marshall Stability Test

11 Bitumen Extraction Test or Stripping value Test

D) SITE VISITS (ANY ONE VISIT MANDATORY)

12 Visit to road under construction State highway or National Highway OR MDR (Nearby area)

13 Visit to Crushing and Hot mix Plant

E) ASSIGNMENT ON SOFTWARE

14 Pavement analysis and design using IIT PAVE software

PCC (CE408) Professional Practice Lab

Teaching Scheme: **Practical:** 02 Hrs. / Week	**Evaluation Scheme:** **Oral Exam** :50 Marks
Credits: 01	**Total** **:**50 Marks

Prerequisites: Basic Mathematics, Building Technology and Materials and Building Planning

Course Objectives:

Sr. No.	Course Objectives
1	To study the methods of estimation and procedure of taking out quantities of various items of work for load bearing, RCC framed structure and other Civil Engineering structure.
2	To learn the procedure of analysis of rate of items, and drafting specification of items of work.
3	To learn the valuation and get acquainted with tender notice.

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

CO No.	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1.	Estimate of proposed civil Engg. Projects	4	Analyse
2.	Perform all operations leading to drafting of specification and rate analysis	4	Analyse
3.	Carry out the valuation of structure/ project and complete tendering procedures and decide the genuine contractor for particular work	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	3	--	--	--	2	2	--	2	3	2	2	2	2	2
CO2	3	2	3	1	2	2	--	2	3	2	2	2	2	2
CO3	1	--	--	--	--	2	--	3	2	2	2	2	2	2

The following exercises should be prepared and submitted:

1. Report on contents, use of current DSR and drafting detailed specification for major items of works.
2. Working out quantities using C-L and PWD method for a small single storied load bearing structure up to plinth and Preparing Abstract Sheet using DSR (Regional).
3. Detailed Estimate of a single storied R.C.C framed building using D.S.R.
4. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab and retaining wall by preparing bar bending schedule.

5. Working out quantities of earthwork for road project
6. Working out rate analysis for the items as in the specifications of Assignment No. 1 using Excel sheet.
7. Estimating quantities for any one of the following Excel sheet.
   a) A Factory Shed of Steel Frame
   b) Water tank (elevated storage tank).
   c) Pipe Culvert
8. Drafting of tender notice for RCC Framed Structure and collecting minimum of 3 tender notices of Civil Engineering Works.

PE-409: Professional Elective-III Practical Labs

PEC (CE409-a): Design of Reinforced and Prestressed Concrete StructuresLab

Teaching Scheme Practical: 02 Hrs./ Week	Evaluation Scheme: Oral Exam : 25 Marks
Credits: 01	Total : 25 Marks

Prerequisite Course: **Analysis of Structures, Concrete Technology, Design of Reinforced Concrete Structures.**

Course Objectives:

1. Analysis and design of earth retaining structures, water retaining structures, Combine footings.
2. To analyze and design the prestressed concrete elements.

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Apply basic guidelines of IS specifications.	3	Apply
2	Design and detailing of various RCC elements using LSM.	4	Analyze
3	Design and detailing of various PSC elements.	4	Analyze

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	3	2	3	---	---	---	---	---	---	---	---	---	3	3
CO2	3	2	3	---	2	---	---	2	2	2	2	---	3	3
CO3	3	2	3	---	2	3	---	2	2	2	2	---	3	3

List of Laboratory Work:

1. Design and detailing of retaining wall for various loading conditions.
2. Design and detailing of water tank.
3. Design and detailing of combined footings.
4. Assignment on stress calculation in prestressed structures.
5. Assignment on calculation of losses in prestress.
6. Design and detailing of design of prestressed girder.
7. Design and detailing of one way two way prestressed slab.
8. Report on analysis and design of any one of the structures listed in the syllabus using software or computer program.
9. Two site visit reports, one each on RCC and Prestressed concrete structure.

Note:

(a) There should be separate design problem statement for a group of students not exceeding four in numbers.

(b) Minimum four full imperial sheets based on two projects on design of RCC and two projects on design of prestressed concrete structural elements.

Text Books:

1. Dr. V. L. Shah and Dr. S. R. Karve, "Illustrated Reinforced Concrete Design", 9 th edition,Structures Publications, 2021, ISBN: 978819037172.
2. S. Ramamrutham and N. Narayan, "Design of Reinforced Concrete Structures", 17 thedition,2013, ISBN: 978-0198086949.
3. B. C. Punmia, Ashok kumar Jain and Arun kumar Jain, "Comprehensive Design of R.C.Structures", 10 th edition, Standard Book House, 2015, ISBN: 978-8131809426.
4. T. Y. Lin, Design of prestressed concrete Structure, Asia Public House, New Delhi, 2000.
5. N. Krishna Raju and R.N. Pranesh, "Design of Reinforced Concrete Structures: Principles andPractice" 1 st edition, New Age International Pvt Ltd Publishers 2018, ISBN: 978-8122414608.

Reference Books:

1. S. U. Pillai and D. Menon, "Reinforced Concrete Design", 3 rd edition, Tata Mc Graw HillPublication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnram, "Limit State Analysis and Design" 5 th edition, Wheeler Publishing company ',Delhi, 2017, ISBN: 978-9386479785.
3. N. Subramanian, "Design of Reinforced Concrete Structures", 1 st edition, OxfordUniversityPress, 2013, ISBN: 978-0198086949.
4. J. K. Wight, "Reinforced Concrete: Mechanics and Design", 7 th edition, Pearson/Prentice Hall,2015.
5. M. Nadim Hassoun, Akthem Al-Manaseer , "Structural Concrete: Theory and Design", 7th Edition-WILEY.
6. F. Leonhardt, "Pre stressed concrete – Design & construction", Welhelm Ernst andsohn –Munich, 2000.

I.S. Codes:

1. IS 456: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
3. IS 875 Part V: Code of practice for design load, Bureau of Indian Standards, New Delhi.
4. IS 13920: Code of practice for ductile detailing of RC Structures subjected to seismic forces,Bureau of Indian Standards, New Delhi.
5. IS 3370: Indian Standard code of practice for concrete structures for storage of liquids, BIS, NewDelhi.

Latest Revision of IS Codes should be used.

e – Resources: www.nptel.iitk.ac.in/courses/iitkharagpur

PEC (PE409- b): Air and Noise Pollution and Control Lab

Teaching Scheme	Examination Scheme
Practical: 02 Hrs. / Week	**Oral Exam: 25 Marks**
Credits: 01	**Total : 25 Marks**

Prerequisite Course: Basics of environmental sciences and Mathematics

Course Objectives:

Sr. No.	Course Objectives
1	Students will be aware of the various tests used to determine the quality of air and noise.
2	Students will be familiar with the various norms /standards set by CPCB and assess the pollution level at a particular location.
3	Students will aware about the design of control equipment.

Course Outcomes (COs): Students will be able to:

CO's No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Use instrument and methodologies to measure Noise pollution and Air pollution	3	Apply
2	Comparison of observed reading characteristics with the IS code/standard limits established by CPCB.	4	Analyzing
3	Use of analyzed results for the design/selection of control equipment.	5	Evaluating

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	1	2	1	2	-	-	-	1	3	3
CO2	-	3	-	3	-	2	2	2	-	-	-	1	1	1
CO3	2	2	3	2	3	2	2	2	-	-	-	1	3	3

List of Experiments:

1. To determine the suspended particulate matter PM10, PM2.5 SO_2, NOx, from air by air ambient pollution method by High volume sampler.
2. Study and use of stack monitoring kit for industrial pollutants sampling
3. To determine the Noise pollution levels by sound level meter.
4. Case study on working of particulate control technology- Cyclone separator
5. Case study on working of particulate control technology ESP (Electrostatic preceptor)
6. Case on working of gaseous control technology- SOx/NOx Control Technology
7. Visit to thermal power plant/ cement industry and its detail report.
8. Study of Web-based Air Monitoring Software for Remote Data Access.

PEC (PE 409 –c): Advanced Concrete Technology Lab

Teaching Scheme	Examination Scheme
Practical: 02 Hrs./ Week	**Oral Exam: 25 Marks**
Credits: 01	**Total :25 Marks**

Prerequisite Course: Building Technology and materials, Concrete Technology

Course Objectives:

Sr. No.	Course Objectives
1	Students will know the selection of various standard material testing methods required for design of concrete mixes.
2	Students will select suitable proportion of special concrete using IS 10262 guidelines.
3	Students will able to check the strength and durability related properties of concrete using NDT and site visits of ongoing construction projects.

Course Outcomes (COs): This course will enable students to:

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
1	Perform various test on ingredients of concrete and check the compatibility of admixture.	4	Analyse
2	Design of special concrete using IS 10262-2019.	4	Analyse
3	Investigate strength characteristic of concrete by using NDT.	4	Analyse
4	Inspect and visit the ongoing concrete construction sites, RMC plant, pre-cast industries, etc.	4	Analyse

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	3	-	-	-	3	-	-	-	-	-	-	-	3	1
CO2	3	3	3	2	3	-	-	-	3	-	-	2	3	1
CO3	3	1	2	2	3	-	-	-	2	-	-	2	3	1
CO4	3	3	3	2	1	1	1	2	3	2	-	1	3	1

List of Laboratory Work:

A. Test on various ingredients of concrete required for mix design.
   1. Compressive strength of cement.
   2. Grading of fine and coarse aggregate.
   3. Specific gravity, water absorption, silt content of aggregate.
   4. Compatibility of admixture.

B. High strength Concrete Mix Design using IS 10262 and Mix design software

C. Test on Fresh concrete.
   1. Effect of admixture on Workability of special concrete.
   2. Effect of VMA on Workability of self-compacting concrete.

3. Effect of fiber content on Workability of FRC.

D. Test on Hardened concrete
   1. Stress strain behavior of high strength and fiber reinforce concrete.
   2. Flexural behavior of FRC.
   3. Split tensile strength of FRC.
   4. NDT of existing RCC elements.

E. Durability of concrete by RCPT and permeability test.

F. Site visit.

PEC (PE409- d): Structural Audit and Retrofitting Lab

Teaching Scheme	Examination Scheme
Practical: 02 Hrs. / Week	**Oral Exam: 25 marks**
Credits: 01	**Total : 25Marks**

Prerequisite Course: **Concrete technology**

Course Objective:

Sr. No.	Course Objectives
1	Students will be aware of the various tests used to determine the quality of concrete
2	Students will be familiar with the various norms /standards set by Bureau of Indian Standards and assess the quality of concrete at a particular structural element.
3	Students will aware about the preparation of structural audit report

Course Outcomes (COs): This course will enable students to:

CO's No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Use instrument and methodologies to measure quality of concrete.	3	Apply
2	Comparison of observed reading characteristics with the IS code/standard limits.	4	Analyzing
3	Use of analyzed results/visual inspection for the preparation audit report of a structure.	5	Evaluating

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	1	2	1	2	-	-	-	1	3	3
CO2	-	3	-	3	-	2	2	2	-	-	-	1	1	1
CO3	2	2	3	2	3	2	2	2	-	-	-	1	3	3

List of Experiments:

1. To determine the strength of the concrete of columns by using rebound hammer
2. To determine the quality of concrete by using Ultra sonic pulse velocity by direct transmission method
3. To determine the quality of concrete by using Ultra sonic pulse velocity by indirect or surface transmission method
4. To determine the quality of concrete by using Ultra sonic pulse velocity by semi-direct transmission method
5. To determine the dynamic Young's modulus of elasticity of concrete using Ultra sonic pulse velocity equipment
6. To study the carbonation of concrete
7. Study of carbonation of concrete test by conducing the experiment.
8. Visit to any multi-storey ongoing construction building and preparation of its detail report with various NDT readings/preparation of report using visual inspection.

PEC (PE 409- e): Construction Safety Management Lab.

Teaching Scheme	Evaluation Scheme
Practical: 02 Hrs./ Week	**Oral Exam: 25 Marks**
Credits: 01	**Total : 25 Marks**

Prerequisite Course: **Building Technology & Material, Infrastructure Engineering & Construction Techniques, Construction Project Management.**

Course Objectives:

Sr. No.	Course Objectives
1	To enhance knowledge about personal protective equipment and safety practices about formwork, electrical, fireworks.
2	To learn applications of BIM in safety engineering.
3	To gain knowledge about safety legislation and OSHA guidelines.

Course Outcomes: This course will enable students to:

COs No.	Course Outcomes (s)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand role and importance of personal protective equipment in construction sector.	2	Understand
2	Apply fundamentals of BIM for safety.	3	Apply
3	Identify safety practices, safety legislation and OSHA guidelines for various construction activities with the help of site visit.	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	-	-	-	-	-	1	2	2	2	2	3	3	2	2
CO2	1	-	1	2	3	1	-	3	3	2	3	3	2	2
CO3	-	-	1	-	3	2	-	3	2	2	3	3	2	2

List of Assignments:

It shall consist of the following exercises.

1. Assignment on personal protective equipment.
2. Assignment on Formwork safety practices.
3. Assignment on Electrical and Fire safety practices for construction sites.
4. Assignment on applications of BIM in safety engineering.
5. Assignment on safety implementation, safety legislation for construction activities.
6. Assignment on OSHA guidelines.
7. Site visit to a Construction project for study of Safety practices at construction sites, use of personal protective equipment with a detailed report.

(Term work: Based on the above syllabus.)

PRJ: (CE410): Project Stage-I

Teaching scheme	Evaluation scheme
Practical: 06 hours/week	**Oral Marks: 50 Marks** **Term Work Marks: 100 Marks**
Credits: 03	**Total: 150 Marks**

Prerequisite Course: Knowledge of all B. Tech subjects from Ist to VIIIth semester, Computer Basics, MS office.

Course Objectives:

Sr. No.	Course Objectives
1.	To know about the use of literature survey.
2.	To identify the problem statement and frame the objectives based on gaps in literature survey.
3. 4.	To select the proper methodology/experimentation/analysis technique, suitable software required for the project.
5.	To design, develop and analyze civil engineering structures and schedule the activities.
6. 7.	To identify social problems and provide viable / sustainable engineering solutions for development of society.

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

CO's	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Understand the importance of literature survey.	2	Understand
CO2	Formulate problem and frame the objectives based on gaps in literature survey.	3	Apply
CO3	Use proper methodology / experimentation / analysis technique / suitable software for the project.	4	Analyse
CO4	Design, develop, and analyze civil engineering structures through proper scheduling.	5	Evaluate
CO5	Identify social problems and provide viable engineering solutions using the latest technology.	5	Evaluate
CO6	Present the project for society, Civil Engineering field and helps for sustainable development.	6	Create

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

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

Project Guidelines:

Note: Student must complete the project work in the VIIth semester only.

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 tStudents 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: Data Science Projects, Robotics and Automation Projects, Aerospace and Defense Projects, Materials Science and Engineering Projects, Civil Engineering Projects, Cyber security Projects

The project work shall be consisting of any demanding area such as.

1. Experimental investigation in the particular domain of engineering field.
2. Software development and usage of software's for solving complex engineering problems.
3. Benefits cost 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 weightage 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 Patent 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.

a) 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.

2. 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.
3. Each project group will submit the registration form along with 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 in1 or 2 week after commencement of the term).
4. 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.
5. Students should identify stakeholders and write a detailed problem statement for the system.
6. 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.
7. If a change in the project topic is unavoidable, then the students should complete the process of project re-approval 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.
8. The record of the remarks/suggestions of the review committee should be properly maintained and made available at the time of examination.
9. Each student/group is required to give a presentation as part of the review for 10 to 15 minutes, followed by a detailed discussion.
10. Students should revisit and reassess the problem statement mentioned in the project-based seminar activity periodically and make appropriate changes if required.
11. By following these guidelines, students and faculty can ensure that the graduate engineering projects are well-structured, timely, and successful.
12. There shall be two project reviews to monitor Project progress in semester-I (VIIth) before final project exam.
13. 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:

1. **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.
2. **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.
3. **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.
4. **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.
5. **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.

6. **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.
7. 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) for an individual student based on 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 final project presentation and examination as scheduled by department. Absent student/S will not be entertained in any circumstances and they have to reappear for the final project presentation and examination in the next year.

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

d) Project report should not be hard bound without final approval / permission of guide, Internal and external examiner.

e) Final project exam presentation must contain 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 the short video on a project in which implementation, execution and application parts will cover.

IV. Final Project Report:

Sequence offront 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 consists of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives, 1.4 Scope of the Project Works, 1.5 Need of the investigation, 1.5 Limitations of study, 1.6 Expected outcome)

Chapter 2 Literature Review / Survey from minimum 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 approach. 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 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) 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) Number of reports (**black color hard bound with front cover embossed**) to prepare / submitted are 1 College copy + 1 Guide copy + each individual copy of student.

d) 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 bottom margin at center.

Font size &font Type:

a. **Chapter Number and Name -** 14 Font size, Times New Roman in **Capital Bold Letters**.
b. **Main Titles (e.g1.1, 2.5 etc) -** 12 Font size, Times New Roman in **Bold Capital Letters**.
c. **Sub Titles (e.g. 1.1.5, 4.5.1 etc) -** 12 Font size, Times New Roman in **Bold Title case**.
d. **All other matter / content -**12 Font size, Times New Roman sentence case.
e. **Figure name -** 12 Font size, Times New Roman below the figure **Bold** in sentence case.
f. **Table title** - 12 font size, **Bold** Times New Roman **sentence case** above the above the table.
g. 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** Centre of page and **Figure name should beat** Centre of page and below the figure.
e. **Table & Table title - Table should be at** Centre of page and **Table title should beat centre** of page and Above the Table.

 # Refer sample Report format given below:

$Refer Engineering Project guidelines and rubrics 2022-2023 available with Department project coordinator and Institute Dean Academics.

MLC (MC-411): Financially Smart

Personal Financial Literacy Program for Young Adults-Being Financially Smart	
•A-Google Survey–Pre-session (via email)	
Unit1- Behavioural Finance- 3 hours	**Unit 2-MoneyManagement Skills-3hours**
Section1 –Let's Talk Money	Section 1–Important Concepts
1.Psychology of Money	1.Savingvs Investing
2. Your Relationship with Money	2.Inflation
3.Human Behaviour in Financial Markets	3. Power of Compounding
Section2–Why Financial Literacy?	Section2–Money Management Techniques
4.Importance of Financial Literacy	4. S.M.A.R.T.E.R way to Wealth
5. Costly Money Mistakes	5.6- Money Jar Method
Micro-Project1-Exercise	
Unit3- Steps of Financial Planning- 3hours	**Unit 4–Risk &Investment Management-3hours**
Section1 –Let's Start Planning	Section1-Risk Management
1.Need & Components of Financial Planning	1.Understanding Risk Management
2.Personal Income Statement–Cash flow Mgt & Net Worth Mgt.	2.Life Insurance
3.S.M.A.R.TGoal Setting	3.HealthInsurance
Section2- Goal Based Investment Planning	Section 2- Investment Management
4.Contingency/Emergency Fund Planning	4. Asset Allocation
5.Lifestyle/Retirement Planning	5.Mutual Funds-Overview
6. Estate Planning	5.Review&Action
Micro-Project2-CaseStudy	
Unit 5– Introduction to Business Finance- 3 hours	
How to Read an Income Statement	
How to Read a Balance Sheet	
Micro-Project3-CaseStudy	
B-Google Survey(via email)	
Post -session: -1. Evaluation 2. Feedback 3. Certification	

Sr.No.	Name of NPTEL Courses	Duration
	OEC-OE412-Open Elective-I	
5)	Optimization methods for Civil Engineering	12 Weeks
6)	Waste water treatment and recycling	12 Weeks
7)	Advance concrete technology	12 Weeks
8)	Ground Improvement	12 Weeks
	OEC-OE413-Open Elective-II	
5)	Bridge Engineering	12 Weeks
6)	Sustainable transportation systems	12 Weeks
7)	Pavement materials	12 Weeks
8)	Railway Engineering	12 Weeks
	OEC-OE414-Open Elective-III	
5)	Principals of construction management	8 Weeks
6)	Remote sensing and GIS	8 Weeks
7)	Sustainable engineering construction and life cycle analysis	8 Weeks
8)	River Engineering	8 Weeks

PRJ: (CE415): Professional Internship

Teaching Scheme	Evaluation Scheme:
Practical: 12 Hrs./ Week	**Oral Exam : 50 Marks** **Term Work : 100 Marks**
Credits: 6	**Total : 150 Marks**

Course Objectives:

Sr. No.	Course Objectives
1	To get opportunity to observe modern technological developments related to the civil engineering infrastructure project.
2	To get opportunity to learn, understand and sharpen the actual experiences on the 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 Civil 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 the 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 shall attend the 200 hours 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 Global Certification examination conducted by **SAP India**.

2. Sanjivani College of Engineering 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	Student must regularly use daily diary, which is to cultivate the habit of documenting and send the Geotag photo of each day to the concern faculty.
4	The presentation is way to evaluate student performance, so student must be ready as institute guide, internal and external examiner evaluates them.
5	Student must submit a comprehensive report to the department before presentation as per provided format.
Steps to apply for internship	
1	Students shall ask for permission letter from Civil Engineering Department office/office of Training & Placement cell of the college in consultation of guide (Institute) to allot Minimum 8 to 12weeks during as internship periods.
2	Students on joining Training at the concerned Industry must submit the permission letter from the office of Training & Placement cell of the college.
3	Students must regularly use dairy to record the details and submit attendance in internship report with the evidence (Geotag photo/Selfi).
4	Students shall be obtained Training Certificate from industry.
5	Students shall submit training report after completion of internship to guide (faculty).
Evaluation process for internship	
1	Students must submit training report and training certificate from industry after completion of internship to guide.
2	Guide will access performance of student through presentation, which is evaluated by institute guide and external examiner from institute itself.

PRJ: (CE416): Project Stage-II

Teaching scheme	Examination scheme
Practical: 04 hours/week	**Oral: 50 Marks**
Credits: 02	**Total: 50 Marks**

Prerequisite Course: Knowledge of all BTech subjects from Ist to VIIth semester, Computer Basics, MS office.

Course Objectives:

Sr. No.	Course Objectives
1	To know about the use of literature survey.
2	To identify the problem statement and frame the objectives based on gaps in literature survey.
3	To select the proper methodology/experimentation/analysis technique, suitable software required for the project.
4	To design, develop and analyze civil engineering structures and schedule the activities.
5	To identify social problems and provide viable / sustainable engineering solutions for development of society.

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

CO's	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Understand the importance of literature survey.	2	Understand
CO2	Formulate problem and frame the objectives based on gaps in literature survey.	3	Apply
CO3	Use proper methodology / experimentation / analysis technique / suitable software for the project.	4	Analyze
CO4	Design, develop, and analyze civil engineering structures through proper scheduling.	5	Evaluate
CO5	Identify social problems and provide viable engineering solutions using the latest technology.	5	Evaluate
CO6	Present the project for society, Civil Engineering field and helps for sustainable development.	6	Create

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

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

Project Guidelines:

Note: Student must complete the project work in the VIIth semester only.

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 t 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: Data Science Projects, Robotics and Automation Projects, Aerospace and Defense Projects, Materials Science and Engineering Projects, Civil Engineering Projects, Cyber security Projects

The project work shall be consisting of any demanding area such as.

1. Experimental investigation in the particular domain of engineering field.
2. Software development and usage of software's for solving complex engineering problems.
3. Benefits cost 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 weightage 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 Patent 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.

a) 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.

2. 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.
3. Each project group will submit the registration form along with 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).
4. 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.
5. Students should identify stakeholders and write a detailed problem statement for the system.
6. 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.
7. If a change in the project topic is unavoidable, then the students should complete the process of project re-approval 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.
8. The record of the remarks/suggestions of the review committee should be properly maintained and made available at the time of examination.
9. Each student/group is required to give a presentation as part of the review for 10 to 15 minutes, followed by a detailed discussion.
10. Students should revisit and reassess the problem statement mentioned in the project-based seminar activity periodically and make appropriate changes if required.

11. By following these guidelines, students and faculty can ensure that the graduate engineering projects are well-structured, timely, and successful.
12. There shall be two project reviews to monitor Project progress in semester-I (VIIth) before final project exam.
13. 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:

1. **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.
2. **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.
3. **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.
4. **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.
5. **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.
6. **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.
7. 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) for an individual student based on 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 final project presentation and examination as scheduled by department. Absent student/S will not be entertained in any circumstances and they have to reappear for the final project presentation and examination in the next year.

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

d) Project report should not be hard bound without final approval / permission of guide, Internal and external examiner.

e) Final project exam presentation must contain 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 the short video on a project in which implementation, execution and application parts will cover.

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 Need of the investigation, 1.5 Limitations of study, 1.6 Expected outcome)

Chapter 2 Literature Review / Survey from minimum 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 approach. 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 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) 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) Number of reports (**black color hard bound with front cover embossed**) to prepare / submitted are 1 College copy + 1 Guide copy + each individual copy of student.

d) **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 bottom margin at center.

Font size & font Type:

a. **Chapter Number and Name -** 14 Font size, Times New Roman in **Capital Bold Letters**.
b. **Main Titles (e.g 1.1, 2.5 etc) -** 12 Font size, Times New Roman in **Bold Capital Letters**.
c. **Sub Titles (e.g. 1.1.5, 4.5.1 etc) -** 12 Font size, Times New Roman in **Bold Title case**.
d. **All other matter / content -**12 Font size, Times New Roman sentence case.
e. **Figure name -** 12 Font size, Times New Roman below the figure **Bold** in sentence case.
f. **Table title** - 12 font size, **Bold** Times New Roman **sentence case** above the above the table.
g. 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** Centre of page and **Figure name should be at** Centre of page and below the figure.
e. **Table & Table title - Table should be at** Centre of page and **Table title should be at center** of page and Above the Table.