

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- 2019 PATTERN**

**SECOND YEAR B. Tech**

**Semester-III and IV**

**W.e.f June 2020**

**Board of Studies in Civil Engineering, June 2020**

# **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 2019 w.e.f. from A.Y 2020-21 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

Dr.A.B.Pawar

Director

Dr.A.G.Thakur



## **DEPARTMENT OF CIVIL ENGINEERING**

### **COURSE STRUCTURE and SYLLABUS- 2019PATTERN**

#### **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 31 June 2021. 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 Spirit 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.
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### 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.

# COURSE STRUCTURE and SYLLABUS- 2019 PATTERN

## SECOND YEAR B. TECH.

(W.e.f June 2020)

Board of Studies in Civil Engineering, June 2020

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
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
BSC	Basic Science Course	PRJ	Project/Seminar/Internship/Online Course

### COURSE STRUCTURE and SYLLABUS- 2019 PATTERN

#### SECOND YEAR B. TECH.

#### SEMESTER-III

Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PRJ	CE201	Professional Externship-I	-	-	-	2	-	-	-	50	-	-	50
BSC	BS202	Vector Calculus and Differential Equation	3	1	-	4	30	50	20	-	-	-	100
PCC	CE203	Solid Mechanics	4	-	-	4	30	50	20	-	-	-	100
PCC	CE204	Surveying	3	-	-	3	30	50	20	-	-	-	100
PCC	CE205	Building Technology and Materials	3	-	-	3	30	50	20	-	-	-	100
HSC	HS206	Universal Human Values and Ethics	3	-	-	3	30	50	20	-	-	-	100
PCC	CE207	Solid Mechanics Lab	-	-	2	1	-	-	-	50	-	25	75
PCC	CE208	Surveying Lab	-	-	2	1	-	-	-	-	50	-	50
PCC	CE209	Building Technology and Materials Lab	-	-	2	1	-	-	-	50	-	25	75
MLC	MC210	Mandatory Course - III	2	-	-	No Credits	-	-	-	-	-	-	-
<b>Total</b>			<b>18</b>	<b>01</b>	<b>06</b>	<b>22</b>	<b>150</b>	<b>250</b>	<b>100</b>	<b>150</b>	<b>50</b>	<b>50</b>	<b>750</b>

## SECOND YEAR B. TECH.

(W.e.f June 2020)

Board of Studies in Civil Engineering, June 2020

LIST OF ABBREVIATIONS			
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ESC	Engineering Science	HSC	Humanity Science
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BSC	Basic Science Course	PRJ	Project/Seminar/Internship/Online Course

### SEMESTER-IV

Cat	Code	Course Title	Hrs./Week			Credits	Evaluation Scheme-Marks						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PCC	CE211	Computational Techniques	3	-	-	3	30	50	20	-	-	-	100
PCC	CE212	Concrete Technology	3	-	-	3	30	50	20	-	-	-	100
PCC	CE213	Geotechnical Engineering	4	-	-	4	30	50	20	-	-	-	100
PCC	CE214	Analysis of Structures	3	1	-	4	30	50	20	-	-	-	100
PCC	CE215	Computer Aided Architectural building drawing	1	-	4	3	-	-	-	-	50	50	100
PCC	CE216	Computational Techniques Lab	-	-	2	1	-	-	-	-	-	50	50
PCC	CE217	Concrete Technology Lab	-	-	2	1	-	-	-	50	-	25	75
PCC	CE218	Geotechnical Engg. Lab	-	-	2	1	-	-	-	-	50	25	75
PRJ	CE219	Seminar	-	-	4	2	-	-	-	25	-	25	50
MLC	MC220	Mandatory Course-IV	2	-	0	No Credits	-	-	-	-	-	-	-
Total			16	1	14	22	120	200	80	75	100	175	750

MC210	Mandatory Course-III	Constitution of India – Basic features and fundamental principles
MC220	Mandatory Course-IV	Innovation - Project based – Sc., Tech, Social, Design & Innovation

## **PRJ: (CE201): Professional Internship-I**

<b>Teaching Scheme</b>	<b>Examination Scheme</b>
	<b>Oral 50 Marks</b>
<b>Credits : 02</b>	<b>Total Marks: 50 Marks</b>

**Introduction:** The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The Internship program not only helps fresh pass-outs in gaining professional expertise but also benefits, corporate on fresh perspectives on business issues and even discovering future business leaders. The internship experience will augment outcome-based learning process and inculcate various attributes in a student in line with the graduate attributes defined by the NBA.

**Objectives:** Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. Following are the intended objectives of internship training, but not limited to...

- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the ‘Industrial Internship’ in classroom will be used in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job.
- Learn to apply the Technical knowledge in real industrial situations.
- Gain experience in writing Technical reports/projects.
- Expose students to the engineer’s responsibilities and ethics.
- Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
- Making students more aware with the conditions of rural or socially deprived brothers & sisters through Rural /Social Internship. Making students to come up with innovative solutions leading to positive impact.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.
- Understand the psychology of the workers and their habits, attitudes and approach to problem solving.



### **Benefits to Students:**

- Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience, which is often worth more than classroom teaching.
- Opportunity to learn new skills and supplement knowledge, to practice communication and teamwork skills, to learn strategies like time management, multi-tasking etc. in an industrial setup, to meet new people and learn networking skills.
- Makes a valuable addition to their resume.
- Enhances their candidacy for higher education.
- Creating network and social circle and developing relationships with industry people.

### **IMPORTANT NOTE:**

The detailed guidelines about internship duration, code of conduct, and its evaluation will lay down by concern department in consultation with T & P at institute level and will communicate to students time to time.

Students are advice to read carefully Internship Guidelines and evaluation procedure published on institute website and clarify their queries (if any) before starting internship from concern Dept. and or T & P. [Source: AICTE Internship Policy Document]

### **Assessment Guidelines laid by the department for Professional Internship**

1. Students have to produce the Internship completion certificate to the department.
2. Students have to submit the brief report of internship or course completed in 20-25 pages in hard bound copy to the department.
3. Students have to prepare the PPT and have to present the knowledge and skills acquired thorough the internship in front of committee constituted by departmental head.
4. Students have to submit the daily work report to the staff concern during internship programme.
5. Committee of faculty members will assess the students marks based on the quality of course or internship completed, Knowledge or skills acquired by the student, presentation performance, report quality and sincerity during the internship.

## BSC: (BS202): VECTOR Calculus and Differential Equations

<b>Teaching Scheme</b> <b>Lectures: 03 Hrs. / Week</b> <b>Tutorial: 01 Hrs./ Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam: 50 Marks</b>
<b>Credits : 04</b>	<b>Total Marks: 100 Mark</b>

**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: 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.	5	Evaluate
CO6	Organize the suitable problems in engineering field and present thoughts related to the problems.	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	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-	-	-

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

## COURSE CONTENTS

Unit No.	Unit Title	No. of Hrs.	COs
I	<b>Vector Differentiation:</b> Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function $\phi$ , Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	08	1,3,5
II	<b>Vector Integration:</b> Line integral, Greens theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem.	08	3,4,5
III	<b>Higher Order Differential Equation:</b> Homogeneous and non-homogeneous linear differential equation of $n^{\text{th}}$ 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	1,2,3
IV	<b>Series Solution Of Differential Equation:</b> 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	3,4,6
V	<b>Partial Differential Equation:</b> Formation of partial differential equation, Partial differential equation of order one (linear and nonlinear), Charpit method, PDE of higher order with constant coefficient	08	2,3,5
VI	<b>Applications of Partial Differential Equation :</b> One dimensional heat equation, Wave equation, Two dimensional heat equation (Laplace equation), Telephone equation, Radio equations	0	1,3,5

### **Text Book(s):**

B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, ISBN-13: 978-8174091154.

N. P. Bali and Manish Goyal, A Text Book of Engineering, Mathematics, 8/e, Lakshmi Publications, 2012. ISBN: 9788131808320.

H. K. Das, Engineering Mathematics, S Chand, 2006, ISBN-8121905209

### **References:**

K.A. Stroud & D. S. Booth, Advanced Engineering Mathematics, Industrial Press, 5/e, 2011, ISBN-9780831134495

P. C. Matthews, Vector Calculus, Springer, 2/e, 2012, ISBN-9783540761808

Robert C. Wrede, Introduction to vector and tensor analysis, Dover, 2013, ISBN-048661879X

W. E. Boyce, R. C. DiPrima, Elementary differential equation and boundary value problems.

R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2014. ISBN-13: 978-1842653418.

Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9/e, 2013, ISBN-13: 978-0471488859.

## SUBJECT: (CE202): SOLID MECHANICS

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Mark
Credits : 03	Total Marks: 100

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

Sr. No.	Course Objectives
1	To introduce fundamental concepts of elastic, plastic and brittle materials.
2	To introduce the shear force and bending moments induced in a beam
3	To study the bending and shearing stresses developed in different cross sections of beam.
4	To study the shafts subjected to torsion and moments.
5	To study the principal stresses and strains on various planes.
6	To study the buckling strength and stresses developed at columns bases.

**Course Outcomes (COs): Students able to:**

CO's No.	COURSE OUTCOME (S)	BLOOM'S TAXONOMY	
		Level	Descriptor
1	Recall the basic concepts of mechanics of deformable bodies to find the stresses, strains and elastic constants.	1	Remembering
2	Explain the internal forces developed due to external loads in the different types beams.	2	Understanding
3	Apply basic concept of pure bending and shear to determine stresses in beams.	3	Applying
4	Apply the basic concepts of torsion to know the bending and twisting in the shafts.	3	Applying
5	Analyze the principal stresses and strains in deformable bodies on the various planes.	4	Analyzing
6	Apply the different column theories to know the buckling and bending stresses in columns.	3	Applying

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

## Course Contents

Unit No	Unit Title	No.of Hours	COs
I	<b>Simple Stresses and Strain:</b> 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). Elastic constants and their relations Stresses and strains due to change in temperature. Stresses, strains and deformations in determinate structures.	06	1
II	<b>Shear Force and Bending Moment Diagram:</b> Concept of determinate and indeterminate beams, Concept of Shear Force and Bending Moment, Shear force and bending moment diagrams for simply supported and cantilever beams subjected to point loads, udl and uvl, Concept of Fixed Beam.	06	2
III	<b>Bending and Shear Stresses:</b> Stress due to Bending: theory of simple or pure bending, Bending stress distribution diagrams, Moment of Resistance of cross-section. Shear stresses in beams: concept of shear, complimentary shear, derivation of shear stress formula, shear stress distribution for various cross sections. Maximum and average shear stress for circular and rectangular sections, Shear connectors. Concept of shear flow.	06	3
IV	<b>Torsion:</b> 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 of homogeneous and composite cross-sections subjected to twisting moments.	06	4
V	<b>Principal Stresses and Strains:</b> 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 moment Combined effect of shear and torsion, Theories of failure: maximum normal stress, Maximum shear stress, maximum strain theory.	06	5
VI	<b>Axially and Eccentrically Loaded Columns:</b> 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. R.Subramanian, “Strength of materials”, Oxford University Press. **ISBN:10:0-19-567590-4**
2. A.K. Datta, D Gosh “Strength of materials”, New Age International Publications. **ISBN:978-81-224-3080-6**
3. S. S.Ratan, “Strength of Materials”, Tata McGraw Hill Publication **ISBN:978-066895-9**
4. S.S.Bhavikatti, “Strength of Materials”, Vikas Publishing House Pvt.Ltd. 4<sup>th</sup> Edition. **ISBN:9789325971578**
5. B.C.Punmia, Ashoak kumar Jain, Arun Kumar Jain. “Mechanics of Materials, Laxmi Publication Pvt. Ltd. **ISBN:978-81-318-0646-3**

**Reference Books**

1. Ferdinand P.Beer, E.Russell Johnston Jr., John T. Dewolf, David F.Mazurek. “Mechanics of Materials.5<sup>th</sup> Edition, Tata McGraw Hill Education Pvt.Ltd. New Delhi. **ISBN10:0-07-015389-2**
2. E.P.Popov, “Introduction to Mechanics of Solids, Prantice Hall Publication. **ISBN:978-0134877693**
3. Gere and Timoshenko, “Mechanics of materials, CBS Publication. **ISBN:978-8123908946**
4. S.Timoshanku Strength of material (Third edition) CBS Publication
5. Stephen H Crandall, Norman C. Dahi, Thomas J Lardner “An introduction to the mechanics of Solids” Tata McGraw Hill
6. S.Ramamrutham, R.Narayanan “Strength of Materials”, Dhanpat Rai Publication Company. ISBN:9788187433545., 9788187433545.

## PCC: (CE204): SURVEYING

<b>Teaching Scheme</b> <b>Lectures: 03 Hrs. / Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 03</b>	<b>Total Marks : 100 Marks</b>

**Prerequisite Course: Nil**

**Course Objectives:**

Sr. No.	Course Objectives
1	To learn the fundamental concepts and instruments used for Plane Surveying
2	To study concepts of levelling, methods of levelling and contouring
3	To learn the essentials of theodolite and theodolite traversing
4	To study the Tachometry and tacheometric contouring
5	To study various types of curves and methods of setting out of curves
6	To study the modern instruments and techniques including GIS, GPS, EDM and Total station for civil engineering projects

**Course Outcomes (COs):** 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	Understanding
2	Make use of dumpy level for various types of levelling and counterling.	3	Applying
3	Experiment with theodolite for horizontal and vertical angle measurement and traversing.	3	Applying
4	Utilize the Tacheometer for determination of horizontal distances and elevations of points and Tachometric contouring.	3	Applying
5	Categorize various types of curves, their design and application in civil engineering projects.	4	Analyzing
6	Examine the modern instruments and techniques including GIS, GPS, EDM and Total station to develop different survey maps for engineering projects.	4	Analyzing

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	-	-	2	-	-	-	-	3	2	2	2	2	2
CO2	2	-	-	2	-	-	-	-	3	2	2	2	2	2
CO3	2	-	-	2	-	-	-	-	3	2	2	2	2	2
CO4	2	-	-	2	-	-	-	-	3	2	2	2	2	2
CO5	3	2	2	-	2	2	2	-	3	3	2	2	2	3
CO6	3	2	2	2	3	2	2	-	3	3	3	3	2	3

## Course Contents

Unit-I	Unit Title	No.of Hrs	COs
I	<b>Compass and Plane Table Surveying:</b> 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, Methods of plane table survey: Radiation and Intersection.	06	1
II	<b>Measurement of Vertical Distances:</b> 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 and Interpolation of Contouring, Application of contours. Introduction to Golden Surfer software.	06	2
III	<b>Theodolite Surveying:</b> Introduction, Study of 20" Vernier transit Theodolite, Use of Theodolite for measurement of horizontal angles by repetition and reiteration method, deflection angles, magnetic bearing, prolonging a Straight line. Fundamental axes. 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.	06	3
IV	<b>Tachometry:</b> 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.	06	4
V	<b>Curves:</b> 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.	06	5
VI	<b>Modern Surveying Techniques:</b> Total Station- Fundamental parameters and 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.	06	6

### **Text Books:**

1. T. P. Kanetkar and S.V.Kulkarni, "Surveying and Levelling Vol. I and Vol. II", Pune Vidyarthi Griha Prakashan.
2. Subramaniam R., "Surveying and Levelling", Oxford University Press.
3. Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain, "Surveying" Vol. I, Laxmi Publications.
4. S. K. Duggal, "Surveying", Vol. I & II, TataMc-Graw Hill.



### **Reference Books**

1. A. M. Chandra , “Plane Surveying”, New Age International,Publishers.
2. N. N. Basak , “Surveying and Levelling”, Tata McGraw Hill.
3. Dr. K. R. Arora , “Surveying”, Vol. I & II, Standard Book House.

### **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.
3. Kang, Tsung Chang, “ Inroduction to geographical information system” McGraw Hill, Dublin University.
4. Peter.A.Burrough, “Principles of Geographical Information System” Dublin University.
5. James M. Anderson, Edward M. Mikhail , “Surveying: Theory and Practice”, Seventh Edition Tata McGraw Hill.

## PCC: (CE205): BUILDING TECHNOLOGY AND MATERIALS

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course: Engineering Graphics**

Sr. No.	Course Objectives
1	To enumerate different types of buildings, structures and study of masonry
2	To illustrate block masonry and understand the concept of formwork.
3	To study different types of flooring and roofing materials and their construction
4	To acquaint about doors, windows, arches and lintels
5	To study different types of vertical circulation and protective coatings.
6	To aware the students about miscellaneous materials and concept of green building.

**Course Outcomes (COs): 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	4	Analyze
6.	Classify miscellaneous materials and Interpret the concept of green building	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	--	--	--	-	--	--	--	--	--	--	1	1	2	2
CO2	-	1	2	-	1	--	--	--	2	1	1	2	1	2
CO3	-	--	-	2	2	1	-	--	1	2	--	1	2	2
CO4	1	--	1	-	--	-	-	--	2	2	-	1	-	2
CO5	2	2	2	2	2	2	2	--	3	2	-	3	3	3
CO6	2	2	--	2	--	2	3	--	3	2	2	2	2	2

## Course Contents

Unit No.	Unit Title	No.of Hrs	COs
I	<p><b>Introduction to Building Construction and Masonry:</b></p> <p><b>a) Introduction to building construction</b>– 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.</p> <p>RCC framed structures. Substructure – shallow and deep foundations and their suitability, plinth filling and soling.</p> <p><b>b) Masonry</b>– 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.</p>	06	1
II	<p><b>Block Masonry and Form work:</b> <b>a) Block Masonry</b> – 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.</p> <p><b>b) Form work:</b> Casting 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.</p>	06	2
II	<p><b>Flooring and Roofing Materials:</b></p> <p><b>a) Flooring and Flooring Materials</b> – Functional requirement of flooring, types of floor finishes and their suitability. Types of flooring.</p> <p><b>b) Roofing Materials</b> –Types of roofing materials, fixing details of roof covering and construction procedure. Roof construction: types and their suitability, method of construction, types of trusses.</p> <p>Types of shell structure: dome, translation shells, space and frame structure: pneumatic structures and prefabricated structures.</p>	06	3
IV	<p><b>Doors, Windows, Arches and Lintels:</b></p> <p><b>a) Doors and Windows</b> – 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.</p> <p><b>b) Arches and Lintels</b> – 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.</p>	06	4
V	<p><b>Vertical Circulation and Protective Coatings:</b></p> <p><b>a) Vertical Circulation</b> – Consideration in planning, design of staircase and types of staircase. Details and types of ramps, ladders, lifts, and escalator.</p> <p><b>b) Protective Coatings</b> – 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.</p>	06	5
VI	<p><b>Miscellaneous Materials and Green Building:</b></p> <p><b>a) Miscellaneous Materials</b> – 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,</p>	06	6

	<p>wall paper .</p> <p><b>b) Ceramic products:</b> ceramic sanitary application, water closet, urinals, washes basins, their common sizes, pipes and fittings.</p> <p><b>c) Eco-friendly materials:</b> eco-friendly decorating materials, eco-friendly flooring, thatch, bamboo, linoleum, cork.</p> <p><b>d) Green building:</b> Energy efficient building, Smart building.</p>		
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**Text Books:**

1. Building Construction by B.C. Punmia, Laxmi Publications.
2. Building Materials by S.V.Deodhar, Khanna Publication.
3. Building Construction by Bindra and Arora, Dhanpat Rai Publications.
4. Civil Engineering Materials by Neil Jackson & Ravindra K. Dhir, Palgrave Macmillan.

**Reference Books**

1. Building Materials by S. K. Duggal, New Age International Publishers.
2. Civil Engineering Materials by TTTI Chandigarh, Tata McGraw Hill Publications.
3. Materials of construction by D.N Ghose, Tata McGraw Hill.
4. Building Construction by S.C. Rangwala, Charotdar Publications.
5. National Building Code of India 2005.
6. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.
7. Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, TataMcGraw Hill.
8. Properties of Concrete by A. M. Neville, Pearson Education Limited.
9. Mitchell's Advanced Building Construction: The Structure by J. Stroud Foster.
10. Fundamentals of Building Construction Materials And Methods by Edward Allen & Joseph,John Wiley, 7th Edition.
11. Materials for Civil and Construction Engineers by Michael S Manlouk & John P Zaniewski.

**e – Resources:**

[www.nptel.iitm.ac.in/courses/iitkanpur](http://www.nptel.iitm.ac.in/courses/iitkanpur)

## HSC: (HS206): UNIVERSAL HUMAN VALUES AND ETHICS

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100Marks</b>

**Prerequisite Course: Nil**

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 starting 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): 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
CO1	-	-	-	-	-	2	-	3	-	1	-	2
CO2	-	-	-	-	-	2	-	3	-	1	-	2
CO3	-	-	-	-	-	3	2	3	-	1	-	2
CO4	-	-	-	-	-	3	-	3	-	1	-	2
CO5	-	-	-	-	-	3	-	3	-	1	-	2
CO6	-	-	-	-	-	3	2	3	-	1	-	2

## Course Contents

Unit No	Unit Title	No.of Hrs	COs
I	<b>Introduction to Value Education:</b> 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	<b>Harmony in Human Being :</b> 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	<b>Harmony in the family, Society and Nature:</b> 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	<b>Professional Ethics :</b> 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	<b>Engineering Ethics and Social Experimentation :</b> 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	<b>Global Issues:</b> 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: (CE207): SOLID MECHANICS LAB

<b>Teaching Scheme</b> Practical: 02 Hrs./ Week	<b>Examination Scheme</b> Oral Exam: 50 Mark
<b>Credits : 01</b>	<b>Total Marks: 50 Mark</b>

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

Sr. No.	Course Objectives
1	Students will know the various material testing methods as per I.S. provisions.
2	Students will test brick, tile, timber and metal samples as per I.S. code provisions.
3	Students will be able to identify the good quality materials and can decide the suitability of material for construction.

**Course Outcomes (COs): Students able to:**

CO's No.	COURSE OUTCOME (S)	BLOOM'S TAXONOMY	
		Level	Descriptor
1	Analyze physical properties of construction materials	4	Analyse
2	Analyse Mechanical properties of construction materials	4	Analyse
3	Identify the quality of material and can decide the selection of material for 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	-	3	-	3	-	3	2	1	2	2	3	-
CO2	3	2	-	3	-	3	-	3	2	1	2	2	3	-
CO3	3	2	-	3	-	3	-	3	2	1	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 Tile.

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 Metal

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: (CE208): SURVEYING LAB

<b>Teaching Scheme</b>	<b>Examination Scheme</b>
<b>Practical: 02 Hrs./ Week</b>	<b>Practical Exam : 50 Marks</b>
<b>Credits: 01</b>	<b>Total Marks : 50 Marks</b>

**Prerequisite Course:** Nil

### Surveying Laboratory:

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):** 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	2	2	2	2	2	2	2	-	3	3	2	2	2	2
CO2	2	2	3	2	2	2	2	-	3	3	2	2	2	2
CO3	1	-	2	-	3	-	-	-	3	2	2	2	2	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: (CE209): BUILDING TECHNOLOGY AND MATERIALS LAB

<b>Teaching Scheme</b> <b>Practical: 02 Hrs./ Week</b>	<b>Examination Scheme</b> <b>Oral Exam: 50 Marks</b> <b>Term work: 25 Marks</b>
<b>Credits: 01</b>	<b>Total: 75 Marks</b>

**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:

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

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) Market survey of various construction materials and tools.**

**Term work: Based on the above syllabus.**

**SUBJECT: (CE210): MANDATORY COURSE – III****Constitution of India**

<b>Teaching Scheme</b> Lectures: 02 Hrs. / Week	<b>Examination Scheme</b> Audit Course
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**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: 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	<b>Introduction to Constitution of India</b> a. Historical background b. Salient features c. Preamble of constitution	07	1
II	<b>Fundamental rights</b> a. Features of fundamental rights b. Basic rights 1. Right to equality; 2. Right to freedom; 3. Right against	05	2

	exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6. Right to property; 7. Right to constitutional remedies		
III	<p><b>(A) Directive principle of state policy:</b></p> <ol style="list-style-type: none"> <li>Features of directive principle</li> <li>Classification of directive principle</li> <li>Criticism of directive principle</li> <li>Utility of directive principle</li> <li>Conflict between Fundamental rights and directive principle</li> </ol> <p><b>(B) Fundamental duties:</b></p> <ol style="list-style-type: none"> <li>List of fundamental duties</li> <li>Features of fundamental duties</li> <li>Criticism of fundamental duties</li> <li>Significance of fundamental duties</li> <li>Swaran Singh Committee Recommendations</li> </ol>	05	3
IV	<p><b>System of Government</b></p> <ol style="list-style-type: none"> <li>Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system</li> <li>Federal system: Federal features of constitution, unitary features of constitution</li> <li>Centre and state relation: Legislative relation, administrative relations and financial relation.</li> <li>Emergency provision: National emergency, Financial emergency and criticism of emergency provision</li> </ol>	05	4
V	<p><b>Central government</b></p> <ol style="list-style-type: none"> <li>President: Election of president, powers and functions of president, and Veto power of president</li> <li>Vice-president: Election of vice-president, powers and functions of vice-president</li> <li>Prime minister: Appointment of PM, powers and functions of PM, relationship with president</li> <li>Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees</li> <li>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.</li> <li>Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court</li> </ol>	05	5
VI	<p><b>State government</b></p> <ol style="list-style-type: none"> <li>Governor: Appointment of governor, powers and functions of governor, constitutional position</li> <li>Chief minister: Appointment of CM, powers and functions of CM, relationship with governor</li> <li>State council of ministers: Appointment of ministers, responsibility of ministers, cabinet.</li> <li>High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC</li> <li>Sub-ordinate court: Structure and jurisdiction, LokAdalats, Family court, Gram Nyayalayas</li> </ol>	05	6

### Reference Books

- Indian Polity for Civil Service Examination, M Laxmikanth, Mc GrawHill Education, Fifth Edition.
- Introduction to the Constitution of India, Durga Das Basu, LexisNexis, 22<sup>nd</sup> Edition

## PCC: (CE211): COMPUTATIONAL TECHNIQUES

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100Marks</b>

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

Sr. No.	Course Objectives
1	To study methods of regression analysis and its application to engineering.
2	Learn the simultaneous algebraic equations and numerical differentiation.
3	To Solve the Linear programming problems using general simplex method.
4	To Solve the Linear programming problems using Big-M Method and Graphical Method.
5	To analyze determinate beams and columns using finite difference method.
6	To learn basics of Excel and SCILAB.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Apply the regression analysis to solve different mathematical problems.	3	Apply
2	Solve the Simultaneous Algebraic equations and Numerical Differentiation using Jacobi's iteration method, Gauss-Seidel method and Central difference method.	3	Apply
3	Solve the Linear programming problems using general simplex method.	3	Apply
4	Solve the Linear programming problems using Big-M Method and Graphical Method.	3	Apply
5	Analyse the deflection in beams using Finite difference method	4	Analyse
6	Solve the numericals on regression analysis and linear programming problem using softwares like Sci-lab and Excel.	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	3	--	--	---	--	---	--	--	--	--	--	2	--
CO2	3	3	--	--	--	--	---	---	--	--	--	--	3	--
CO3	3	3	--	--	--	--	---	---	--	--	2	--	3	--
CO4	3	3	--	--	--	--	---		--	--	2	--	3	--
CO5	3	2	--	--	--	--	---	--	--	--	--	--	2	--
CO6	3	2	--	--	2	--	---	--	--	--	--	--	2	--

## Course Contents

Unit No	Unit Title	No. of Hrs	COs
I	<b>Regression Analysis:</b> Least square method, polynomial functions, curve fitting. Interpolation – Polynomial approximation, Lagrange's method, spline interpolation	06	1
II	<b>Simultaneous Algebraic equations:</b> Jacobi's iteration method and Gauss-Seidel method. <b>Numerical Differentiation:</b> Central difference method- Forward and Backward differentiation.	06.	2
III	<b>Linear Programming (Part A):</b> Introduction to Linear Programming (LP), LP definition, Advantages, Limitations, Requirements of LP, The Simplex Method for Maximization and Minimization.	06	3
IV	<b>Linear Programming (Part B) :</b> Method of Big-M, Graphical Approach in Linear Programming (LP), Formulation of Linear Programming problems, Duality in LP.	06	4
V	<b>Finite Difference Method:</b> Forward, backward and centred finite difference approximations to the derivatives. Applications to determinate (1D and 2D) beams and columns	06	5
VI	<b>Introduction to Computation Tools Excel-</b> basics and advanced excel applications, Numerical solution of linear programming problem <b>Introduction to SCILAB:</b> Basics in SCILAB, Programming on -matrix operations, Gauss elimination, Gauss Jordan method, discretization of structures, finite difference method with matrix operation in 1D element.	06	6
<b>Term-Work:</b> Term-work shall consist of following assignments			
1	Assignment on Regression analysis.		
2	Assignment on a simultaneous algebraic equations and numerical differentiation		
3	Assignment on Linear Programming problems using General Simplex Method		
4	Assignment on linear programming methods using Big-M and Graphical Method		
5	Assignment on basics of finite difference method with numerical.		
6	Assignment on fundamentals of SCILAB and Excel.		
<b>Text Books:</b>			
<ul style="list-style-type: none"> <li>• Numerical methods in Engineering Salvadori &amp; Baron ISBN-13: 978-0136267966</li> <li>• Numerical Methods in Finite Element Analysis Bathe &amp; Wilson ISBN-13: 978-0136271901</li> <li>• Numerical methods for engg. Problems by N. Krishnaraju and K.U.Muthu, Mac- Milon India ISBN 13: 978-0333-92424-2</li> <li>• Operations research: an introduction, Volume 1, Hamdy A. Taha, Fifth Edition, Macmillan Publication, ISBN 0024189758, 9780024189752</li> </ul>			
<b>Reference Books</b>			
<ul style="list-style-type: none"> <li>• Advanced Mathematics Kresysig ISBN-13: 978-8126531356</li> <li>• Numerical Analysis Scarborough ISBN-13: 978-8120417595</li> <li>• Numerical Methods in Finite Element Analysis, Klaus-Jürgen Bathe, E. L. Wilson, Prentice Hall</li> <li>• Numerical Methods in Engineering &amp; Science, Dr. B.S.Grewal, Khanna Publishers, ISBN No. 978-81-7409-248-9.</li> <li>• Linear Models and Generalizations: Least Squares and Alternatives, C. Radhakrishna Rao, Helge Toutenburg, Shalabh, Christian Heumann, 3rd edition, Springer series in Statistics</li> <li>• Problems in Operation Research (Principles &amp; Solution): Principles and Solutions, Prem Kumar Gupta and Dr. D. S. Hira, S.Chand and Company Pvt Ltd. Publication, Fourth Edition</li> </ul>			

## PCC: (CE212): CONCRETE TECHNOLOGY

<b>Teaching Scheme</b> Lectures: 03 Hrs./ Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course: Building Technology and Materials**

Sr. No	Course Objectives
1	To know the properties of various ingredients of concrete.
2	To study and check the compatibility of admixtures.
3	To learn the behaviour and properties of fresh concrete.
4	To know the various mechanical properties of concrete.
5	To learn and develop the Concrete Mix Design.
6	To understand special concrete and durability aspect of concrete

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Acquired the knowledge to select the various ingredients of concrete.	1	Remembering
2	Use of concrete through scientific approach.	2	Understand
3	Apply knowledge of concrete in civil engineering construction projects	3	Applying
4	Analyze and examine the various types of concrete and their properties	3	Applying
5	Predict required grade of concrete	3	Applying
6	Design new generation concrete	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	PSO1	PSO2
CO1	3	---	---	---	2	---	---	---	---	---	---	2	3	2
CO2	2	---	---	---	3	---	---	3	---	---	---	---	2	3
CO3	---	2	---	---	3	---	---	2	---	---	---	---	2	3
CO4	---	3	---	---	3	1	---	---	---	---	2	---	3	2
CO5	---	---	3	---	---	2	---	---	1	---	2	---	3	3
CO6	---	3	3	2	2	---	2	---	---	2	---	---	3	1

## Course Contents

Units	Topics	No of Hrs	COs
<b>I</b>	<b>Ingredients of Concrete:</b> <b>Cement:</b> -Historical background, Manufacturing of Portland cement, Chemical composition, chemistry of cement Hydration, Classification and types of cement, Tests on cement. <b>Aggregate:</b> - Classification, Mechanical and Physical properties, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial (crushed sand) and Recycled aggregate. <b>Water:-</b> Mixing Water, Curing water.	06	1
<b>II</b>	<b>Admixtures and Additives in concrete:</b> <b>Admixtures:</b> Functions, Classification, Types; Mineral and Chemical. <b>Chemical Admixtures:</b> Plasticizers, Super plasticizers, Retarders, Air entraining agents. <b>Mineral Admixtures:</b> Fly ash, Silica Fume, GGBS, Rice husk ash, Metakeoline, etc., compatibility test, <b>Fibres:</b> natural, artificial and Synthetic, etc.	06	2
<b>III</b>	<b>Properties of Fresh Concrete:</b> <b>Workability:</b> Definition, Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete, <b>Curing:</b> Methods of curing, Influence of temperature, Maturity rule, Steam curing.	06	3
<b>IV</b>	<b>Properties of Hardened Concrete:</b> <b>Properties of concrete:</b> – General, Factors affecting strength, Micro cracking and stress strain relationship, Relation between tensile and compressive strength, modulus of elasticity, Poisson’s Ratio. <b>Non Destructive Testing:-</b> Rebound hammer, Ultra Sonic Pulse Velocity, Impact echo test, core test, Resonance frequency, Rebar locator.	06	4
<b>V</b>	<b>Concrete Mix Design:</b> 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. Introduction to Performance based Mix design using artificial and natural sand. <b>(Site visit is recommended to learn this topic)</b>	06	5
<b>VI</b>	<b>Future Concretes and Durability:</b> 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. Durability of concrete: - Significance, Permeability, Creep, Shrinkage, chloride, sulphate and sea water attack on concrete.	06	6

### **Text Books:**

1. M. L. Gambhir, “Concrete Technology”, Tata McGraw Hill Publications, 2016.
2. M. S. Shetty, “Concrete Technology”, S. Chand Publications, 2006.



3. A. R. Shantakumar, “Concrete Technology”, Oxford University Press, 2018.
4. A. M. Neville, “Properties of Concrete”, Pearson Education India.

**Reference Books:**

1. A. M. Neville, J. J. Brooks, “Concrete Technology” Pearson Education India.
2. R.S. Varshney, “Concrete Technology”, Oxford and IBH.
3. P. Kumar Mehta, “Microstructure and properties of concrete”, Prentice Hall.SP-26
4. A. P. Remideos, “Concrete Mix Design” Himalaya Publishing House.
5. V. M. Malhotra, “Fly ash in concrete”, Canmet, 1994.
6. A. Sarja and E. Vesiari, “Durability design of concrete structures”, E & FN Spon, 1996.
7. J. Newman and Choo, Ban Sang, “Advanced concrete technology- testing and Quality”, Elsevier, 2003.
8. P. N. Balguru and S. P. Shah, “Fibre Reinforced Cement composites”, McGraw Hill, 1992.
9. D.J. Hannant, “Fibre cements and fibre concrete, Wiley-Interscience, Newyork,2011
10. **IS Codes:** IS 456, IS 383, IS 9103, IS 10262 Latest revised editions.

## PCC: (CE213): GEOTECHNICAL ENGINEERING

<b>Teaching Scheme</b> Lectures: 04 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 04</b>	<b>Total: 100 Marks</b>

**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 retaining 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): 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	Analysing
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	<b>Properties of Soil:</b> 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	<b>Permeability and Seepage:</b> 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	<b>Compaction:</b> 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.	08	3
IV	<b>Shear Strength of Soil:</b> 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	<b>a) Lateral Earth Pressure:</b> 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>b) Stability of Slopes:</b> Slope classification, slope failure, modes of failure. Finite and Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.	08	5
VI	<b>SOIL EXPLORATION AND BEARING CAPACITY:</b> Objectives and methods of explorations-Sampling and its design features, SPT, Cone penetration test and in-situ vane shear test, Bearing Capacity	08	6

### 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.
6. William Powrie “Soil Mechanics Concepts & Applications” CRC Press.
7. Donald Wood Taylor “Fundamentals of Soil Mechanics” New York J. Wiley Publication.
8. Arnold Verrujit “An Introduction to Soil Mechanics” Springer International Publisher.
9. R F Scott “Principles of Soil Mechanics” Addison Wesley Publisher.

**e – Resources:**

1. [www.nptel.iitm.ac.in/courses/iitkanpur](http://www.nptel.iitm.ac.in/courses/iitkanpur)
2. [www.cdeep.iitb.ac.in/nptel](http://www.cdeep.iitb.ac.in/nptel)

## PCC: (CE214): ANALYSIS OF STRUCTURES

<b>Teaching Scheme</b> <b>Lectures: 03 Hrs. / Week</b> <b>Tutorial: 01 Hrs./ Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam: 50 Marks</b>
<b>Credits : 04</b>	<b>Total Marks: 100 Mark</b>

**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 Analyze statically indeterminate Beams and Frames by using strain energy, Three moment theorem and Castigliano's first theorem.
3	To Analyze the Beam and Truss under Moving load using Influence line diagrams.
4	To analyze the two and three hinged arches.
5	To analyze the determinate and indeterminate structures using concept of plastic analysis.

### Course Outcomes: 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	Analyze statically indeterminate Beams and Frames by the strain energy, Three moment theorem and Castigliano's second theorem.	4	Analyze
CO3	Analyze Beam under moving Loads by influence Line Diagrams.	4	Analyze
CO4	Analyze Truss under moving Loads by influence Line Diagrams.	4	Analyze
CO5	Analyze two and three hinged arches.	4	Analyze
CO6	Analyze determinate and indeterminate structural elements using theory of plasticity.	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	3	---	---	---	---	---	---	---	---	---	---	3	---
CO2	3	3	---	2	---	---	---	---	---	---	---	---	3	---
CO3	3	3	---	2	---	---	---	---	---	---	---	---	3	---
CO4	3	3	---	2	---	---	---	---	---	---	---	---	3	---
CO5	3	3	---	--	---	---	---	---	---	---	---	---	3	---
CO6	3	3	1	--	---	---	---	---	---	---	---	---	3	---

## COURSE CONTENTS

Unit No.	Unit Title	No.of Hrs	COs
I	<b>SLOPE AND DEFLECTION METHODS:</b> Introduction, Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy. Slope and deflection of determinate beams by Macaulay's method, concept of moment area method and conjugate beam method and its application. Castigliano's first theorem, application to determine slope and deflection of determinate beams.	06	1,2
II	<b>ANALYSIS OF INDETERMINATE BEAMS:</b> Fixed beams by strain energy method, Analysis of continuous beams by three moment theorem (Clapeyron theorem). Castigliano's second theorem, analysis of beams, Propped cantilever beam.	06	1,2
III	<b>INFLUENCE LINE DIAGRAM FOR BEAMS:</b> 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.	06	3,4
IV	<b>INFLUENCE LINE DIAGRAM FOR TRUSSES:</b> 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.	06	3,4
V	<b>ANALYSIS OF ARCHES :- THREE HINGED ARCHES</b> - Types of arches, analysis of parabolic 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</b> – Analysis of parabolic and semicircular arches with supports at same level, determination of horizontal thrust, radial shear and normal thrust.	06	1,2,5
VI	<b>PLASTIC ANALYSIS OF STRUCTURE:</b> a) 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, Statical and kinematical method of analysis, uniqueness theorem. b) Plastic analysis of determinate and indeterminate beams, single bay single storied portal frame.	06	1,6

### **Text Books:**

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

Publications. 2012, **ISBN: 6700000000037.**

**References:**

1. R.C. Hibbeler, “Structural Analysis”, 6<sup>th</sup> Edition, Pearson Education.2006  
**ISBN: 9788131721414.**
2. C. S. Reddy, “Basic Structural Analysis”, 3<sup>rd</sup> Edition, Tata McGraw Hill. 2010.  
**ISBN: 9780070702769.**
3. Devadoss Menon, Structural Analysis, 2<sup>nd</sup> Edition, Narosa Publishing House, New Delhi.2018 **ISBN: 13: 9781842653371.**
4. Timoshenko S.P. and Young D.H., “Theory of Structures”, McGraw Hill. 2002  
**ISBN: 978-0070648685.**

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

<b>Teaching Scheme</b> Lectures: 1Hr/Week Practical: 04 Hrs./ Week	<b>Examination Scheme</b> Practical: 50 Marks Term Work: 50 Mark
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course:** Building Technology and Materials

### Course Objectives:

Sr. No.	Course Objectives
1	To understand necessity of principles of planning, principles of architecture and bye-laws to create various Civil engineering drawings.
2	Analyze the available data and plan different types of structures considering futuristic need of a building.
3	To develop the plan, elevation, section and working drawings for column, brickwork and plinth beams in framed structures.

### 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 principles of architectural Planning.	3	Apply
2	Develop floor plan, elevation, section and working drawings of framed structures.	3	Apply
3	Solve contemporary issues at multi-dimensional functional levels of building planning using fundamentals of Town Planning.	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	1	1	-	-	-	-	-	-	-	-	-	1	-
CO2	2	-	1	-	-	-	1	-	2	-	-	-	1	-
CO3	3	3	2	-	-	-	2	-	3	-	-	-	3	-

### Course Contents

Unit No	Topic	No. of Hrs	COs
I	<p><b>Town Planning:</b> Necessity of town planning, Development plan and its importance, Objectives and Contents of DP, Introduction to different zones of land in town planning, Requirements of various zones, Height zoning and Density zoning.</p> <p><b>Legal Aspects:</b> Role of Plan sanctioning authority, 7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, Concept of TDR, List of documents to be submitted to local authority for sanctioning of plan, Various NOC's required. Introduction to Real Estate Regulatory Authority [RERA] and Environmental Regulations.</p>	06	1



II	<p><b>Architectural Planning and Building bye laws</b>  Principles of Architectural planning, relation between form and function, utility, aesthetics. Noise and Acoustics – Sound insulation, Acoustical defects, planning for good acoustics. Ventilation – Necessity of Ventilation, Natural ventilation: stack effect and wind effect.  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, Area calculations, Rules for ventilation, lighting and Parking of vehicles.</p>	06	2,3
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>1. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition.)</li> <li>2. Building science and planning by Dr. S. V. Deodhar, Khanna Publishers.</li> <li>3. Building Services Engineering by David V. Chadderton, sixth edition, London &amp; New York.</li> <li>4. Drawing for Civil Engineering by Jan A. Van Der Westhuizen</li> </ol>			
<b>Reference Books</b>			
<ol style="list-style-type: none"> <li>1. National Building Code (latest).</li> <li>2. Building Design and construction by Frederick Merrit, Tata McGraw Hill.</li> <li>3. Times Saver standards of Architectural Design Data by Callender, Tata McGraw Hill.</li> <li>4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.</li> <li>5. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.</li> <li>6. Maharashtra Real Estate Regulatory Authority Act.</li> </ol> <p><b>e-Resources :</b></p> <ol style="list-style-type: none"> <li>1. <a href="http://www.grihaindia.org/">http://www.grihaindia.org/</a></li> <li>2. <a href="http://new.usgbc.org/">http://new.usgbc.org/</a></li> <li>3. <a href="http://www.hcd.ca.gov/hpd/green_build.pdf">http://www.hcd.ca.gov/hpd/green_build.pdf</a></li> <li>4. <a href="http://ncict.net/Examples/Examples1.aspx">http://ncict.net/Examples/Examples1.aspx</a></li> <li>5. <a href="http://www.igbc.in/site/igbc">http://www.igbc.in/site/igbc</a></li> </ol>			

### **List of Laboratory Assignments:-**

Students shall prepare working drawings of any type of building from the list. (Individual project to be planned and manually drafted to suitable scale):

1. Layout/ Site plan indicating water supply and drainage line (with area statement).
2. Floor Plan/ Typical floor plan (with construction notes, schedule of openings).
3. Elevation and Sectional Elevation (preferably to be drawn on same sheet).
4. Centre line plan of footing.
5. Working drawing of substructure: working drawing of column, brick work and plinth beam.

## PCC: (CE216): COMPUTATIONAL TECHNIQUES LAB

<b>Teaching Scheme</b> Practical: 02 Hrs./ Week	<b>Examination Scheme</b> Term work: 50 Marks
<b>Credits: 01</b>	<b>Total: 50Marks</b>

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

Sr. No.	Course Objectives
1	To solve regression analysis, linear programming, simultaneous algebraic equations and finite difference method analytically.
2	To solve regression analysis, linear programming, simultaneous algebraic equations and finite difference method by using software tools like Sci-Lab and Excel

**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	Solve regression analysis, linear programming, simultaneous algebraic equations and finite difference method analytically.	3	Apply
CO2	Solve regression analysis, linear programming, simultaneous algebraic equations and finite difference method by using software tools like Sci-Lab and Excel	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	--	--	3	--	---	---	--	--	2	--	3	--

### Course Contents

<b>Term-Work:</b> Term-work shall consist of following assignments	
1	Assignment on Regression analysis.
2	Assignment on a simultaneous algebraic equations and numerical differentiation
3	Assignment on Linear Programming problems using General Simplex Method
4	Assignment on linear programming methods using Big-M and Graphical Method
5	Assignment on basics of finite difference method with numerical.
6	Assignment on fundamentals of SCILAB and Excel.

## PCC: (CE217): CONCRETE TECHNOLOGY LAB

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

Sr. No	Course Objectives
1	To know the properties of various ingredients of concrete.
2	To learn the behaviour and properties of fresh concrete.
3	To know the various mechanical properties of concrete, Concrete Mix Design

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

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Analyse physical properties of construction materials	4	Analyse
CO2	Analyse Mechanical properties of construction materials	4	Analyse
Co3	Design of various concrete mixes	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	2	1	2	2	3	-
CO2	3	2	-	3	-	3	-	3	2	1	2	2	3	-
CO3	3	2	-	3	-	3	-	3	2	1	2	2	3	-

### List of Laboratory Experiments

The Laboratory Experiments shall consist of a journal giving details of all the following experiments.

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.
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 and gradation of fine and coarse aggregate.
9. Concrete mix design by IS code method. **(Site visit is recommended to learn this topic)**
10. Workability of concrete by slump test/flow test, compaction factor, Vee Bee test, effect of admixture and retarders on setting time concrete.
11. Compressive strength test of concrete by crushing and Rebound hammer.
12. Indirect tensile strength, Modulus of elasticity and flexural strength of hardened concrete.

**Oral: Based on above syllabus and term work.**

## PCC: (CE218): GEOTECHNICAL ENGINEERING LAB

<b>Teaching Scheme</b> Practical: 02 Hrs./ Week	<b>Examination Scheme</b> Practical Exam: 50 Marks Term work: 25 Mark
<b>Credits: 01</b>	<b>Total: 75 Marks</b>

### 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 Pycnometer /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: (CE219): SEMINAR

<b>Teaching Scheme</b> Practical: 04 Hrs./ Week	<b>Examination Scheme</b> Oral Exam: 25 Marks Term work: 25 Marks
<b>Credits: 02</b>	<b>Total: 50 Marks</b>

**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	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

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 subjectives, 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: (MC220): Mandatory Course-IV

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

<b>Teaching Scheme</b> Lectures: 02 Hrs. / Week	<b>Examination Scheme</b> Audit Course
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#### 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

- Exposure to social problems (which are amenable to technological solutions)
- 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- 2019 PATTERN**

**THIRD YEAR B. Tech**

**Semester-V and VI**

**W.e.f June 2021**

**Board of Studies in Civil Engineering, June 2021**

# **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 2019 w.e.f. from A.Y 2021-22 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

**Submitted by**

(Dr.M.V.Jadhav)

BoS Chairman

**Approved by**

Dean Academics

Dr.A.B.Pawar

Director

Dr.A.G.Thakur





## **DEPARTMENT OF CIVIL ENGINEERING**

### **COURSE STRUCTURE and SYLLABUS- 2020 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 31 June 2021. 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 Spirit through field study, expert talk etc. The department also, provides an opportunity to learn software like AUTOCAD, REVIT ARCHITECTURE, STAAD- 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- 2019 PATTERN

### THIRD YEAR B. TECH.

(W.e.f June 2021)

Board of Studies in Civil Engineering, June 2021

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
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
BSC	Basic Science Course	PRJ	Project/Seminar/Internship/Online Course

### SEMESTER-V

Cat	Code	Course Title	Hrs./Week			Credits	Marks						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PRJ	CE301	Professional Internship -II	-	-	-	2	-	-	-	50	-	-	50
PCC	CE302	Design of Steel Structures	4	-	-	4	30	50	20	-	-	-	100
PCC	CE303	Fluid Mechanics	3	-	-	3	30	50	20	-	-	-	100
PCC	CE304	Project Management and Economics	3	-	-	3	30	50	20	-	-	-	100
PCC	CE305	Engineering Geology	3	-	-	3	30	50	20	-	-	-	100
PEC	PE306	Professional Elective-I	3	-	-	3	30	50	20	-	-	-	100
PCC	CE307	Design of Steel Structures	-	-	2	1	-	-	-	50	-	-	50
PCC	CE308	Fluid Mechanics	-	-	2	1	-	-	-	50	-	-	50
PCC	CE309	Engineering Geology	-	-	2	1	-	-	-	-	50	--	50
PRJ	CE310	Skill based credit course	-	-	2	1	-	-	-	-	-	50	50
MLC	MC311	Mandatory Course-V: (Field Practices in Civil Engineering)	(1)	-	-	Non Credit	-	-	-	-	-	-	-
<b>Total</b>			<b>17</b>	<b>---</b>	<b>08</b>	<b>22</b>	<b>150</b>	<b>250</b>	<b>100</b>	<b>150</b>	<b>50</b>	<b>50</b>	<b>750</b>

**COURSE STRUCTURE and SYLLABUS- 2019 PATTERN****THIRD YEAR B. TECH.**

(W.e.f June 2021)

Board of Studies in Civil Engineering, June 2021

<b>LIST OF ABBREVIATIONS</b>			
<b>Abbreviation</b>	<b>Full Form</b>	<b>Abbreviation</b>	<b>Full Form</b>
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
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
BSC	Basic Science Course	PRJ	Project/Seminar/Internship/Online Course

**SEMESTER-VI**

Cat	Code	Course Title	Hrs./Week			Credits	Marks						
			L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PCC	CE312	Hydrology and Water Resource Engineering	3	-	-	3	30	50	20	-	-	-	100
PCC	CE313	Design of Reinforced Concrete Structures	3	-	-	3	30	50	20	-	-	-	100
PEC	PE314	Professional Elective-II	3	-	-	3	30	50	20	-	-	-	100
OE	CE315	Open Elective-I	4	-	-	4	30	50	20	-	-	-	100
PRJ	PR316	IPR and EDP	2	-	-	2	15	25	10	-	-	-	50
PRJ	PR317	IPR and EDP Lab	-	-	2	1	-	-	-	-	-	50	50
HSMC	HS318	Corporate Readiness	1	-	2	2	-	-	-	-	-	50	50
PCC	CE319	Hydrology and Water Resource Engineering Lab	-	-	2	1	-	-	-	50	-	-	50
PCC	CE320	Design of Reinforced Concrete Structures Lab	-	-	2	1	-	-	-	50	-	-	50
MLC	MC321	Mandatory Course-VI: (Formwork in Constructions)	(1)	-	-	No Credits	-	-	-	-	-	-	-
<b>Total</b>			<b>17</b>	<b>-</b>	<b>08</b>	<b>20</b>	<b>135</b>	<b>225</b>	<b>90</b>	<b>100</b>	<b>-</b>	<b>100</b>	<b>650</b>

## PRJ (CE301) Professional Internship –II

<b>Teaching Scheme</b> <b>Credits : 2</b> <b>Duration: 4 weeks.</b>	<b>Examination Scheme</b> <b>Oral: 50 Marks</b>
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### Course Objectives:

1.	To get opportunity to observe current technological developments relevant to the subject.
2.	To get opportunity to learn, understand and sharpen the real time technical skills.
3.	To get expose to the industrial environment.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the attitudes and approach of the workers to problem solving.	2	Understanding
2	Gain experience in writing technical reports.	3	Applying,
3	Professional competency in civil engineering.	4	Analyzing

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

### Course Contents

Sr. No	Particulars
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.
4	The presentation is way to evaluate student performance, so student must be ready as they are evaluated by institute guide, internal and external examiner.
5	Student must submit a comprehensive report to the department before presentation.

### Steps to apply for internship

Sr. No	Particulars
1	Students shall ask for permission letter from Civil Department office/office of Training & Placement cell of the college in consultation of guide (Institute) to allot various slots of 4 to 6 weeks during as internship periods.

## PCC (CE302): Design of Steel Structure

<b>Teaching Scheme</b> <b>Lectures: 04 Hrs. / Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 04</b>	<b>Total: 100 Marks</b>

**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
<b>I</b>	<b>Introduction to steel structure and Design of Connection:</b> 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
<b>II</b>	<b>Design of Tension Member:</b> 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
<b>III</b>	<b>Design of Compression Members:</b> 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
<b>IV</b>	<b>Design of Bracing systems and Bases:</b> 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
<b>V</b>	<b>Design of Flexural members:</b> 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 using single rolled steel section with and without flange plate, Apply appropriate checks. Introduction to Plate girder and Gantry Girder, Component parts and Uses (Only concepts-No Numerical).	08	5
<b>VI</b>	<b>Design of Industrial roof trusses:</b> 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	08	6



	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-Engineering Building (PEB) structures.		
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### **Text Books:**

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

### **Reference Books:**

1. Design of Steel Structure by N Subramanian, Oxford University Press, 2<sup>nd</sup> Edition, 2016, New Edi. New Delhi.
2. Limit state design of steel structures by S. K. Duggal, Tata McGraw Hill, 3<sup>rd</sup> Edition, New Delhi.
3. Structural Design in Steel by Sarwar Alam Raz, New Age International Publishers. Ltd. 3<sup>rd</sup> 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, 3<sup>rd</sup> Edition, New Delhi.
6. Limit State Design of Steel Structures by S. Kanthimathina - WILEY, Dream tech Press, 1<sup>st</sup> 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](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 (CE303): Fluid Mechanics

<b>Teaching Scheme</b> <b>Lectures : 03 Hrs. / Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 03</b>	<b>Total : 100 Marks</b>

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

### Course Objectives:

1. To understand the physical properties of fluid.
2. To understand different flow conditions under fluid motion.
3. To apply fundamental principles of fluid mechanics.
4. To prepare the students for higher studies and competitive exam in the field of fluid mechanics.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	State and explain basic principles and physical properties of fluids	2	Understanding
2	Use pressure measuring devices for pressure measurement	3	Applying
3	Classify the fluid flow based on flow conditions	3	Applying
4	Analyze fluid flow problems with the application of the momentum and energy equations	4	Analyzing
5	Assess the pipe flow problems	5	Evaluate
6	Analyze the growth of Boundary layer over a flat plate	4	Analyzing

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

## Course Contents

Unit No	Topics	No. of Hrs.	COs
<b>I</b>	<p><b>a) Fluid Properties:</b> 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.</p> <p><b>b) Fluid Statics:</b> Pressure at a point, Equation of hydrostatics, Pascal's law, Types of pressure, Hydrostatic paradox, Pressure measuring devices and their applications,</p>	06	1
<b>II</b>	<p><b>a) Hydrostatic forces on surfaces</b> - Concept of total pressure and centre of pressure, Total pressure on a horizontal, vertical and inclined plane surface, Total pressure on curved surfaces.</p> <p><b>b) Buoyancy:</b> Archimedes' principle, Concept of buoyancy, Metacenter, Equilibrium of floating and submerged bodies, Determination of metacentric height by analytical and experimental method.</p>	06	2
<b>III</b>	<p><b>a) Fluid Kinematics:</b> 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.</p> <p><b>b) Dynamics:</b> 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.</p>	06	3
<b>IV</b>	<p><b>Dimensional Analysis:</b> Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using Buckingham's <math>\pi</math> theorem method, Geometric, Kinematic and Dynamic similarity, Dimensionless parameters.</p>	06	4
<b>V</b>	<p><b>Flow-through Pipes:</b> Major and Minor losses in pipe flow, Darcy – Weisbach equation for head loss due to friction in a pipe, Variation of friction factor for laminar flow and turbulent flow, Equivalent pipe and Pipe network analysis.</p>	06	5
<b>VI</b>	<p><b>Boundary Layer Theory:</b> Concept and thickness of laminar and turbulent boundary layers over flat plates, Application of the integral momentum equation, Boundary layer separation and their control, Concept of drag and lift.</p>	06	6

### Text Books:

1. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", 10<sup>th</sup> Edition, Laxmi Publications (P) Ltd., New Delhi, 2019. ISBN – 10: 8131808157.

2. R. K. Rajput, “A Textbook of Fluid Mechanics and Hydraulic Machines”, 3<sup>rd</sup> Revision, 2006 edition S. Chand Publishing, New Delhi, ISBN – 10: 9789385401374.\

**Reference Books:**

1. V. L. Streeter and E. B. Wylie, “Fluid Mechanics”, 9<sup>th</sup> Edition, McGraw Hill Publications, New York, 2010. (ISBN – 10 : 0070625379)
2. P.N. Modi and S.M. Seth, “Hydraulics & Fluid Mechanics” 22<sup>nd</sup> 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, 8<sup>th</sup> Edition, 2013. (ISBN-13: 978-9350143926)
4. Y. Cengel and J. Cimbala, “Fluid Mechanics”, Tata McGraw Hill, New Delhi, 3<sup>rd</sup> edition, 2017. (ISBN-13: 978-9339204655)
5. S K Som, Gautam Biswas, S Chakraborty, “Introduction to Fluid Mechanics & Fluid Machines”, 3<sup>rd</sup> Edition, McGraw Hill Publications, 2011.
6. V. Gupta and S. K. Gupta, “Fluid Mechanics and Applications”, New-Age International Pvt. Ltd., 2015. (ISBN -13: 978-8122439977)

**e – Resources:**

7. <https://nptel.ac.in/courses/105/103/105103095/>
8. <https://nptel.ac.in/courses/105/103/105103192/>

## PCC (CE304): Project Management and Economics

<b>Teaching Scheme</b> <b>Lectures: 03 Hrs. / Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course: Mathematics, Basic Economics**

### Course Objectives:

1.To understand the importance of Project management in industrial organization and to apply specific tools, models and processes, Project's life cycle.
2. To understand the importance of Leadership specifically in heterogeneous and virtual teams as well as governance and approaches to conflict resolutions.
3. Identify and Analyze factors for successful Projects, as well as reasons for failure based on specific case studies in the context of effective Risk Management ,analyze cost , justify -reject alternatives for projects on an economic basis

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand project characteristics and various stages of a project to Achieve Project Goals	2	Understand
2	Understanding Planning, Scheduling, and Executing Of Construction Projects using CPM, PERT.	2	Understand
3	Integrate the activities of materials manager like purchasing, inventory analysis, and storage in a scientific manner, Managing the material using ABC, EOQ.	3	Apply
4	Analyze the techniques for Project planning, scheduling and Execution Control.	3	Apply
5	Understand how optimum decisions are taken by firms in the economy and understand how optimum real life decisions are taken by individuals under situations of scarcity.	2	Understand
6	Understand how Subcontract Administration and Control are practiced in the industry.	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	2	-	-	-	-	-	-	2	-	3	2	1	3
CO2	3	2	-	3	-	-	-	-	-	-	3	2	1	3
CO3	-	-	3	3	-	3	-	-	2	-	3	2	3	3
CO4	-	-	3	3	-	3	-	-	2	-	3	2	3	2
CO5	2	2	-	2	3	-	-	-	3	-	2	2	3	2
CO6	2	2	-		2	-	-	-	3	-	3	2	3	2

## Course Contents

Unit No	Topics	No of Hrs	COs
<b>I</b>	<b>Introduction to Management-</b> Significance, Objectives, Functions, Principles of Management, hierarchy of organization, Categories of Project, Project Failure, Project- Life cycle. <b>Overview of Project Management-</b> Work Breakdown Structure (WBS), Line Of Balance (LOB), Critical Path Method (CPM) - Activity On Arrow (AOA), Activity On Node (AON), Precedence network analysis.	06	1
<b>II</b>	<b>Project Planning &amp; Scheduling-</b> Work scope planning, project Gantt/Bar chart, CPM network development and analysis, Critical path and type of Floats, Project Evaluation and Review Technique (PERT) Analysis, CPM vs. PERT	06	2
<b>III</b>	<b>Material Management-</b> Objectives, Material Procurement Procedures - Material requirement - raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping – Use of Excel Sheets, MS- Project, Inventory Control - ABC analysis, EOQ (Economical Order Quantity)	06	3
<b>IV</b>	<b>Project Monitoring and Control-</b> Project Monitoring- Methods-Updating and Earned Value, Network crashing, Resource Allocation and scheduling, Leveling and Smoothing, Construction Safety measures for Roads, Dams, Industrial/commercial buildings, disputes and resolution techniques	06	4
<b>V</b>	<b>Introduction to Project Economics-</b> Definition, Principles, Importance in construction Industry, Difference between Cost, Value, Price and its relevance to Marketing utility, Rent, simple and compound interest, profit, Annuities, Demand, demand schedule, Law of demand, demand curve, elasticity of demand, supply, supply schedule, supply curve, elasticity of supply. Equilibrium, Equilibrium price, Equilibrium amount, factors affecting price determination- Law of Diminishing Marginal Utility, Law of substitution, Concept of Cost of Capital.	06	5
<b>VI</b>	<b>Project Finance And Appraisal-</b> Need and types of project appraisals, Types of Capital, Types of Appraisals such as political, social, environmental Techno-legal, financial and Economical, Fundamental and Application Component, Indian practice of investment appraisal, time value of money, discounted and non-discounted cash flow methods (NPV-Net Profit Value, IRR- Internal Rate of Return, Pay-back period, BCR- Benefit Cost Ratio)	06	6

### Text Books:

1. Sitangshu Khatua , Project Management and Appraisal , Oxford University, 2011 Edition.
2. B. Sengupta and H. Guha, Construction Management and Planning, Tata McGraw Hill Publishing Company, New Delhi, 2021 Edition
3. S.Seetharaman, Construction Engineering and Management, Umesh Publications 5th Edition.

**Reference Books:**

1. S C Sharma, SV Deodhar, Construction Engineering And Management, Khanna Publishing House, 1<sup>st</sup> Edition 2019.
2. K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015.
3. K K Chitkara, Construction Project Management: Planning, Scheduling & Controlling, , Tata McGraw - Hill Publishing Co. Ltd., New Delhi, 3rd Edition , 2014.
4. P Chandra, Projects: Planning, Analysis, Selection, Financing, Implementation, and Review, Tata Mc Graw Hill, New Delhi, 2009 edition.
5. R L Peurifoy, Construction Planning, Equipment, and Methods, Tata McGraw-Hill, New Delhi, 2002 edition.
6. F Harris and R Mc Caffer, Modern Construction Management, Seventh Edition, Blackwell Publishers, Oxford, 2013.
7. S. Rajaram and M. Sivakumar, Total Quality Management, Biztantra, 2008 edition

**e – Resources:**

1. <https://nptel.ac.in/courses/105/102/105102199/>

## PCC (CE 305): Engineering Geology

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam : 50 Marks
<b>Credits: 03</b>	<b>Total : 100 Marks</b>

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

### Course Outcomes:

1.	To understand the basic principles of Engineering Geology
2.	To understand the utility and applications of Engineering Geology in various fields of Civil Engineering
3.	To learn the basic aspects of structural features like folds and faults in foundation rock
4.	To learn the application of geological site investigations in various infrastructure projects

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the fundamental concepts of the Earth; Rocks and minerals	2	Understand
2	Develop the ability to perform basic engineering geological assessment with respect to application in civil engineering	3	Apply
3	Understand the relevance of engineering geology in complex project which will strengthen the practical knowledge	2	Understand
4	Analyze favorable and unfavorable conditions for the buildings, roads, dam, tunneling etc. through the structural Suitability of rocks.	4	Analyze
5	Explain effects of different geomorphological processes & applications GIS & RS in Civil Engineering	3	Apply
6	Analyse the geological hazards and influence of hydrogeological properties of rocks for safety & suitability of foundation rocks	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	1
CO2	3	--	2	--	-	--	--	--	2	--	1	--	3	3
CO3	3	--	--	--	-	--	--	--	--	--	1	--	3	3
CO4	3	--	--	2	--	--	--	--	2	-	--	--	2	2
CO5	3	--	--	--	3	--	--	--	--	--	1	--	2	2
CO6	3	--	--	1	--	--	2	--	--	-	--	--	1	1



## Course Contents

Unit No	Topics	No of Hrs.	COs
I	<p style="text-align: center;"><b>Mineralogy and Petrology</b></p> <p><b>Mineralogy</b> Introduction to subject, Scope and sub divisions, Rock forming minerals and their properties. Silicate &amp; non silicate minerals Primary and secondary minerals. Felsic and mafic minerals. Essential and accessory minerals</p> <p><b>Petrology-</b> Rock cycle and main divisions of rock.</p> <p><b>Igneous rocks-</b> Mineral composition Texture and structure of plutonic, Hypabyssal and volcanic rocks. Classification of igneous rock, study of common rocks.</p> <p><b>Sedimentary rocks-</b> 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.</p> <p><b>Metamorphic rocks:</b> Agents and types of metamorphism, Texture and Structure, Study of common rocks and their Engineering. Applications.</p>	06	1
II	<p style="text-align: center;"><b>Structural Geology and Tectonics</b></p> <p><b>Structural geology:</b> Out crop ,Dip Strike, Conformable and unconformable series and over lap</p> <p><b>Fault</b> and their types, Inliers and outlier.</p> <p><b>Fold</b> and their types, Structural features resulted due to igneous intrusions. Concordant and Discordant igneous intrusions, Joints and their types. Stratification and lamination,</p> <p><b>Introduction to plate tectonics.</b> Plate boundaries.</p> <p>Geological Maps, its interpretation and its applications in solving of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges.</p>	06	2
III	<p style="text-align: center;"><b>Preliminary Geological Studies.</b></p> <p><b>Preliminary geological Investigations:</b> 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.</p> <p><b>Geophysical Techniques:</b> 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.</p>	06	3
IV	<p style="text-align: center;"><b>Role of Geology in Reservoirs, Dams and Tunneling</b></p> <p><b>Geology of Dam site,</b> Preliminary geological work on dam sites ,case studies Types of dam</p> <p><b>Geology of Reservoir sites,</b> Physical properties and rock structure Condition likely to cause leakage through reservoir rim. Reservoir Induced</p>	06	4

	<p>Seismicity R.I.S.</p> <p>Importance of ground water studies and effect of rising the water table and case studies.</p> <p><b>Tunnelling</b>, 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.</p>		
V	<p><b>Geomorphology, Remote Sensing and G.I.S.</b></p> <p><b>Geomorphology:</b> Geological action of river, Rejuvenation, Land forms resulted due to river</p> <p>Land forms due to river deposition,</p> <p>Application of Remote Sensing and GIS Techniques in Civil Engineering Projects –GPS (Global Positioning System) and its uses,</p> <p>Remote sensing Satellites and their characteristics, GIS Spatial data models and data editing. Introduction to DEM (Digital Elevation Modelling) analysis.</p>	06	5
VI	<p><b>Geological Hazards &amp; Hydrogeology</b></p> <p><b>Geological hazards:</b> Volcanism, Earthquakes and Seismic zones of India, Landslides and stability of hill slopes and preventive measures.</p> <p><b>Groundwater:</b> Types of ground water, water table and depth zones, influence of hydrogeological properties of rocks, geological work of groundwater, types of aquifers, fluctuations in water table levels, effects of dams and canals, effect of pumping, cone of depression, circle of influence, conservation of groundwater, artesian wells, its geological conditions, artificial recharge of groundwater.</p>	06	6

**Text Books:**

1. K.V.G.K. Gokhale and D. M. Rao, “Geology and Engineering” 4<sup>th</sup> edition, Tata McGraw-Hill.2017
2. R.B. Gupte “Text Book of Engineering Geology” 7<sup>th</sup> Edition, P.V.G. Publications, Pune. 2015, ISBN 10: 0471034363.
3. N. Chenna Kesavulu “A Text Book of Engineering Geology” 2<sup>nd</sup> Edition, Mc –Millan India, 2010. ISBN 0333927079,

**References Books**

1. F.G.H. Blyth and M.H.deFreitas, “A Geology for Engineers” 7<sup>th</sup> Edition Elsevier Science, 2018 ISBN 9780415502917
2. F. G. Bell, “Fundamentals of Engineering Geology”, 2<sup>nd</sup> edition, BS Publications, 2005. ISBN 9780408011693,
3. D. P. Krynine & W. R. Judd “Principles of Engineering Geology and Geotechniques”, 4<sup>th</sup> Edition, CBS Publishers, New Delhi. 2013 ISBN 9780070355606
4. F. G. H Blyth and De Frietus “Handbook 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](http://www.nptel.iitm.ac.in)
2. Free online course-swayam-<https://swayam.gov.in>

## Professional Elective: 01 (PE306)

- I. (PE306-a): Advanced Analysis of Structures
- II. (PE306-b): Advance Foundation Engineering
- III. (PE306-c): Infrastructure Engineering and Construction Techniques
- IV. (PE306-d): Sustainable Building Planning

### PEC (PE306-a): Professional Elective-I): Advanced Analysis of Structures

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In- Sem Exam : 30 Marks End - Sem Exam : 50 Marks
<b>Credits: 03</b>	<b>Total: 100Marks</b>

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

#### Course Objectives:

1.	To analyze the statically Determinate and Indeterminate pin jointed plane Truss by Castigliano's first and Second theorem.
2.	To apply different method to analyze Indeterminate Beams and frames.
3.	To analyze the multistoried frame subjected to lateral and vertical loading using approximate methods.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply the Castigliano's first and Second theorem for statically Determinate and Indeterminate pin jointed plane Truss.	3	Apply
CO2	Apply the slope deflection method for statically Indeterminate Beams and Frame.	3	Apply
CO3	Apply the moment distribution method for statically Indeterminate Beams and Frame.	3	Apply
CO4	Apply the Flexibility method for statically Indeterminate Beams and Frame..	3	Apply
CO5	Analyze the statically Indeterminate Structures by stiffness method.	4	Analyze
CO6	Examine 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	3	3	---	---	2	---	---	---	---	2	---	---	3	---
CO2	2	3	---	1	2	---	---	---	---	2	---	---	3	---
CO3	2	3	---	1	2	---	---	---	---	2	---	---	3	---
CO4	2	3	---	1	2	---	---	---	---	2	---	---	3	---
CO5	2	3	---	1	2	---	---	---	---	2	---	---	3	---
CO6	2	3	---	1	2	---	---	---	---	2	---	---	3	---

**Course Contents**

Unit No	Topics	No of Hrs	COs
I	<b>Analysis of pin jointed plane Trusses:</b> Joint displacement of determinate trusses by Castiglione's first theorem. Analysis of redundant trusses by Castiglione's second theorem, lack of fit, sinking of support, temperature changes (indeterminacy up to second degrees).	06	1
II	<b>Slope-Deflection Method:</b> Introduction to different Indeterminate method, Slope-deflection equations, Equilibrium equation. Application to beams with and without support settlement. Application to rigid jointed rectangular portal frames with and without sway. Shear force and bending moment diagram. (Numerical Problem not Involving more than three Unknown).	06	2
III	<b>Moment Distribution Method:</b> Introduction, Stiffness factor, carry over factor, distribution factor. Application to beams with and without support settlement. Application to rigid jointed rectangular portal frames with and without sway. Shear force and bending moment diagram. (Numerical Problem not Involving more than three Unknown)	06	3
IV	<b>Flexibility Matrix Method:</b> Introduction, Fundamental concepts of flexibility method of analysis, Formulation of flexibility matrix. Application to beams with and without support settlement. Application to rigid jointed rectangular portal frames with and without sway. Shear force and bending moment diagram. (Numerical Problem not Involving more than three Unknown)	06	4
V	<b>Stiffness Matrix Method:</b> Introduction, Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix. Application to beams with and without support settlement. Application to rigid jointed rectangular portal frames with and without sway. Shear force and bending moment diagram. (Numerical Problem not Involving more than three Unknown)	06	5

<b>VI</b>	<b>Approximate Methods of Analysis:</b> Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed frames by substitute frame method, cantilever method and portal method.	06	6
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**Text Books:**

1. S. Ramamrutham and N. Narayan, “Theory of Structures”, 9<sup>th</sup> Edition, Dhanpat Rai, New Delhi.(2014),**ISBN: 978-93-5216-553-7.**
2. G. S. Pandit & S.P. Gupta (1998), “Structural Analysis (A matrix approach)”, 2<sup>nd</sup> edition Tata McGraw Hill Publishing Ltd.(2008), **ISBN: 13:978-0070667358.**
3. B.C.Punmia, Ashokkumar Jain and Arunkumar Jain, “Theory of Structures”, 13<sup>th</sup> Edition, Laxmi Publication. (2017), **ISBN : 81-7008-618-3**

**Reference Books:**

1. S.P. Timoshenko and Young D.H., “Theory of Structures”, 2<sup>nd</sup> 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”, 3<sup>rd</sup> Edition, Tata McGraw Hill. (2010). **ISBN: 9780070702769.**
5. Devdas Menon, “Structural Analysis”, 2<sup>nd</sup> Edition, Narosa Publishing House, New Delhi.(2018), **ISBN: 13: 9781842653371.**
6. Jain, A.K., “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 (PE306-): Professional Elective I-b): Advanced Foundation Engineering

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In- Sem Exam : 30 Marks End - Sem Exam : 50 Marks
<b>Credits: 03</b>	<b>Total: 100Marks</b>

**Prerequisite Course: Geotechnical Engineering**

### 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): student 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	Analyzing
5	Designs the deep foundations as per the prevailing site conditions	4	Analyzing
6	Understand various techniques of soil stabilization	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	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	<b>Subsurface Investigations for Foundations:</b> 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, DCPT, SCPT, Pressure meter test.	06	1
II	<b>Bearing capacity and Shallow Foundation:</b> 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. Bearing Capacity evaluation: - Plate Load Test and SPT. Housel's perimeter shear concept. Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Presumptive bearing capacity.	06	2
III	<b>a) Settlement and Consolidation Settlement:</b> - 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>b) Consolidation</b> - 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 Preconsolidation pressure.	06	3
IV	<b>Design of shallow foundations:</b> 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	<b>Design of Deep foundations:</b> 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	<b>(a) Introduction to soil stabilization:</b> Mechanical Stabilization cement Stabilization – Lime Stabilization –Bituminous Stabilization – Chemical	06	6

	Stabilization– Stabilization by geosynthetics <b>b) Foundation on Black Cotton Soils:</b> 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.		
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### 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:

1. [www.nptel.iitm.ac.in/courses/iitkanpur](http://www.nptel.iitm.ac.in/courses/iitkanpur)
2. [www.cdeep.iitb.ac.in/nptel](http://www.cdeep.iitb.ac.in/nptel)



## **PEC (PE306-c): Professional Elective-I-c): Infrastructure Engineering & Construction Techniques**

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course: Infrastructure Engineering and Construction Techniques**

### **Course Objectives:**

1. The objective of this course is to introduce the students to the various infrastructure elements
2. To know the concept of permanent way, underground and underwater construction
3. To know the concept of permanent way, underground and underwater construction

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the basic infrastructure needs of society and improved transportation system.	2	Understand
2	Interpret the basics, design and execution of railway construction project.	2	Understand
3	Apply new techniques for construction work.	3	Apply
4	Understand the projects like tunnel, open cuts and micro tunneling.	2	Understand
5	Apply construction methods and design criteria for docks and harbours.	3	Apply
6	Understand the advancements in construction Equipment's and repair procedure.	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	1	-	-	2	3	1	2	2	-	-	1	2	3	3
CO2	1	3	-	-	2		2	2	-	-	-	2	3	3
CO3	1	2	-	-	2	1	2	2	1	-	-	2	3	3
CO4	1	2	-	-	2	-	2	2	2	2	-	2	2	3
CO5	1	3	-	2	-	-	2	2	-	3	1	2	2	2

CO6	1	3	2	2	-	1	2	2	-	-	-	2	2	2
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### Course Contents

Unit No	Topics	No of Hrs	COs
I	<b>Infrastructure:-</b> Definitions of infrastructure, Governing Features, Infrastructure organizations & Systems, Overview of Infrastructure development in India - Power Sector, Water Supply and Sanitation Sector, Transportation, Urban and Rural, BOT projects, PPP projects, Infrastructure elements of Smart city.	06	1
II	<b>Railway-Permanent way-</b> Definitions, 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, Points, crossings & Turnouts, Concept of Negative cant, Railway Signals.	06	2
III	<b>Construction Techniques-</b> Dredging techniques, Barges, Use Of Barges Vacuum Dewatering and Well point system, construction of power generating systems-Atomic power stations, Thermal power stations, Grouting methods in soft and hard soil, Construction of diaphragm wall, Modular Construction, Modular coordination, Modular Standardization, Modular System Building, Limitation and Advantages of Modular Construction.	06	3
IV	<b>Underground &amp; Underwater construction-</b> a) <b>Underground construction-</b> Definition, concepts of pilot tunnel, shaft, portals, twin tunnels etc., shapes of tunnel, Tunneling methods in hard and soft ground, Tunnel Boring Machines (TBM), Modern developments in tunnel drainage & ventilation b) <b>Underwater construction-</b> Underwater drilling, blasting, underwater concreting using Tremie method	06	4
V	<b>Docks &amp; Harbors-</b> Introduction, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Various components of ports, Types & construction of Break waters, Quay wall, Wet & dry dock, Floating dock, Wharves, Jetties, Types of fenders, Dolphins.	06	5
VI	<b>Construction Equipment:</b> Operations, Applications and performance of dozers, excavators, graders, compactors, pavers, haulers, crawler, wheel tractors, power shovels, Cranes, hauling equipment, Concrete Pumps,	06	6

	Economic Maintenance and repair of construction Equipment,		
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**Text Books:**

1. Satish Chandra and M. M. Agrawal, “Railway Engineering”, Oxford University Press, 2<sup>nd</sup> edition, 2013.
2. S.C Sharma, “Construction Equipment & its Management”, Khanna Publication. 1<sup>st</sup> edition, 2014.
3. R. Srinivasan, “Harbour, Dock & Tunnel Engineering ”28<sup>th</sup> edition, 2016.

**Reference Books:**

1. Puerifoy, “Construction Planning Methods & Equipment”, Tata McGraw Hill. 7<sup>th</sup> edition, 2010.
2. Chandra , “ Railway Engineering”, Oxford University Press
3. J.S.Mundrey , “ Railway Track Engineering” , Tata McGraw Hill, 5<sup>th</sup> edition, 2007.
4. Hasmukh P. Oza & Gautam H. Oza , “ Dock & Harbour Engineering” , Charoter Book Stall, 8<sup>th</sup> edition, 2016.
5. Pune Metropolitan Region Development Authority (PMRDA), City and Industrial Development Corporation of Maharashtra (CIDCO), Mumbai Metropolitan Region Development Authority (MMRDA), Maharashtra Housing & Area Development Authority (MHADA) , Maharashtra Industrial Development Corporation (MIDC)

**e – Resources:**

1. <https://infracon.nic.in>
2. <https://www.india.gov.in/infrastructure>

## PEC (PE306-d): (Professional Elective I-d): Sustainable Building Planning

<b>Teaching Scheme</b>  <b>Lectures: 03 Hrs. / Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam: 50 Marks</b>
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**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	<b>Sustainable Development and Design:</b> 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	<b>Sustainable Building Policies:</b> 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	<b>Innovative Low Cost Building Material:</b> Innovative building material for rural and urban areas, Low Cost Infrastructure in rural Areas, Cost Cutting of housing Infrastructure, Green materials.	06	3
IV	<b>Urban Housing And Infrastructure:</b> Vernacular Architecture; Urban climate, effect of built environment, Impact of urbanization on sustainability, growth, issues related to sustainability.	06	4
V	<b>Green Buildings:</b> 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.	06	5
VI	<b>Building Performance Assessment:</b> Concept, tools at international-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.	06	6

### Text Books:

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

**Reference Books:**

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

**e – Resources:**

2. [www.nptel.iitm.ac.in/courses](http://www.nptel.iitm.ac.in/courses)



## PCC (CE307): Design of Steel Structure (Lab Work)

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

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

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Draw detailed sketches of different steel structure components with suitable scales and software	3	Understand
CO2	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
CO3	Inspect and visit the undergoing steel construction sites, steel manufacturing industry, Fabrication shops, etc.	4	Analyse
CO4	Prepare and create the scaled model of roof truss with suitable material in a project group.	5	Create

### Mapping of COs with POs

COs	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.

## PCC (CE308): Fluid Mechanics (Lab Work)

<b>Teaching Scheme</b> Practical : 02 Hrs / Week	<b>Examination Scheme</b> Oral : 50 Marks
<b>Credits: 01</b>	<b>Total : 50 Marks</b>

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Measure Velocity and discharge in pipe flow	5	Evaluate
2	Compute total energy of flowing fluid	3	Applying
3	Compute the head loss in pipe flow	3	Applying

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

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.
6. Drawing flow net by electrical analogy for flow below weir (with and without sheet pile).
7. Plotting the pattern of laminar flow using Reynolds apparatus or Heleshaws apparatus.
8. Determination of minor loss/friction factor in pipe for given pipe section.
9. Solution for pipe flow problems using any simulation tool or programming language.
10. Preparation of working model of any fluid system.

## PCC (CE309): Engineering Geology (Lab Work)

<b>Teaching Scheme</b> Practical: 02 Hrs./ Week	<b>Examination Scheme</b> Practical : 50 Marks
<b>Credits: 01</b>	<b>Total: 50 Marks</b>

### Course Outcomes:

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Identify engineering properties of rock and its utility for design of foundation	3	Apply
2	Examine the geological condition at various phases of civil engineering activities.	4	Analyse
3	Survey the civil engineering project site for engineering geological investigation for foundation suitability	4	Analyse

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

### List of Laboratory Experiments

**During the laboratory hours students will complete the following assign work:**

1. Identification of Minerals based on their Physical Properties, Chemical composition and Uses
2. Identification of rocks based on their Geological properties.
3. Igneous rocks, Sedimentary rocks. Metamorphic Rocks
4. Interpretation and construction of geological sections from contoured geological maps.
5. Solution of engineering geological problems such as alignment of dams, tunnels, roads, Canals, bridges, etc. based on geological maps (Total 3)
6. Logging of drill core, interpretation of drilling data and graphical representation of bore log.
7. Study of engineering properties pertaining to Rock mechanics, (R.Q.D.) Rock Quality, Designation and Joint Frequency Index (J.F.I.) in rocks.
8. Two site visits are desirable to study various geological features and their application.
9. Assignment on Golden Surfer software and ARC GIS software like preparing the contour Geological map of desired area with coordinates taken by GPS. (Global positioning System)

## PRJ (CE310): Skill Based Credit Course (Software Application in Project Planning)

<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Practical: 02 Hrs./ Week	Term work : 50 Marks
Credits: 01	Total: 50 Marks

**Prerequisite Course: Basics of Project Management**

### Course Objectives:

1. Understand the project planning through Primavera P6 software.
2. Monitor and Control projects through software

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand the Project data through Primavera	2	Understand
2	Apply project planning using software	3	Apply
3	Create a case study of any construction project in Primavera	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	2	--	--	1	--	3	--	--	--	--	--	--	--	1
CO2	1	2	--	1	1	--	--	--	--	--	--	--	3	3
CO3	2	--	1	3	1	--	1	3	2	--	--	--	--	3

### Course Contents

Topic No	Topics	No of Hrs	COs
I	<b>Preparing Global Data of Project and Project Data</b> Introduction to Primavera P6, Concepts of Enterprise-wide Project Management, Defining Enterprise Project Structure (EPS), Defining Organization Breakdown Structure (OBS), Defining Project Codes and Project calendars, Adding a New Project, Defining Work Breakdown Structure (WBS), Adding Activities to WBS, Defining and Assigning Activity Codes, Assigning Calendars to Activities.	06	1
II	<b>Preparing Project Plan and Monitoring and Controlling</b> Different Types of Relationships, Assigning Relationship between Activities, Critical Path Analysis, Defining and Assigning Work Products and Documents,	06	2

	Customizing Timescale, Customizing Bars, Creating Baseline Project and Monitoring the project.		
<b>III</b>	<b>Creating a Project Case study and Project Reporting</b> Export / Import Project Data, Page Setup, Grouping & Sorting, Reports, Creating a project case study related to any one construction project.	06	3

**Text Books:**

1. Paul E. Harris, "Planning and Controlling using Oracle Primavera P6", Eastwood Harris Pvt. Ltd., ISBN 1925185176, 1<sup>st</sup> Edition
2. Prof. Sham Tickoo, "Exploring Oracle Primavera P6 version", BPB Publications, ISBN 9789388511292, 2<sup>nd</sup> Edition

**Reference Books/ Handbooks :**

1. Oracle Help Center, Primavera P6 reference manual
2. Oracle Help Center, Primavera P6 Professional Users Guide

**e – Resources:**

1. [www.oracle.com/industries/Primavera P6](http://www.oracle.com/industries/Primavera P6) (Text Content)
2. [www.youtube.com/Primavera P6](http://www.youtube.com/Primavera P6) ( Videos and Tutorials)

## MLC (MC311): Field Practices in Civil Engineering

<b>Teaching Scheme</b> Lectures: 01 Hrs. / Week	<b>Examination Scheme</b> CIA : 00 Marks
<b>Credits: 00</b>	<b>Total : 00 Marks</b>

**Prerequisite Course: Engineering Graphics**

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	Understanding
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):**

	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	<b>Site clearance and plinth construction:</b> 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	<b>RCC Elements and Formwork:</b> 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. <b>Form work:</b> Types, component parts and installation as per design and specifications. Scaffolding and types. (Note: Site visit is recommended)	03	1,2
III	<b>Masonry and Flooring work:</b> Brick and block masonry- quality check and workmanship, Requirements of a good partition wall, Composite masonry, <b>Flooring-</b> Materials, Types and construction. (Note: Site visit is recommended)	03	1,2
IV	<b>Finishing works:</b> 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., edn 2011.

## (CE312): Hydrology and Water Resource Management

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In - Sem Exam : 30 Marks End - Sem Exam : 50 Marks
Credits : 03	Total Marks : 100 Marks

**Prerequisite Course:** Basic Sciences, Fluid Mechanics.

### Course Objectives:

Sr. No.	Course Objectives
1	To learn and understand precipitation, abstractions, runoff, hydrograph, stream gauging and introduce students about government organizations.
2	To introduce the concept of floods, hydrologic routing and use of Q-GIS software in hydrology, reservoir planning and evaluate the capacity of reservoir
3	To study the concept of irrigation, crop water requirement, piped distribution network, canal revenue assessment, ground water hydrology, water logging - drainage and water management.

### Course Outcomes: Students will be able to:

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

### Mapping of Course Outcomes to Program Outcomes (POs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	2	2	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
<b>I</b>	<p><b>Introduction to Hydrology:</b> Hydrological cycle, Practical applications. Hydrological data- classification of data and sources. Introduction to Government organizations: IMD, CWPRS, MERI, HDUG, WALMI, NIH, CWC.</p> <p><b>Precipitation:</b> Types, Measurement, Rain gauge network and Consistency test. Presentation of rainfall data. Mean precipitation over an area: Various methods. Maximum depth-area-duration and Intensity-duration-frequency curves.</p> <p><b>Abstractions of Precipitation:</b> 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, and Infiltration indices.</p>	06	1
<b>II</b>	<p><b>Run-off:</b> Introduction, Catchment characteristics affecting the runoff, Rainfall-Runoff relationships and Empirical methods to determine runoff.</p> <p><b>Runoff hydrograph:</b> Introduction, Factors affecting flood hydrograph, Components of hydro-graph, Base flow separation and Effective rainfall. Unit hydrograph: Uses and Limitations of unit hydrograph, S-curve hydrograph and Concept of Synthetic unit hydrograph.</p> <p><b>Stream Gauging:</b> Selection of site, methods of discharge measurement and Stage discharge relationship.</p>	06	2
<b>III</b>	<p><b>Floods:</b> 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.</p> <p><b>Hydrologic Flood Routing:</b> Introduction, Reservoir Routing and Channel Routing. Q-GIS software application in Hydrologic Studies- (Watershed Delineation).</p>	06	3
<b>IV</b>	<p><b>Reservoir Planning:</b> Introduction, Term related to reservoir planning, Investigation for reservoir planning, Significance and applications of mass and demand curves, Fixation of reservoir capacity from annual inflow and outflow, Reservoir losses. Reservoir sedimentation- Phenomenon, Measurement, Measures to control reservoir sedimentation, Density of sediment and Significance of trap efficiency.</p>	06	4
<b>V</b>	<p><b>Introduction to Irrigation:</b> Definition, Necessity and Advantages. Methods of Irrigation. Piped distribution network for irrigation (PDN) - Concept, Advantages and Disadvantages of PDN over conventional canal distribution network.</p> <p><b>Water Requirements of Crops:</b> 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.</p> <p><b>Assessment of Canal Revenue:</b> Introduction, Various methods of assessment</p>	06	5

VI	<p><b>Ground Water Hydrology:</b> 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.</p> <p><b>Water logging and Drainage:</b> Causes, Effects, Preventive and curative measures of water logging, Land drainage and types, Reclamation of water logged areas, Alkaline and saline lands.</p> <p><b>Water Management:</b> Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Co- operative water distribution systems- Water Users Association (WUA).</p>	06	6
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>1. Irrigation Engineering and Hydraulic Structures- S. K. Garg, Khanna Publishers, New Delhi, <b>2011</b>. (36<sup>th</sup> Edition). ISBN – 13: 978-81-7409-047-8.</li> <li>2. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Laxmi Publications, <b>2021</b>, (17<sup>th</sup> Edition), ISBN: 9788131807637.</li> <li>3. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House, New Delhi, <b>2020</b>. ISBN: 978-81-87401-29-0.</li> <li>4. Engineering hydrology-K. Subramanya, Tata McGraw Hill, <b>2020</b>, (5<sup>th</sup> Edition). ISBN – 10: 9390177502.</li> </ol>			
<b>Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. Elementary Engineering Hydrology- M.J. Deodhar-Pearson Education, New Dehi, 2008, (3<sup>rd</sup> Edition).</li> <li>2. Irrigation Engineering, H. M. Raghunath, Wiley Publication, 2011, ISBN: 9788126528813.</li> <li>3. A Textbook of Hydrology by Dr. P. Jaya Rami Reddy, USP Publisher. 2016 (3<sup>rd</sup> edition).</li> <li>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.</li> <li>5. A Guide for Estimating Irrigation Water Requirements by Govt. of India, Ministry of Irrigation (Water Management Division), May 1984. Pp 1-115.</li> </ol>			
<b>e – Resources:</b>			
<ol style="list-style-type: none"> <li>3. For online courses- SWAYAM –<a href="https://swayam.gov.in">https://swayam.gov.in</a></li> <li>4. <a href="http://www.iitb.ac.in/nptel">www.iitb.ac.in/nptel</a></li> </ol>			

## (CE313): Design of Reinforced Concrete Structures

<b>Teaching Scheme</b> <b>Lectures: 03 Hrs. / Week</b>	<b>Examination Scheme</b> <b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

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

*Course Objectives:*

<b>1</b>	To learn basic fundamental philosophies used in the design of RCC structures using IS 456:2000 specifications.
<b>2</b>	To evaluate the effect of bending, shear and torsion on structural elements of RCC structures.
<b>3</b>	To design and check the RCC structural element for different limit states.
<b>4</b>	To demonstrate the basics of structural design and detailing for various structural elements

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Demonstrate 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	<p><b>a) Introduction to design philosophies:</b> Historical development, Concept of working stress method, stress block parameters, Moment of Resistance (M.R.) of singly and doubly reinforced rectangular section.</p> <p><b>b) Limit state method:</b> 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.</p>	06	1
II	<p><b>a) Design of One way slab:</b> simply supported, cantilever and continuous slabs.</p> <p><b>b) Design of two way slab:</b> simply supported, continuous and restrained.</p>	06	2
III	<p><b>a) Design of staircase:</b> Dog legged, open well and concept of stringer beam.</p> <p><b>b) Design of rectangular beam sections only for flexure:</b> Cantilever, simply supported, continuous beams (singly reinforced, doubly reinforced section).</p>	06	3
IV	<p><b>a) Design of flanged beam sections only for flexure:</b> Cantilever, simply supported, continuous beams (Flanged section).</p> <p><b>b) Design of secondary reinforcement in beams:</b> Concept of Shear, Bond and torsion.</p>	06	4
V	<p><b>a) Design of axially loaded short Column:</b> Introduction, strain and stress variation diagrams, minimum eccentricity requirements. Lateral ties, helical reinforcement, Design of short column for axial load.</p> <p><b>b) Design of short Column subjected to bending:</b> effect of uni-axial and bi-axial bending, interaction curves, SP 16 guidelines, Design of column for uni-axial and bi-axial bending.</p>	06	5
VI	<p><b>a) Design of isolated footing:</b> Critical section for B.M., Single and double shear, design of isolated pad footing and sloped footing.</p> <p><b>b) Introduction to Ductile detailing:</b> Guidelines for ductile detailing of slab, staircase, beam, column and footing as per IS 13920, SP34. Introduction to earthquake resistant design.</p>	06	6

### Text Books:

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

### Reference Books:

1. S. U. Pillai and D. Menon, "Reinforced Concrete Design", 3<sup>rd</sup> edition, Tata Mc Graw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnam, "Limit State Analysis and Design" 5<sup>th</sup> 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.456-2000: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS 875 Part I and Part II-2008: Code of practice for design load, Bureau of Indian Standards, New Delhi.
3. IS 13920-2000 Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
4. S.P. 16-1978: Design aids for reinforced concrete. (Interaction Charts Only) Bureau of Indian Standards, New Delhi.
5. SP 34-1978: 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](http://www.nptel.iitk.ac.in/courses/iitkharagpur)

## (PE314): Professional Elective-II

### (PE314-a): Advanced Surveying

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam : 50 Marks
<b>Credits: 03</b>	<b>Total : 100 Marks</b>

**Prerequisite Course: Basic Civil Engineering, Surveying**

#### Course Objectives:

1. To learn the concept of triangulation and trilateration in geodetic surveying.
2. To understand methods of advanced surveying and their application over ground, water and air surveying.
3. To understand the theory of errors, concept of most probable value and to learn modern techniques and tools for surveying.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	<b>Demonstrate</b> the techniques of triangulation and trilateration in geodetic surveying.	2	Understanding
2	<b>Demonstrate</b> the classification and to identify topographical maps of the existing features on the Ground.	2	Understanding
3	<b>Interpret</b> the problem and remedial measures for hydrographic Survey.	3	Applying
4	<b>Compute</b> an azimuth, declination etc. of celestial bodies using principle of astronomy.	4	Analyzing
5	<b>Utilize</b> the theory of error with measured quantities in surveying	3	Applying
6	<b>Use</b> of Drone technology, Remote sensing, Geographical information system and digital land surveying for civil engineering applications	3	Applying

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

## Course Contents

Unit No	Topics	No of Hrs	COs
I	<b>Geodetic Surveying:</b> Introduction, Classification of Triangulation Systems, Triangulation figures, Concept of well-conditioned Triangle, Types of signals and towers. Intervisibility and height of stations. Introduction to trilateration, Advantages and disadvantages of Trilateration.	06	1
II	<b>Aerial Surveying:</b> Introduction, classification, Applications, comparison of map and aerial photograph, Types of photographs, Scale & Relief displacement in vertical photograph, Difference in elevation between two points from differential parallax. Ground control points (GCP), Flight planning.	06	2
III	<b>Hydrographic Surveying:</b> Introduction, application, Shore line survey, Establishing horizontal and vertical controls. Sounding and its measurements, Methods of locating soundings, Reduction and plotting of soundings, Nautical Sextant and its use, Three point problem and its application, Tides and tide gauges, determination of mean sea level (MSL).	06	3
IV	<b>Trigonometric Levelling:</b> Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations. <b>Field Astronomy:</b> Introduction, purposes, astronomical terms, determination of azimuth, latitude, longitude and time corrections to the observations.	06	4
V	<b>Theory of Errors:</b> Introduction, types of errors, definitions, laws of accidental errors, laws of weights, Theory of least squares: Principle, rules for assigning weights and distribution of errors to the field observations, determination of the most probable values (MPV) of quantities.	06	5
VI	<b>Modern Surveying Techniques:</b> <b>Drone Technology-</b> Introduction and its application <b>Digital land Survey-</b> Introduction and its applications <b>Remote Sensing</b> - Electromagnetic spectrum, Atmospheric windows, Importance of satellite data, digital elevation model (DEM) and application <b>Geographical Information System (GIS)</b> - Applications of GIS, Preparation of thematic maps. Quantum-GIS interface.	06	6

### **Text Books:**

1. T. P. Kanetkar and S.V. Kulkarni, "Surveying and Levelling Part- II", Pune Vidyarthi Griha Prakashan. 15th Edition 2015, ISBN-13: 978-8185825007.
2. S. K. Duggal, "Surveying, Vol. II", Tata Mc-Graw Hill. 5<sup>th</sup> Edition, 2019, ISBN :13:978-0-07-0151352.
3. Peter A. Burrough and R. A. McDonnell, "Principles of Geographical Information System", Oxford University Press. 4<sup>th</sup> Edition, 2013, ISBN-13:978-0-19-922862-1
4. M. Anji Reddy, "A Textbook of Remote sensing and Geographical Information System", B S Publications, 3<sup>rd</sup> Edition 2008, ISBN-13 : 978-9381075975.

**Reference Books:**

1. B. C. Punmia, Ashok. K. Jain, Arun. K.Jain , “Surveying Vol. II”, Laxmi Publications. 16th Edition, 2016, ISBN-13: 978-8170088837.
2. K. R. Arora, “Surveying Vol. II”, Standard Book House. 15<sup>th</sup> Edition 2018,ISBN-13: 9788189401245.
3. Subramanian, “Surveying and Levelling”, Oxford University Press. 2<sup>nd</sup> edition 2012, ISBN-13: 978-0198085423.
4. A. M. Chandra and S. K. Ghosh, “Remote sensing and Geographical Information System”, Narosa Publication,2<sup>nd</sup> Edition Reprint 2019,ISBN- 978-81-8487-454-9
5. P. R. Wolf, B. A. Dewitt and B. E. Wilkinson “Elements of Photogrammetry with applications in GIS”, McGraw-Hill Education, 4<sup>th</sup> Edition 2014, ISBN-13: 978-0071761123.
6. Lillesand, T. L., and Kiefer, R.W., “Remote Sensing and Image Interpretation”, 7<sup>th</sup> Edition 2015, John Wiley and Sons publication.ISBN: 978-1-118-34328-9.

**e – Resources:**

1. [www.nrsa.gov.in](http://www.nrsa.gov.in)
2. [www.iirs-nrsa.gov.in](http://www.iirs-nrsa.gov.in)
3. [www.surveyofindia.gov.in](http://www.surveyofindia.gov.in)
4. <https://nptel.ac.in/courses/105/107/105107158>



## (PE314-b): Air and Noise Pollution and Control

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

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

### 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: Students will 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	Analyse
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):

CO's	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	<p><b>Air Pollution: Introduction:</b> Definition, Sources and classification of Air Pollutants, Photochemical smog, Effects of air pollution on health, vegetation &amp; materials, air quality, Air Pollution Episodes.</p> <p><b>Meteorology:</b> 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.</p>	06	1
II	<p><b>Modeling of Dispersion of Air Pollutants:</b> 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.</p>	06	2
III	<p><b>Particulate Pollution Control Methods:</b> 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.</p> <p><b>Gaseous pollution control:</b> Types of gaseous pollution control methods – absorption, adsorption and combustion processes. SO<sub>x</sub> Control Technology, Desulfurization of flue gas emissions, NO<sub>x</sub> Control Technology.</p> <p><b>Air (Prevention and Control of Pollution Act 1981)</b></p>	06	3
IV	<p><b>Indoor air pollution:</b> 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.</p> <p><b>Odour pollution:</b> Theory, sources, measurement and methods of control of odour pollution.</p> <p><b>Global effects air pollution:</b> Greenhouse effect, Heat island effect, Acid rain, Ozone Depletion, Global warming</p> <p><b>Various treaties and protocols:</b> Kyoto Protocol and Montreal Protocol etc</p>	06	4
V	<p><b>Noise Pollution:</b> Introduction, Definition, sources of noise <i>i.e.</i>, 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</p>	06	5
VI	<p><b>Effects and control of noise pollution:</b> 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.</p>	06	6

<b>Noise pollution (Regulation and Control) Rules 2000</b>		
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**Text Books:**

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

**Reference Books:**

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

**E Resources:**

1. <https://nptel.ac.in/courses/105/104/105104099/>

## (PE314-c): Hydraulics and Hydraulic Machinery

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam : 50 Marks
<b>Credits: 03</b>	<b>Total : 100 Marks</b>

**Prerequisite Course: Fluid Mechanics**

**Course Objectives:**

1. To produce Civil Engineers with an ability to design and acquaint fundamentals of open channel flow.
2. To understand the water surface profiles under different flow conditions.
3. To understand the working principles of hydraulic machinery.
4. To produce graduates who have the ability to pursue careers as Hydraulic Engineer.

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	<b>Explain</b> the fundamental knowledge of open channel	2	Understanding
2	<b>Apply</b> the knowledge of uniform flow formulae to identify the economical channel sections	3	Applying
3	<b>Apply</b> the energy concepts to open channel flow	3	Applying
4	<b>Analyze</b> the water surface profiles under different flow conditions	4	Analyzing
5	<b>Analyze</b> the performance of turbine working under different operating conditions	4	Analyzing
6	<b>Analyze</b> the performance of pump working under different operating conditions	4	Analyzing

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

### Course Contents

Unit No	Topics	No of Hrs	COs
I	<b>a) Introduction to Open Channel Flow:</b> Classification of open channels, Classification of flow in open channel, Velocity distribution in open channel, Continuity equation, Momentum equation and Energy equation in open channel, Kinetic energy and Momentum correction factors.	06	1

	<b>b) Measurement of Discharge:</b> Notches and Weirs <b>c) Measurement of Velocity:</b> Floats, Current meter and Pitot tube		
<b>II</b>	<b>Uniform Flow in Open Channel:</b> Uniform flow characteristics, Discharge through open channel by Chezy's and Manning's Formulae, Empirical formulae for the values of Chezy's constant, Factors affecting Manning's roughness coefficient, Uniform flow computations, Normal depth, Conveyance, Section factor, Hydraulic exponent, Hydraulically most efficient sections (Rectangular, Triangular and Trapezoidal) , Specific energy, Specific force, Unit discharge and Discharge diagram.	06	2
<b>III</b>	<b>Rapidly Varied Flow (Hydraulic Jump):</b> Hydraulic jump - Location, Classification, Examples of occurrence, Uses, Assumptions and Derivation, Conjugate depths, Energy dissipation in hydraulic jump, Graphical Method of determination of energy dissipation, Venturiflume and Standing wave flume.	06	3
<b>IV</b>	<b>Gradually Varied Flow:</b> Gradually Varied Flow (GVF) - Basic assumptions, Dynamic equation - alternative forms, Classification of channel bed-slopes, Zones of gradually varied flow (GVF) profiles, Control section, Gradually Varied Flow (GVF) computations.	06	4
<b>V</b>	<b>a) Impact of Jet:</b> Impact of jet on stationary and moving flat and curved vanes. <b>b) Turbines:</b> Work done and efficiency of an impulse and reaction turbines, Unit quantities, Specific speed, Design aspects and performance characteristics, Draft tube and Cavitation.	06	5
<b>VI</b>	<b>Centrifugal Pump:</b> Classification and selection criterion, Classification of centrifugal pumps, Work done, Losses and efficiencies, Minimum starting speed , Priming, Design considerations, Net positive suction head (NPSH), Multistage pumps, Performance characteristics of Centrifugal pump. Introduction to reversible pump.	06	6

### Text Books:

1. R. K. Bansal, "*Fluid Mechanics and Hydraulic Machines*", 10<sup>th</sup> Edition, Laxmi Publications (P) Ltd., New Delhi, 2019.
2. K. Subramanya, "*Flow in Open Channel*", 5<sup>th</sup> edition, Tata McGraw Hill Publishing Co. Ltd. 2019.

### Reference Books:

1. V. L. Streeter and E. B. Wylie, "*Fluid Mechanics*", 9<sup>th</sup> Edition, McGraw Hill Publications, New York, 2010.
2. P.N. Modi and S.M. Seth, "*Hydraulics & Fluid Mechanics*" 22<sup>nd</sup> Edition, Standard Book House, Unit of Rajsons Publications Pvt. Ltd., 2019.
3. M Hanif Chaudhry, "*Open-Channel Flow*", 2<sup>nd</sup> Edition, Springer US.
4. S K Som, Gautam Biswas, S Chakraborty, "*Introduction to Fluid Mechanics & Fluid Machines*", 3<sup>rd</sup> Edition, McGraw Hill Publications, 2011.
5. Chow V. T. "*Open Channel Hydraulics*", Blackburn Press, International edition, 1959.

### e – Resources:

1. <https://nptel.ac.in/courses/105/103/105103096/>
2. <https://nptel.ac.in/courses/105/107/105107059/>
3. <https://www.energy.gov/eere/water/water-power-technologies-office>

## (PE314-d): Advanced Engineering Geology with Rock Mechanics

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Examination Scheme</b> In-Sem Exam : 30 Marks End-Sem Exam: 50 Marks CIA : 20 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course:** Engineering Geology, Engineering Mechanics, material properties and physics,

**Course Objectives:**

1. To Illustrate Distribution and Geological characters of Major Rock formations of India. The study of Plate Tectonics and highlights of Seismic Zones of India.
2. To introduce the students to the principles and basic mechanism of Rocks
3. To understand Mechanical behavior of Foundation rocks, various engineering Rock Mass classification for deciding competencies of various rock formations for engineering use and constructions.
4. To Study the laboratory and field results to determine engineering properties of rock and rock mass

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

COs No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Demonstrate the geological formation in civil engineering processes for strong foundation.	2	Understand
2	Demonstrate Geohydrological characters of rock formations.	2	Understand
3	Analyze the Physical & Mechanical Properties of Rocks	4	Analyze
4	Analyze strength and deformation behavior, of rock and rock mass.	4	Analyze
5	Determine engineering properties of rock and rock mass by laboratory and field results	4	Analyze
6	Analyze & Suggest the improvement properties of rock mass.	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	--	1	--	2	2	--	--	--	--	2	3	1
CO2	2	1	--	2	1	--	1	--	--	--	2	1	3	3
CO3	3	2	1	--	2	2	--	--	--	--	--	--	3	3
CO4	2	1	2	3	--	--	--	--	--	--	--	--	2	2
CO5	3	2	1	1	2	2	--	--	--	--	--	1	2	2
CO6	1	3	2	2	2	--	1	--	--	--	2	--	2	1

## Course Contents

Unit No	Topics	No of Hrs	COs
<b>I</b>	<b>Overview of Indian Geology:</b> Geological Map of India with special reference to Maharashtra. Distribution and Geological characters of Major rock formations. Engineering characters of major rock formations of India. The study of Plate Tectonics and highlights of Seismic Zones. Importance of Geological Studies in Engineering Investigations.	06	1
<b>II</b>	<b>Geological Process of Soil formations:</b> Effect of climate on formation of soil, Soil profile of different states in India. Rock weathering conditions favorable for decomposition, disintegration, residual and transported soils. <b>Geohydrological characters of rock formations:</b> Geohydrological characters, factors controlling characters of rocks, Morphometric analysis, Water conservation techniques, effect of over exploitation of tube wells, bore wells and dug wells. Artificial recharge, rainwater harvesting, watershed development and necessity of geological studies. Relevant Case Studies.	06	2
<b>III</b>	<b>Rock Mechanics:</b> Definition, importance, Rock mass and material form, Effects of discontinuities on rock mass. <b>Physical Properties:</b> Porosity, Density, Moisture content, Degree of saturation, Coefficient of permeability, Electrical properties, Thermal properties, Swelling, Anisotropy, Durability. <b>Mechanical properties:</b> Strength (Compressive, Tensile and Shear), Deformability Elasticity, Plasticity and Hardness.	06	3
<b>IV</b>	<b>Rock mass Classification:</b> Deere and Miller, Geological classification, ISRM, (International Society for Rock Mechanics) Terzaghi, Rock Quality Designation, Rock Structure Rating, Rock Mass Rating and Q classifications, Rating, Applications. <b>Rock Exploration:</b> Introduction, objectives, methods, viz. Direct Penetration, Core Boring, Core Recovery, Rock Quality Designation, Fracture Frequency, Electrical Resistivity, Seismic method, Determination of thickness of overburden and locating Ground water potential zones for strengthening major civil engineering projects, Calculation of R.Q.D. of Rock from given drill hole dataset.	06	4
<b>V</b>	<b>Rock Testing:</b> Sampling, Sample preparation, Specimen, Uniaxial compressive strength. <b>Laboratory Test:</b> Tests for measuring rock strengths- Tensile strength tests , Brazilian tests , Bending tests, Flexural strength test, Three point & Four point load test. <b>In situ tests:</b> Deformability, Shear & Strength, Bearing Capacity, Compressive strength & Tensile strength test, Test for internal stress in rocks, Introduction to GEO5 software	06	5
<b>VI</b>	<b>Improvement in Properties of Rock Mass:</b> Necessity, Grouting, Grouting Materials, Grouting Operations, Methods Of Grouting, Gunniting. In-situ experimental studies on improvement of rock masses. Rock bolting & Methods, Design principles and Cable anchorage.	06	6

**Text Books:**

1. B.P. Varma, “Rock Mechanics for Engineers”, Khanna Publishers New Delhi, 1985 ( 7<sup>th</sup> Edition) *ISBN: 978-87-93102-90-3*
2. Goodman RE., Introduction to Rock Mechanics Jhon Wiley, London, 1989. (3rd Edition) *ISBN 0-471-81200-5 1.*
3. Jaeger JC, Cook NG, Zimmerman R, Fundamentals of Rock Mechanics, Blackwell Publishing, Oxford, 2009 ( 4<sup>th</sup> Edition) *ISBN: 978-0-632-05759-7*

**Reference Books:**

1. Bieniawski ZT, Engineering Rock Mass Classifications, John Wiley and Sons, New York, 1989 ( 3<sup>rd</sup> Edition) *ISBN: 978-0-471-60172-2*
2. Zhang L, Engineering Properties of Rocks, Butterworth-Heinemann, Cambridge, 2016..(7<sup>th</sup> Edition) *ISBN: 9780128028339*
3. Karl Terzaghi, “Soil Mechanics in Engineering Practice” A Wiley Interscience Publication. 1996 ( 7<sup>th</sup> Edition) *ISBN 3-540-21121-7*
4. Jaeger J, C, Rock Mechanics in Engineering, Cambridge University Press London, 1990. ( 4<sup>th</sup> Edition) *ISBN-10 : 052110338X*
5. Deere D.U. Geological Considerations, Rock mechanics in Engineering Practice John Wiley and Sons 1968 (5<sup>th</sup> Edition)

**Handbooks:**

1. Manual on Rock Mechanics, Central Board of Irrigation and Power, New Delhi, 1988.
- 2, Handbook of Geology in Civil engineering, Robert Fergusson, Legget, Mc- Graw hill. 1990

**I. S. Codes**

- a. IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.
- b. I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts & shaft.
- c. I. S. 6926-1973 Code of practice for diamond drilling for site investigation;
- d. I. S. 4078-1967 Code of practice for Logging and Storage of Drilling Core.
- e. I. S. 5313-1969 Guide for core drilling observation

**e – Resources:**

1. [www.ebd.co.in/undergraduate/eng](http://www.ebd.co.in/undergraduate/eng)
2. [www.library.iisc.ernet.in](http://www.library.iisc.ernet.in)
3. [www.iitb.ac.in](http://www.iitb.ac.in)
4. [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)
5. Free online course-swayam-<https://swayam.gov.in>
6. Open source course management – <https://moodle.org>



## Open Elective (CE315) - Industrial Safety and Environment

Teaching Scheme		Examination Scheme	
Lectures: <b>04 Hrs. / Week</b>		<b>CIA</b>	<b>20 Marks</b>
		<b>In-Sem Exam:</b>	<b>30 Marks</b>
		<b>End Sem Exam:</b>	<b>50 Marks</b>
<b>Credits:</b>	<b>04</b>	<b>Total</b>	<b>100 Marks</b>

**Prerequisite Course:** Basic Knowledge of Hydrology and Fluid Mechanics, Construction Drawings.

### Course Objectives:

Sr. No	Course Objectives
1.	To study fire and explosion scenario identification, Alternative protection evaluation, Types of fires and Ignition sources.
2.	To study Fire protection siting considerations, Environmental effects, Firefighting organizations and their codes, Plant layout for fire and explosion protection, Smoke Production and Properties.
3.	To study Fire Resistant Construction, Construction materials, Fire resistance calculations, Fire resistance tests, Warehouse Storage, Storage configurations, Storage of special commodities and bulk materials.

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

CO No.	Course Outcomes (COs):	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand and become expertise in the domain area of Industrial Fire and explosions.	2	Understand
CO2	Apply the knowledge of Fire and Safety Studies, codes and general principles.	3	Apply
CO3	Apply the knowledge to construct fire resistant structures.	3	Apply
CO4	Understand the concept of Smoke Production & its Properties.	2	Understand
CO5	Analyse the design configuration of the different storage houses.	4	Analyse
CO6	Understand the concept of Storage of special commodities and industrial safety norms.	2	Understand

### Mapping of COs with POs

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

## Course Contents

Unit-I	Industrial Fire Protection	No. Hours	COs
	<p><b>Engineering Approach to industrial fire protection</b> – Fire and explosion scenario identification, Consequence analysis and Alternative protection evaluation.</p> <p><b>Statistical overview of industrial fires and explosions</b> – Industrial occupancies in large loss fires, Types of fires and explosions in the largest losses, Facilities involved in multiple fatality fires and explosions, Ignition sources and Need for automatic detection and suppression.</p> <p><b>Historic industrial fires and explosions</b> – Fire protection lessons learned and Lessons not learned.</p>	06	1
Unit-II	Plant location and layout	No. of Hours	COs
	<p><b>Fire protection location considerations</b> – Safe separation distances, Water supplies, Firefighting organizations, Codes and attitudes and Environmental effects.</p> <p><b>Plant layout for fire and explosion protection</b> – General principles and procedures, Hazard segregation and isolation, Ignition source isolation, Passive barriers, Sprinkler system layout, Accessibility for manual firefighting, Emergency exits and Computer aided plant layout.</p>	06	2
Unit-III	Fire Resistant Construction	No. of Hours	COs
	<p><b>Construction materials</b> – Steel, Steel Insulation, Concrete.</p> <p><b>Fire resistance calculations, Fire resistance tests</b> – Furnace exposure tests, Empirical correlations and High intensity fire resistance tests.</p> <p><b>Fire Walls</b> – General criteria for fire walls, Fire wall design and Fire wall loss experience.,<b>Fire doors</b> – Types of fire doors, Fusible links and detectors, and Reliability issues. <b>Insulated metal deck roofing</b> – Description, Tests, classifications and water spray protection of exposed structures.</p>	06	3
Unit-IV	Heat and smoke roof venting	No. of Hours	COs
	<p><b>Smoke Production &amp; Properties</b> - Particle size of smoke from burning wood and plastics, Smoke Aerosol Properties, Visibility, Smoke isolation and venting, Isolation and suppression within ventilated equipment Isolation within rooms – Building smoke control – Buoyancy pressure differences, Volumetric expansion pressures, Isolation via ventilation exhaust, Upstream smoke propagation and Door and damper smoke leakage.</p> <p><b>Heat and smoke venting in sprinklered buildings</b> – Testing, Loss experience and mathematical modeling.</p>	06	4

Unit-V	Warehouse Storage and Warehouse fire losses	No. of Hours	COs
	<p><b>Storage configurations, Effect of storage height, flue space and aisle width and Commodity effects</b> – Generic commodity classification, Laboratory flammability testing, Small array tests and Large array sprinkle red fire tests.</p> <p><b>Sprinkler flow rate requirements</b> – Ceiling spray sprinklers, In-rack sprinklers and Early suppression fast response (ESFR) sprinklers</p> <p><b>Bulk storage</b> – General Description, Spontaneous ignition testing, Spontaneous ignition theory, Detection and suppression of bulk storage fires.</p>	06	5
Unit-VI	Storage of special commodities and bulk materials	No. of Hours	COs
	<p><b>Roll Paper</b> – Commodity description, Loss experience, Roll paper fire tests and Roll paper protection requirements.</p> <p><b>Nonwoven roll goods</b> – Commodity description, Loss experience, Fire tests, Sprinkler protection requirements for nonwovens and Rubber tire storage.</p> <p><b>Aerosol Products</b> – Product description, Aerosol warehouse fires, Aerosol product formulation effects, Sprinkler protection guidelines and Solid oxidizers.</p> <p><b>Industrial Safety Norms-</b> Occupational Safety and Health Administration (OSHA), Hazard and operability study (HAZOP), National Examination Board in Occupational Health and Safety (NEBOSH).</p>	06	6

#### Text Books:

1. R. K. Jain and Sunil S. Rao, “*Industrial Safety, Health and Environment Management Systems*” 4<sup>th</sup> Edition, Khanna publishers, New Delhi (2006), ISBN: 978-81-7409-210-6.
2. R E Levitt and N M Samelson, “*Construction Safety Management*” - 2<sup>nd</sup> Edition, John Wiley and Sons, New York, 1993, ISBN: 978-0-471-59933-3.
3. Robert G. Zalosh, “*Industrial Fire Protection Engineering*” 2<sup>nd</sup> Edition, John Wiley & Sons, Ltd (2003), ISBN: 9781118903117.

#### Reference Books:

1. National Fire Protection Association (NFPA) – NFPA 13, NFPA 30B, NFPA 49, NFPA 70A, 101, NFPA 325M.
2. Society of Fire Protection Engineers (SPFE) Handbook of Fire Protection Engineering.
3. Automatic Sprinkler performance table, Fire Journal, NFPA, 1970 Edition.
4. National Fire Protection Association Handbook.
5. Factory Mutual loss prevention data sheet (2-8 and 1-20) for Earthquake and Protection for sprinkler system.

#### E- Resources:

Online Course – SWAYAM- <https://swayam.gov.in> (<https://nptel.ac.in/courses/110/105/110105094/>)

## (PR316): Intellectual Property Rights and Entrepreneurship development

Teaching Scheme		Examination Scheme	
<b>Lectures: 02 Hrs. / Week</b>		<b>CIA</b>	<b>10 Marks</b>
		<b>In-Sem Exam:</b>	<b>15 Marks</b>
		<b>End Sem Exam:</b>	<b>25 Marks</b>
<b>Credits: 02</b>		<b>Total</b>	<b>50 Marks</b>

**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 learning the course the learners will be able to,

Course Outcome(s)	Blooms Technology	
	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

	<b>Introduction to IPR</b>	No.of Hours	COs
Unit-I	<ul style="list-style-type: none"> <li>• Concepts of IPR</li> <li>• The history behind development of IPR</li> <li>• Necessity of IPR and steps to create awareness of IPR</li> <li>• Concept of IP Management</li> <li>• Intellectual Property and Marketing</li> <li>• IP asset valuation</li> <li>• 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</li> </ul>	4	1
	<b>Patents</b>	No.of Hours	COs
Unit-II	<ul style="list-style-type: none"> <li>• Introduction to Patents</li> <li>• Procedure for obtaining a Patent</li> <li>• Licensing and Assignment of Patents                             <ul style="list-style-type: none"> <li>i. Software Licensing</li> <li>ii. General public Licensing</li> <li>iii. Compulsory Licensing</li> </ul> </li> <li>• Infringement of Patents</li> <li>• Software patent and Indian scenario</li> </ul>	4 Hrs.	2
	<b>Designs</b>	No. of Hours	COs
Unit-III	<ul style="list-style-type: none"> <li>• Registrable and non-Registrable Designs</li> <li>• Novelty &amp; Originality</li> <li>• Procedure for Registration of Design</li> <li>• Copyright under Design</li> <li>• Assignment, Transmission, License</li> <li>• Procedure for Cancellation of Design</li> <li>• Infringement</li> <li>• Remedies</li> </ul>	4 Hrs.	3
	<b>Trademarks and Copy Rights</b>	No.of Hours	COs
Unit-IV	<p><b>A) Trademarks</b></p> <ul style="list-style-type: none"> <li>• Concept of trademarks</li> <li>• Importance of brands and the generation of “goodwill”</li> <li>• Trademark registration procedure</li> <li>• Infringement of trademarks and Remedies available</li> <li>• Assignment and Licensing of Trademarks</li> </ul> <p><b>B) Copyright Right</b></p> <ul style="list-style-type: none"> <li>• Concept of Copyright Right</li> <li>• Assignment of Copyrights</li> <li>• Registration procedure of Copyrights</li> <li>• Infringement (piracy) of Copyrights and Remedies</li> <li>• Copyrights over software and hardware</li> </ul>	4 Hrs.	4

		<b>Entrepreneurship: Introduction</b>	No.of Hours	COs
Unit-V		<p><b>5.1 Concept and Definitions:</b>  Entrepreneur &amp; Entrepreneurship,  Entrepreneurship and Economic Development,  A Typology of Entrepreneurs.</p> <p><b>5.2 Entrepreneurial Competencies:</b>  The Entrepreneur's Role,  Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality;  Self-Analysis,  Culture &amp; values,  Risk-taking ability,  Technology knowhow.</p> <p><b>5.3 Factor Affecting Entrepreneurial Growth:</b>  Economic &amp; Non-Economic Factors,  EDP Programmes.</p> <p><b>5.4 Steps in Entrepreneurial Process:</b>  Deciding  Developing  Moving  Managing  Recognizing.</p>	4	5
Unit-VI		<p><b>Resources for Entrepreneurship</b></p> <p><b>6.1 Project Report Preparation:</b>  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.</p> <p><b>6.2 Role of Support Institutions and Management of Small Business:</b>  Director of Industries,  DIC,  SIDO,  SIDBI,  Small Industries Development Corporation (SIDC),  SISI,  NSIC,  NISBUED,  State Financial Corporation (SFC)  EPC,  ECGC.</p> <p><b>6.3 Various Governmental Initiatives:</b>  Make in India  Start Up India  Stand Up India  Digital India  Skill India</p> <p><b>6.4 Case Studies of Successful Entrepreneurs</b></p>	No.of Hours	COs
			4	
<b>Text Books:</b>				

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.

## (PR317): Intellectual Property Rights and Entrepreneurship development (Lab)

Teaching Scheme		Examination Scheme	
Practicals: 02 Hrs. / Week		Term Work	50 Marks
Credits: 01		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.

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

Course Outcome(s)	Blooms Technology	
	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

### 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	-	-

**List of experiments:** The term work shall consist following experiments/reports to be completed within the semester.

1. Searching of patent, design, trademarks, and copy rights at various databases and its report preparation.
2. Patent draft preparation for a sample invention
3. Design draft preparation for a sample design
4. Trademark draft preparation for a sample Trademark/Device
5. Copy right draft preparation for a sample documents/audio/video
6. Report preparation of patent Infringement
7. Preparation of Detailed project report for new business/industry/startup
8. Visit to industry to understand entrepreneurship and its report preparation



## (HS318): Corporate Readiness

Teaching Scheme		Examination Scheme	
Lectures: 01 Hrs. / Week		Term work	50 Marks
Practical: 02 Hrs. / Week			
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):** After learning the course the learners will be able to,

Course Outcome(s)	Blooms Technology	
	Level	Descriptor
<b>CO1.</b> Remember placement processes of various organizations and modern job search approach.	2	Create
<b>CO2.</b> Understand Industry Specific skill set with a view to design an Ideal Resume.	2	Apply
<b>CO3.</b> Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.	2	Understand
<b>CO4.</b> Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests.	4	Analyse
<b>CO5.</b> Evaluate Technical/General Dataset to interpret insights in it.	4	Analyse
<b>CO6.</b> Create an ideal personality that fits Industry requirement.	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	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-I	Placement Awareness	No.of Hours	COs
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	06 Hrs.	CO 1
Unit-II	Resume Writing	No.of Hours	COs
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	05 Hrs.	CO2
Unit-III	Group Discussion and Presentation skills	No.of Hours	COs
	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 Hrs.	CO3
Unit-IV	Logical Reasoning, I	No.of Hours	COs
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic.	05 Hrs.	CO4
Unit-V	Logical Reasoning II	No.of Hours	COs
	Data Interpretation, Data Sufficiency	04 Hrs.	CO5
Unit-VI	Logical Reasoning III	No.of Hours	COs
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle.	05 Hrs.	CO6
<b>Learning Resources :</b>			
<b>Text Books:</b>			
1. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal 2. Reasoning verbal and non verbal by B. S. Sijwali.			
<b>Reference Books:</b>			
1 Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical) 2 Analytical Reasoning by M. K. Panday 3 Logical and analytical reasoning by K. Gupta 4 Multi dimensional reasoning by Mishra & Kumar Dr. Lal			
<b>E- Books :</b>			
<a href="https://themek.in/quantitative-aptitude-and-logical-reasoning-books/">https://themek.in/quantitative-aptitude-and-logical-reasoning-books/</a> <a href="https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html">https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html</a>			
<b>E-learning Resources/MOOCs/ NPTEL Course Links:</b>			
1. <a href="https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/">https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/</a> 2. <a href="https://www.educationquizzes.com/11-plus/non-verbal-reasoning/">https://www.educationquizzes.com/11-plus/non-verbal-reasoning/</a> 3. <a href="https://www.livecareer.com/resume/examples/web-development/e-learning-developer">https://www.livecareer.com/resume/examples/web-development/e-learning-developer</a>			

**(CE319): Hydrology and Water Resource Engineering (Lab. work)**

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

**Course Outcomes: Students will be able to:**

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Apply Q-GIS software in Hydrology	3	Applying
2	Estimate the flood, analyze the data and evaluate reservoir capacity.	5	Evaluating

**Mapping of Course Outcomes to Program Outcomes (POs):**

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

**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. Modelling 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

## (CE320): Design of Reinforced Concrete Structures (Lab)

<b>Teaching Scheme</b> Practical: 02 Hrs./ Week	<b>Examination Scheme</b> Oral Exam : 50 Marks
Credits: 1	Total: 50 Marks

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

**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.

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

Cos No.	Course Outcomes (COs)	Bloom's 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):**

CO's	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<sup>2</sup>.
3. To study the RCC structural drawing.
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.
6. Minimum one site visit of building under construction

**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", 9<sup>th</sup> edition, Structures Publications, 2021, ISBN: 978819037172.
2. N. Krishna Raju and R.N. Pranesh, "Design of Reinforced Concrete Structures: Principles and Practice" 1<sup>st</sup> edition, New Age International Pvt Ltd Publishers 2018, ISBN: 978-8122414608.
3. S. Ramamrutham and N. Narayan, "Design of Reinforced Concrete Structures", 17<sup>th</sup> edition,

2013, ISBN: 978-0198086949.

4. B. C. Punmia, Ashok kumar Jain and Arun kumar Jain, “Comprehensive Design of R.C. Structures”, 10<sup>th</sup> edition, Standard Book House, 2015, ISBN : 978-8131809426

#### **Reference Books:**

1. S. U. Pillai and D. Menon, “Reinforced Concrete Design”, 3<sup>rd</sup> edition, Tata Mc Graw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnam, “Limit State Analysis and Design” 5<sup>th</sup> 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.456-2000: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards, New Delhi.
2. IS 875 Part I and Part II-2008: Code of practice for design load, Bureau of Indian Standards, New Delhi.
3. IS 13920-2000 Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
4. S.P. 16-1978: Design aids for reinforced concrete. (Interaction Charts Only) Bureau of Indian Standards, New Delhi.
5. SP 34-1978: 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](http://www.nptel.iitk.ac.in/courses/iitkharagpur)

## (MC321): Formwork in Constructions (Audit Course)

<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Lectures: 01 Hrs./ Week	Continuous Assessment
Credits: 00	00

**Prerequisite Course:** Building Construction, Concrete Technology

### Course Objectives:

1. To demonstrate the purpose of formwork and its application.
2. To select the proper formwork for various RCC elements.

**Course Outcomes (COs): student will be 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	Design formwork for various RCC constructions.	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	---	---	---	3	3
CO2	3	---	2	---	---	---	2	---	2	---	---	---	3	3

### Course Contents

Unit	Unit Title	No. of Hours	COs
I	Introduction: Purpose, Materials, requirements of good formwork, difference between formwork and scaffolding, Technical terms.	01	1
II	Types of formwork based on materials: Timber, Steel, Plywood, Aluminium, Slip form technology (Alluform)	02	1
III	Types of Formwork Based on Structural Member: formwork for slab, beams, columns, staircase, foundations and arches.	02	1
IV	Formwork design Consideration: prime requirements, important parameters for formwork design, IS 14687 specifications.	02	2
V	Design of formwork: load calculation, effect of rate of concrete pouring, Design of timber formwork.	02	2
VI	Removing the formwork: stripping time, procedure to remove formwork of slab, beam, column, footings, staircase, arches, IS 456 recommendations, Safety measures taken on site, Checklist, (recommended site visit)	03	2

**Text Books:**

1. Kumar Neeraj Jha, “Formwork for Concrete Structures” McGraw Hill Education, 4<sup>th</sup> edition, 2019.
2. Punmia B. C. and Arunkumar Jain, “Building Construction”, Laxmi Publishers Pvt. Ltd, New Delhi, 2000.

**Reference Books:**

1. Tudor Dinescu and Constantin Rabulescu, “ slip Form techniques”, Abacus Prss, Turn Bridge Wells, Kent, 2004
2. Austin C. K., “Formwork Work for Concrete”, Cleaver-Hume Press Ltd., London, 1996.
3. S. Ramamurtham, Reinforced Cement Concrete”, Dhanpat Rai Publishing Co., New Delhi, 7<sup>th</sup> edition.

**I.S. Codes:**

IS:14687-1999: Guidelines for false work for concrete structures.

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](http://www.nptel.iitk.ac.in/courses/iitdelhi/formwork%20in%20constructions)

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- 2019 PATTERN**

**FINAL YEAR B. Tech**

**Semester-VII and VIII**

**W.e.f June 2022**

**Board of Studies in Civil Engineering, June 2022**



# **Sanjivani College of Engineering, Kopergaon**

(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 2019 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**

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- 2019 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 Spirit 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

## FINAL YEAR B. TECH.

(W.e.f July 2022)

Board of Studies in Civil Engineering, June 2022

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
BSC	Basic Science Course	PRJ	Project/Seminar/Internship/Online Course

### SEMESTER-VII

Cat	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme / Marks						
			Hrs./Week				Theory			OR	PR	TW	Total
			L	T	P		CIA	ISE	ESE				
PROJ	CE401	Professional Internship-III	-	-	-	2	-	-	-	50	-	-	50
PCC	CE402	Water and Waste Water Treatment	3	-	-	3	20	30	50	-	-	-	100
PCC	CE403	Dams and Hydraulic Structures	3	-	-	3	20	30	50	-	-	-	100
PEC	PE404	Professional Elective-III	3	-	-	3	20	30	50	-	-	-	100
OEC	OE405	Open Elective-II	-	-	-	3	25	-	75	-	-	-	100
OEC	OE406	Open Elective-III (Online through MOOCs)	3	-	-	2	20	-	30	-	-	-	50
PCC	CE407	Water and Waste Water Treatment Lab	-	-	2	1	-	-	-	50	-	-	50
PCC	CE408	Dams and Hydraulic Structures Lab	-	-	2	1	-	-	-	50	-	-	50
PRJ	CE409	Project Stage-I	-	-	4	2	-	-	-	50	-	-	50
MLC	MC410	Mandatory Learning	(1)	-	-	Non-	-	-	-	-	-	-	-

		Course				Credit								
			<b>Total</b>	<b>13</b>	<b>-</b>	<b>08</b>	<b>20</b>	<b>105</b>	<b>90</b>	<b>255</b>	<b>200</b>	<b>-</b>	<b>-</b>	<b>650</b>

**Open Elective: II (OE405) Through NPTEL Platform**

- 1) Introduction to multimodal urban transportation Systems
- 2) Advanced Geomatics Engineering

**Open Elective: III (OE406) : Through MOOCS Coursera Platform**

- 1) BIM fundamentals for Engineers
- 2) Introduction to GIS Mapping
- 3) Introduction to Sustainability

**Professional Elective: 03 (CE404):**

1. Design of Advance Concrete Structures
2. Air and Noise pollution and Control
3. Advanced Engineering Geology with Rock Mechanics
4. System Approach in Civil Engineering

## FINAL YEAR B. TECH. SEM-II

(W.e.f July 2022)

Board of Studies in Civil Engineering, June 2022

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
BSC	Basic Science Course	PRJ	Project/Seminar/Internship/Online Course

### SEMESTER-VIII

Course		Course Title	Teaching Scheme			Credits	Evaluation Scheme / Marks						
Cat	Code		Hrs /Week				Theory			OR	PR	TW	Total
			L	T	P		CIA	ISE	ESE				
PCC	CE411	Highway Engineering	3	-	-	3	20	30	50	-	-	-	100
PCC	CE412	Quantity Survey, Contracts and Tenders	3	-	-	3	20	30	50	-	-	-	100
PCC	CE413	Construction Management	3	-	-	3	20	30	50	-	-	-	100
PEC	PE414	Professional Elective-IV	3	-	-	3	20	30	50	-	-	-	100
PCC	CE415	Highway Engineering Lab	-	-	2	1	-	-	-	-	-	50	50
PCC	CE416	Quantity Survey, Contracts and Tenders Lab	-	-	2	1	-	-	-	50	-	-	50
PRJ	CE417	Project Stage-II	-	-	8	4	-	-	-	50	-	100	150
MLC	MC418	Mandatory Course-VII – Energy Studies	1	-	-	-	-	-	-	-	-	-	-
<b>Total</b>			<b>13</b>	<b>-</b>	<b>12</b>	<b>18</b>	<b>80</b>	<b>120</b>	<b>200</b>	<b>100</b>	<b>-</b>	<b>150</b>	<b>650</b>

### PEC-CE414- Professional Elective-IV

1. Design of Earthquake Resistance Buildings
2. Metro Construction Technology
3. Solid Waste Management

#### 4. Rehabilitation and Strengthening of Structures

### **PROJ: (CE401): Professional Internship-III**

<b>Teaching Scheme</b>	<b>Evaluation Scheme:</b>
	<b>Oral 50 Marks</b>
<b>Credits : 02</b>	<b>Total Marks: 50 Marks</b>

**Introduction:** The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The Internship program not only helps fresh pass-outs in gaining professional expertise but also benefits, corporate on fresh perspectives on business issues and even discovering future business leaders. The internship experience will augment outcome-based learning process and inculcate various attributes in a student in line with the graduate attributes defined by the NBA.

**Objectives:** Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. Following are the intended objectives of internship training, but not limited to.

- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job.
- Learn to apply the Technical knowledge in real industrial situations.
- Gain experience in writing Technical reports/projects.
- Expose students to the engineer's responsibilities and ethics.
- Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.



- Making students more aware with the conditions of rural or socially deprived brothers & sisters through Rural /Social Internship. Making students to come up with innovative solutions leading to positive impact.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.
- Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

### Course Outcomes:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understanding the modern tool use in the field of civil engineering for product development.	2	Understand
2	Demonstrate ethical conduct and professional accountability while working in a team for the benefits of the society.	2	Understand
3	Understanding the resources requirement and planning to facilitate the project success.	2	Understand

### 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	2	2	2	2	2	2	2	2	2	2	2	2	3	2
CO2	3	2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	2	2	2	2

### Benefits to Students:

- Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience, which is often worth more than classroom teaching.
- Opportunity to learn new skills and supplement knowledge, to practice communication and teamwork skills, to learn strategies like time management, multi-tasking etc. in an industrial setup, to meet new people and learn networking skills.
- Makes a valuable addition to their resume.
- Enhances their candidacy for higher education.
- Creating network and social circle and developing relationships with industry people.

### **Important Note:**

- The detailed guidelines about internship duration, code of conduct, and its evaluation will lay down by concern department in consultation with T & P at institute level and will communicate to students time to time.
- Students are advice to read carefully Internship Guidelines and evaluation procedure published on institute website and clarify their queries (if any) before starting internship from concern Dept. and or T & P. [Source: AICTE Internship Policy Document]

### **Assessment / Evaluation guidelines laid by the department for Professional Internship:**

1. Students have to produce the Internship completion certificate to the department issued by the competent authority of the organisation.
2. Students have to submit the brief report of internship or course completed in 20-25 pages in hard bound copy to the department.
3. Students have to submit the daily work report / attendance report to the staff concern during internship programme.
4. Students have to prepare the PPT and present the knowledge and skills acquired thorough the internship, in front of committee constituted by departmental head.
5. Student has to show few photographs taken during internship programme as evidence.
6. Committee of faculty members will assess the student performance based on the quality of course or internship completed, Knowledge or skills acquired by the student, presentation performance, report quality and sincerity during the internship. Committee may call the concern organization for verification of internship documents and records submitted by the students.

## PCC: (CE402): Water and Wastewater Treatment

Teaching scheme	Evaluation scheme
Lectures: 3 hours/week	CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam : 50 Marks
Credits: 03	Total: 100 Marks

### Course Objectives:

Sr. No.	Course Objectives
1	To learn sources of water, water demand, characteristics of water and various treatment processes involves in water treatment and water distribution systems
2	To learn sources of sewage, sewage quantity, design of sewer, characteristics of wastewater and various treatment processes in wastewater treatment

### Course Outcomes:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Students will be able to know sources of water, water demand, and conveyance of raw water, quality and characteristics of water.	2	Understand
2	Students will be aware with principles of water treatment, flow sheets, aeration, sedimentation and filtration concept and design.	3	Apply
3	Students will able to know about disinfection, systems of water supply and water distribution systems.	2	Understand
4	Students will understand the sources of sewage, sewage quantity, and design of sewer and characteristics of wastewater.	2	Understand
5	Students will learn preliminary and primary techniques for sewage treatment and their design for sewage treatment plant.	3	Apply
6	Students will able to know about secondary techniques for sewage treatment and their design also the knowledge of anaerobic digestion techniques.	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	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.	Unit Title	No. of Hours	COs
I	<p><b>A) Introduction to water supply scheme:</b> Sources of water, Uses of water, Components of water supply scheme, Design period, Factors affecting design period.</p> <p><b>B) Quantity:</b> Rate of water consumption for various purposes like domestic, Industrial, Institutional, Commercial, Fire demand and Water system losses, Factors affecting rate of demand, Population forecasting.</p> <p><b>C) Quality:</b> Physical, Chemical and Bacteriological Characteristics of Water. Standards as per IS: 10500 (2012)</p>	06	1
II	<p><b>A) Water treatment:</b> Principles of water treatment, Water treatment flow sheets and Introduction to Aeration and its Types.</p> <p><b>B) Sedimentation, Coagulation and flocculation:</b> Plain and chemical assisted - principle, efficiency of an ideal settling basin, Settling velocity, Types of sedimentation tanks. Introduction and Principle of coagulation and flocculation, coagulation, Common coagulants, Design of sedimentation tank</p> <p><b>C) Filtration:</b> Theory and mechanism of filtration, Filter materials, Types: Rapid, Pressure filter, dual and multimedia filter. Working and cleaning of filters and Problems associated with working of filters, Design of Rapid Sand filter.</p>	06	2
III	<p><b>A) Disinfection:</b> Mechanism, Factors affecting disinfection, Types of disinfectants, Types and methods of chlorination, Break point chlorination, Bleaching powder estimation.</p> <p><b>B) Water distribution system:</b> System of water supply- Continuous and intermittent system. Different distribution systems and their components. Design of Reservoir capacity.</p>	06	3
IV	<p><b>A) Sewage quantity:</b> Sources of sewage/domestic wastewater,</p>	06	4

	<p>variations in sewage flow, Flow quantity estimation, Collection and conveyance of sewage, and Design of circular sanitary sewers.</p> <p><b>B) Characteristics of sewage:</b> Physical, chemical and biological characteristics, effluent discharge standards as per CPCB norms.</p> <p><b>C) Self-purification of natural streams:</b> Factors affecting, Oxygen Sag Curve</p>		
<b>V</b>	<p><b>A) Sewage treatment:</b> Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, Process flow diagram for sewage treatment, Theory of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.</p> <p><b>B) Aerobic treatment:</b> Introduction to unit operations and processes for secondary treatment. Suspended growth processes/Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking &amp; control, modifications in ASP.</p>	<b>06</b>	<b>5</b>
<b>VI</b>	<p><b>A) Attached growth processes:</b> Biological principle, different T.F media &amp; their characteristics, design of standard rate and high rate filters using NRC formula, single stage &amp; two stage filters, Concept of MBR, MBBR, FMBR.</p> <p><b>B) Anaerobic Treatment:</b> Principle of anaerobic digestion, stages of digestion, factors governing anaerobic digestion, Septic Tank, Dewatering of sludge by gravity thickener, sludge drying bed, decanters.</p>	<b>06</b>	<b>6</b>
<b>Text Books</b>			
<ol style="list-style-type: none"> <li>1. Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi</li> <li>2. Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.</li> <li>3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.</li> <li>4. Waste Water Treatment &amp; Disposal – Metcalf &amp; Eddy - TMH publication.</li> </ol>			
<b>Reference Books</b>			
<ol style="list-style-type: none"> <li>1. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications.</li> <li>2. Optimal Design of Water Distribution Networks: P. R. Bhawe, Narosa Publishing House.</li> <li>3. Waste Water Engg. – B.C. Punmia&amp; Ashok Jain - Arihant Publications.</li> <li>4. Water Supply &amp; Waste Water Engg.- B.S.N. Raju – TMH publication.</li> <li>5. CPHEEO Manual on water and wastewater treatment</li> </ol>			
<b>I.S. Codes</b>			

I.S. 3025 (all parts)

E- Resources : <https://nptel.ac.in/courses/105107207>

### **PCC: (CE403):Dams and Hydraulic Structures**

<b>Teaching scheme</b>	<b>Evaluation scheme</b>
<b>Lectures: 3 hours/week</b>	<b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course:** Hydrology and Water Resources Engineering

**Course Objectives:**

<b>Sr. No.</b>	<b>Course Objectives</b>
1	To impart knowledge regarding the design of the various hydraulic structures
2	To convey the knowledge on the causes of failure, design criteria and stability analysis of different types of dams.
3	To make able to analyze and design hydraulic structures.
4	To contribute knowledge to pursue career, post-graduation and competitive exams.

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

<b>COs No</b>	<b>Course Outcome (s)</b>	<b>Bloom's Taxonomy</b>	
		<b>Level</b>	<b>Descriptor</b>
1	Classify dams and study safety considerations in dams.	2	Understand
2	Perform the stability analysis of gravity dams.	5	Evaluate
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 and stability analysis of earthen dam.	5	Evaluate
5	Classify canals, canal structures, canal outlets and design of canal	3	Apply
6	Explain cross drainage and river training works.	2	Understand

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

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

<b>CO4</b>	3	3	2	2	--	2	2	-	-	-	-	2	2	2
<b>CO5</b>	3	3	2	-	-	2	2	-	-	-	-	2	2	2
<b>CO6</b>	3	1	1	2	-	-	-	-	-	-	-	2	2	2

## Course Contents

Unit No.	Unit Title	No.of Hours	COs
I	<p><b>Dams and Dam Safety:</b></p> <p><b>Dams:</b> 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.</p> <p><b>Dam safety and instrumentation:</b> Introduction, Objectives, working principles of instruments, selection of Equipment. Different Instruments Extensometer, Plumb bob, Water level meter, Embedded strain gauge, Temperature gauge, Distributed fibre optics temperature tool, Seismograph.</p>	06	1
II	<p><b>Stability Analysis of Gravity Dam:</b></p> <p><b>Gravity Dam:</b> Introduction, 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.</p> <p><b>Construction of gravity dams:</b> Colgrout masonry, Roller Compacted Concrete (R.C.C.), Crack in gravity dam, construction joints, Keys, Water seal and Retrofitting.</p> <p><b>Arch Dam:</b> 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 of Buttress dams.</p>	06.	2

<p><b>III</b></p>	<p><b>Spillways and Spillway Gates:</b></p> <p><b>Spillway:</b> Introduction, 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. 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.</p> <p><b>Spillway gates:</b> Classification based on function, movement of gates, special features, Requirements of spillway gates, Maintenance of gates, Inspection of gates.</p>	<p>06</p>	<p>3</p>
<p><b>IV</b></p>	<p><b>Stability Analysis of Earthen Dam and Diversion Head works:</b></p> <p><b>Earthen Dam:</b> Introduction, 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, Felonious Method of Locating Centre of Critical Slip circle, Failure of earth dam, Seepage control in earth dams: causes, and control measures.</p> <p><b>Diversion head works:</b> Introduction, Functions, Selection of site, Layout and Components of diversion head works.</p>	<p>06</p>	<p>4</p>
<p><b>V</b></p>	<p><b>Canal and Canal Structures:</b></p> <p><b>Canal:</b> 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.</p> <p><b>Canal lining:</b> Necessity, requirements of lining material, Classification, Advantages and disadvantages.</p> <p><b>Canal Structures/Canal falls:</b> Selection of site, Classification- Free fall or open fall, Notch fall, Ogee Fall, Rapid Stepped fall, Straight glacis fall, Sarda fall, Montague fall.</p> <p><b>Canal outlets-</b> Introduction to Canal outlets. Canal escapes, Canal regulators.</p>	<p>06</p>	<p>5</p>



<b>VI</b>	<p><b>Cross Drainage and River Training Works:</b></p> <p><b>Cross Drainage work:</b> Introduction, Necessity, Selection of site and data required for design of Cross Drainage work. Classification of Cross Drainage works. Selection of suitable type of C. D. works. Design considerations for cross drainage works.</p> <p><b>River Training Works:</b> Introduction, Classification of rivers, Classification based on topography, regime, alignment, source, behaviour of rivers. River training structures: Embankment or Levee, Guide banks, Groynes or spurs.</p>	06	6
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**Text Books:**

1. Irrigation Engineering and Hydraulic Structures, 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, Asawa G.L., New Age International (P) Ltd. Publishers, first Edition, 2005.
4. Irrigation and water power Engineering, Punmia B. C., Laxmi Publications; Revised edition (2016), ISBN-13: 978-8131807637.

**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, Nemchand & brothers-roorkee, 2007.
5. Hydraulic Structures by P Novak, A.I.B. Moffat, C. Nalluri, R. Narayanan, CRC Press, 2006.

**Professional Elective III**  
**PEC: (PE404-a): Design of Advanced Concrete Structures**

<b>Teaching scheme:</b>	<b>Evaluation scheme:</b>
Lectures: 3 hours/week	CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam : 50 Marks
Credits: 03	Total: 100 Marks

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

**Course Objectives:**

1. To analyze and design of prestressed concrete members.
2. To analyze and design of RCC Flat slab.
3. To introduce earthquake engineering with ductile detailing codes.
4. To analyze and design of earth and 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.	3	Apply
2	Analyse and design of prestressed concrete beam.	4	Analyze
3	Analyze and design of prestressed concrete one way and two way slabs.	4	Analyze
4	Analyze and design of RCC flat slab.	4	Analyze
5	Analyze and design of RCC cantilever retaining wall.	4	Analyze
6	Analyze and design of RCC water tank resting on ground	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
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CO1	3	2	---	---	---	2	---	---	---	1	1	1	3	2
CO2	2	2	3	---	---	2	---	2	2	2	2	2	3	2
CO3	2	2	3	---	---	2	---	2	2	2	2	2	3	2
CO4	2	2	3	---	---	2	---	2	2	2	2	2	3	2
CO5	2	2	3	---	---	2	---	2	2	2	2	2	3	2
CO6	2	2	3	---	---	2	---	2	2	2	2	2	3	2

### Course Contents

Unit No.	Unit Title	No.of Hours	COs
<b>I</b>	<b>Analysis of Prestressed concrete section:</b> Introduction, Basic concepts, materials, various Pre-tensioning and Post-tensioning systems, concept of losses, Stress calculations, and concept of cable profile.	06	1
<b>II</b>	<b>Design of Prestressed concrete beams:</b> Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block.	06	2
<b>III</b>	<b>Design of Prestressed concrete slab:</b> Design of one way and two way post tensioned slabs (Single panel only). <b>Introduction to Earthquake Engineering &amp; Ductile detailing:</b> Introduction to Indian seismic codes, IS: 1893(Part I), IS: 875 (Part V), concepts of ductile detailing for structural elements as per IS: 13920.	06	3
<b>IV</b>	<b>Design of RCC Flat slab:</b> Introduction to flat slab, Types, methods of analysis as per IS 456, Design of flat slab by direct design method.	06	4
<b>V</b>	<b>Earth retaining structures:</b> Introduction, Functions and types of retaining walls. Analysis and design of RCC cantilever retaining wall for various types of backfill conditions.	06	5
<b>VI</b>	<b>Liquid retaining structures:</b> Introduction, types, function, codal provisions, methods of analysis and design of circular, square, and rectangular water tanks resting on ground.	06	6

**Note:-1.** Students should complete **minimum** one assignment on **each unit**.

**2. Site visit** is recommended to explore practical knowledge in **Prestressed Concrete** and various Advanced Concrete Structures (Retaining wall / Water tank / Flat slab).

### **1. TextBooks:**

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”, 17th edition, 2013, ISBN: 978-0198086949.
4. B. C. Punmia, Ashok kumar Jain and Arunkumar Jain, “Comprehensive Design of R.C. Structures”, 10th edition, Standard Book House, 2015, ISBN : 978-8131809426

### **2. Reference Books:**

1. S. U. Pillai and D. Menon, “Reinforced Concrete Design”, 3rd edition, Tata McGraw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnam, “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.

### **3. 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 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, BIS, New Delhi.
4. IS 875 Part V: Code of practice for design load, Bureau of Indian Standards, New Delhi.
5. IS 13920: Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
6. 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](http://www.nptel.iitk.ac.in/courses/iitkharagpur)

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

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Evaluation Scheme:</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

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

**Course Objectives:**

- 1.To understand factor affecting the extent of pollution, methods and devices for controlling the 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	Analyse
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):**

CO's	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	<p><b>Air Pollution: Introduction:</b> Definition, Sources and classification of Air Pollutants, Photochemical smog, Effects of air pollution on health, vegetation &amp; materials, air quality, Air Pollution Episodes.</p> <p><b>Meteorology:</b> 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.</p>	06	1
II	<p><b>Modeling of Dispersion of Air Pollutants:</b></p> <p>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.</p>	06	2
III	<p><b>Particulate Pollution Control Methods:</b></p> <p>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.</p>	06	3

	<p><b>Gaseous pollution control:</b> Types of gaseous pollution control methods– absorption, adsorption and combustion processes. SO<sub>x</sub> Control Technology, Desulfurization of flue gas emissions, NO<sub>x</sub> Control Technology.</p> <p><b>Air (Prevention and Control of Pollution Act 1981)</b></p>		
IV	<p><b>Indoor air pollution:</b> 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.</p> <p><b>Odour pollution:</b> Theory, sources, measurement and methods of control of odour pollution.</p> <p><b>Global effects air pollution:</b> Greenhouse effect, Heat island effect, Acid rain, Ozone Depletion, Global warming</p> <p><b>Various treaties and protocols:</b> Kyoto Protocol and Montreal Protocol etc</p>	06	4
V	<p><b>Noise Pollution:</b> Introduction, Definition, sources of noise <i>i.e.</i>, 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</p>	06	5
VI	<p><b>Effects and control of noise pollution:</b> 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.</p> <p><b>Noise pollution (Regulation and Control) Rules 2000</b></p>	06	6

**Text Books:**

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

**Reference Books:**

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

**E Resources:**

1. <https://nptel.ac.in/courses/105/104/105104099/>

**(PE404-c):Advanced Engineering Geology with Rock Mechanics**

<b>Teaching Scheme:</b> Lectures: 03 Hrs. / Week	<b>Evaluation Scheme:</b> CIA : 20 Marks In-Sem Exam : 30 Marks End-Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course:** Engineering Geology, Engineering Mechanics, material properties and physics,

**Course Objectives:**

1. To Illustrate Distribution and Geological characters of Major Rock formations of India. The study of Plate Tectonics and highlights of Seismic Zones of India.
2. To introduce the students to the principles and basic mechanism of Rocks
3. To understand Mechanical behavior of Foundation rocks, various engineering Rock Mass classification for deciding competencies of various rock formations for engineering use and constructions.
4. To Study the laboratory and field results to determine engineering properties of rock and rock mass

**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 the geological formation in civil engineering processes for strong foundation.	2	Understanding
2	Demonstrate Geohydrological characters of rock formations.	2	Understanding
3	Analyze the Physical & Mechanical Properties of Rocks	4	Analyzing
4	Analyze strength and deformation behavior, of rock and rock mass.	4	Analyzing



5	Determine engineering properties of rock and rock mass by laboratory and field results	4	Analyzing
6	Analyze & Suggest the improvement properties of rock mass.	4	Analyzing

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

**Course Contents**

Unit No	Topics	No of Hrs	COs
<b>I</b>	<b>Overview of Indian Geology:</b> Geological Map of India with special reference to Maharashtra. Distribution and Geological characters of Major rock formations. Engineering characters of major rock formations of India. The study of Plate Tectonics and highlights of Seismic Zones. Importance of Geological Studies in Engineering Investigations.	06	1
<b>II</b>	<b>Geological Process of Soil formations:</b> Effect of climate on formation of soil, Soil profile of different states in India. Rock weathering conditions favorable for decomposition, disintegration, residual and transported soils. <b>Geohydrological characters of rock formations:</b> Geohydrological characters, factors controlling characters of rocks, Morphometric analysis, Water conservation techniques, effect of over exploitation of tube wells, bore wells and dug wells. Artificial recharge, rainwater harvesting, watershed development and necessity of geological studies. Relevant Case Studies.	06	2

<b>III</b>	<p><b>Rock Mechanics:</b> Definition, importance, Rock mass and material form, Effects of discontinuities on rock mass.</p> <p><b>Physical Properties:</b> Porosity, Density, Moisture content, Degree of saturation, Coefficient of permeability, Electrical properties, Thermal properties, Swelling, Anisotropy, Durability.</p> <p><b>Mechanical properties:</b> Strength (Compressive, Tensile and Shear), Deformability Elasticity, Plasticity and Hardness.</p>	06	3
<b>IV</b>	<p><b>Rock mass Classification:</b> Deere and Miller, Geological classification, ISRM, (International Society for Rock Mechanics) Terzaghi, Rock Quality Designation, Rock Structure Rating, Rock Mass Rating and Q classifications, Rating, Applications.</p> <p><b>Rock Exploration:</b> Introduction, objectives, methods, viz. Direct Penetration, Core Boring, Core Recovery, Rock Quality Designation, Fracture Frequency, Electrical Resistivity, Seismic method, Determination of thickness of overburden and locating Ground water potential zones for strengthening major civil engineering projects, Calculation of R.Q.D. of Rock from given drill hole dataset.</p>	06	4
<b>V</b>	<p><b>Rock Testing:</b> Sampling, Sample preparation, Specimen, Uniaxial compressive strength.</p> <p><b>Laboratory Test:</b> Tests for measuring rock strengths- Tensile strength tests , Brazilian tests , Bending tests, Flexural strength test, Three point &amp; Four point load test.</p> <p><b>In situ tests:</b> Deformability, Shear &amp; Strength, Bearing Capacity, Compressive strength &amp; Tensile strength test, Test for internal stress in rocks, Introduction to GEO5 software</p>	06	5
<b>VI</b>	<p><b>Improvement in Properties of Rock Mass:</b> Necessity, Grouting, Grouting Materials, Grouting Operations, Methods Of Grouting, Gunning.</p> <p>In-situ experimental studies on improvement of rock masses.</p> <p>Rock bolting &amp; Methods, Design principles and Cable anchorage.</p>	06	6

**Text Books:**

1. B.P. Varma, "Rock Mechanics for Engineers", Khanna Publishers New Delhi, 1985 ( 7<sup>th</sup> Edition)  
ISBN: 978-87-93102-90-3

2. Goodman RE., Introduction to Rock Mechanics Jhon Wiley, London, 1989. (3rd Edition)  
*ISBN 0-471-81200-5 1.*
3. Jaeger JC, Cook NG, Zimmerman R, Fundamentals of Rock Mechanics, Blackwell Publishing, Oxford, 2009 ( 4<sup>th</sup> Edition) *ISBN: 978-0-632-05759-7*

### **Reference Books:**

1. Bieniawski ZT, Engineering Rock Mass Classifications, John Wiley and Sons, New York, 1989 ( 3<sup>rd</sup> Edition) *ISBN: 978-0-471-60172-2*
2. Zhang L, Engineering Properties of Rocks, Butterworth-Heinemann, Cambridge, 2016..(7<sup>th</sup> Edition) *ISBN: 9780128028339*
3. Karl Terzaghi, “Soil Mechanics in Engineering Practice” A Wiley Interscience Publication.1996 ( 7<sup>th</sup> Edition) *ISBN 3-540-21121-7*
4. Jaeger J, C, Rock Mechanics in Engineering, Cambridge University Press London, 1990. ( 4<sup>th</sup> Edition) *ISBN-10 : 052110338X*
5. Deere D.U.Geological Considerations, Rock mechanics in Engineering Practice John Wiley and Sons 1968 (5<sup>th</sup> Edition)

### **Handbooks:**

1. Manual on Rock Mechanics, Central Board of Irrigation and Power, New Delhi,1988.
- 2, Handbook of Geology in Civil engineering, Robert Fergusson, Legget, Mc- Grawhill.1990

### **I. S. Codes**

- a. IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I andII.
- b. I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts &shaft.
- c. I. S. 6926-1973 Code of practice for diamond drilling for site investigation;
- d. I. S. 4078-1967 Code of practice for Logging and Storage of DrillingCore.
- e. I. S. 5313-1969 Guide for core drillingobservation

### **e – Resources:**

1. [www.ebd.co.in/undergraduate/eng](http://www.ebd.co.in/undergraduate/eng)
2. [www.library.iisc.ernet.in](http://www.library.iisc.ernet.in)
3. [www.iitb.ac.in](http://www.iitb.ac.in)
4. [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)
5. Free onlinecourse-swayam-<https://swayam.gov.in>

6. Open source course management –<https://moodle.org>

### **PEC: (CE404-d):System Approach in Civil Engineering**

<b>Teaching Scheme:</b> Lectures: 3 Hrs./Week	<b>EvaluationScheme:</b> CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam: 50 Marks
<b>Credits: 3</b>	<b>Total:100Marks</b>

**Prerequisite Course:Mathematics**

#### **CourseObjectives:**

1	To learn the basics of optimization, formulation and solution of optimization problems and its applications in civil engineering.
2	To learn linear and non-linear programming techniques for problem solving
3	To study and learn the scheduling technique, queuing theory and system simulation
4	To study the dynamic programming for multistage problem, game theory and replacement.

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

CO	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
1	To formulate and solve optimization problems in civil engineering	3	Apply
2	To apply transportation and assignment models to solve real life linear optimization problems	3	Apply
3	To formulate and to solve linear optimization problems using various methods.	3	Apply
4	To solve the single and multivariable non-linear problems.	3	Apply
5	To plan the scheduling of activities and improving the system by simulation and queuing theory.	3	Apply
6	To solve multistage problems like route optimization, resource allocation, decision making by game theory and for replacement of machinery by replacement models.	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	PSO3
CO1	3	3	--	--	--	--	--	--	--	--	2	--	2	2	--
CO2	3	2	--	2	3	1	--	--	--	--	2	1	2	2	--
CO3	3	2	--	--	3	1	--	--	--	--	2	1	2	2	--
CO4	3	2	--	--	3	1	--	--	--	--	2	1	2	2	--
CO5	3	2	--	2	--	1	--	--	--	--	2	1	2	2	--
CO6	3	2	--	2	--	1	--	--	--	--	2	1	2	2	--

### Course Contents

Unit-I	Introduction to System Approach and Operation Research	No. of Hours	COs
	(A) Introduction to System approach, Operations Research and Optimization Techniques, Applications of systems approach in Civil Engineering. (B) Introduction to Linear and Non-linear programming methods (with reference to objective function, constraints), Graphical solutions to linear programming problems. (C) Local & Global optima, unimodal function, convex and concave function.	06	1
Unit-II	Linear Programming-1: Allocation Problems		

	(A) Transportation Model and its variants. (B) Assignment Model, and its variants.	06.	2
<b>Unit-III</b>	<b>Linear Programming-2</b>		
	Formulation of linear programming models for Civil engineering applications using method i.e. Simplex method, Big M method, Two phase method and concept of Primal and Dual and its relationship.	06	3
<b>Unit-IV</b>	<b>Non- Linear Programming (Unconstrained Optimization)</b>		
	(A) <b>Single variable unconstrained optimization techniques:</b> Sequential Search Techniques-Dichotomous, Fibonacci, Golden section. (B) <b>Multivariable optimization without constraints-</b> Gradient vector and Hessian Matrix, Gradient techniques, Steepest Ascent/Decent technique, Newton's Method. (C) <b>Multivariable optimization with equality constraints -</b> Lagrange Multiplier Technique.	06	4
<b>Unit-V</b>	<b>Stochastic Programming</b>		
	(A) <b>Sequencing</b> – n jobs through 2, 3 and M machines. (B) <b>Queuing Theory</b> : Elements of Queuing system and it's operating characteristics, waiting time and ideal time costs, Kendall's notations, Classification of Queuing models, single channel Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/ /). (C) <b>Simulation:</b> Monte Carlo Simulation	06	5
<b>Unit-VI</b>	<b>Dynamic programming, Games Theory &amp; Replacement Model</b>		
	(A) <b>Dynamic programming:</b> Multi-stage decision processes, Principle of optimality, recursive equation, Applications of D. P. (B) <b>Games Theory:</b> 2 person games theory, various definitions, application of games theory to construction management. (C) <b>Replacement Models:</b> Replacement of items whose maintenance and repair cost increase with time, ignoring time value of money	06	6

**Reference Books:**

1. Operations Research by Premkumar Gupta and D.S. Hira, Revised Edition 2017, ISBN: 978-8121902816 S. Chand Publications

2. Engineering Optimization: Theory and Practices, by S. S. Rao, Fifth Edition (2019), ISBN: 978-1119454717, Wiley Publication.

3. Operations Research by Hamdy A. Taha. Tenth Edition (2016), ISBN:978-0134444017, Pearson Publication

4. Quantitative Techniques in Management by N.D. Vohra FifthEdition (2017), ISBN: 978-9352606269, Mc-Graw Hill Publication .

5. Operations Research by Pannerselvam, Second Edition (2016), ISBN : 9788120329287, PHI publications.

6. A System Approach to Civil Engineering Planning & Design by Thomas K. Jewell, First Edition (1986), ISBN: 978-0060433178, Harper Row Publishers.

**E-Resources:**

<https://nptel.ac.in/courses/105103210/> Optimization methods for Civil engineering

<https://nptel.ac.in/courses/111105039/> Optimization

**OE405: Open Elective-II**

**(Through Online on NPTEL Platform)**

**Course 1) Introduction to multimodal urban transportation Systems**

**Course 2) Advanced Geomatics Engineering**

**OE406: Open Elective-III**

**(Through MOOCs on Coursera Platform)**

**Course 1) BIM fundamentals for Engineers**

**Course 2) Introduction to GIS Mapping**

**Course 3) Introduction to Sustainability**



## PCC: (CE407): Water and Wastewater Treatment Lab

<b>Teaching scheme</b>	<b>Evaluation scheme</b>
<b>Practical: 2 hours/week</b>	<b>Oral Exam: 50 Marks</b>
<b>Credits: 01</b>	<b>Total: 50 Marks</b>

### Course Outcomes:

Sr. No.	Course Objectives
1	Students will be aware of the many tests used to determine the quality of raw water.
2	Students will be familiar with the various tests used to assess the pollution level of wastewater.
3	Students are becoming informed about the functioning of water and 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 water and wastewater.	3	Apply
2	Comparison of observed water and wastewater characteristics with the IS code/standard limits established by CPCB.	4	Analyzing
3	Water and wastewater testing results have to be analyzed and interpreted for the design of water and 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:

1. Determination of pH, Alkalinity, and hardness of raw water
2. Determination of Chlorine demand and residual chlorine.
3. Determination of Turbidity and optimum dose of Coagulant.
4. Microbiological analysis of water: Most Probable Number (MPN) Test
5. Determination of different types of Solids for sewage
6. Determination of Sludge Volume Index and Electrical Conductivity for sewage
7. Determination of Bio-Chemical Oxygen Demand for sewage sample
8. Determination of Chemical Oxygen Demand for sewage sample.

9. Study of Atomic Absorption Spectrophotometer for determination of heavy metals.

10. Visit to water treatment and wastewater treatment plants and detailed report.

11. Exercise on the design of water distribution network using any suitable software such as EPANET / tools (total pipe length @ 10 km and minimum 10-12 nodes) **OR** Complete design of WTP using appropriate software/Program/excel spreadsheet etc.

**Oral: Based on the practical and term work.**

## PCC: (CE408): Dams and Hydraulic Structures Lab

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

**Prerequisite Course:** Hydrology and Water Resources Engineering

**Course Outcomes: Students will be able to:**

Cos No	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
1	Classify and analyze hydraulic structures.	4	Analyse
2	Design dams, spillways and canals.	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	PSO1	PSO2		
CO1	3	2	2	2	1	2	2	2	2	2	1	2	2	2
CO2	3	3	3	2	2	2	2	2	3	2	2	2	2	2

**Term work (A+B+C):**

**A) Analysis/Design Assignments**

1. Stability Analysis of Gravity Dam.
2. Design of profile of spillway and energy dissipation device below the spillway.
3. Stability analysis of zoned earthen dam.
4. Design of lined canal.
5. Design of unlined canal.

**B) Site visit and reports (Any Two)**

1. Gravity Dam/Masonry Dam.
2. Earth Dam.
3. C. D. works/Canal Structures

**C) Case study on failure of any hydraulic structures.**

## **PRJ: (CE409): Project stage-I**

<b>Teaching scheme</b>	<b>Examination scheme</b>
<b>Practical: 04 hours/week</b>	<b>Term Work: 50 Marks</b>
<b>Credits: 02</b>	<b>Total: 50 Marks</b>

**Prerequisite Course:** Knowledge of all BTech subjects from I<sup>st</sup> to VIII<sup>th</sup> semester, Computer Basics, MS office.

### **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): (Strictly Six Outcomes need to be specified here)**

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 phase-I Guidelines:

#### I. Guide selection and Project Allocation:

The main objective of the project is to learn and experience the process of conducting a good research project. Assistant Professor/Associate Professor/Professor as per norms having at least 5 years of full time approved experience can guide the project without compromising the quality of the work. The project work load for each group (2 to 4 students in one group) constituting laboratory work of 2 hrs. /week will be allocated to the guide.

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. ( 2-3 weeks after commencement of the term).

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.

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

## **II. Evaluation guidelines:**

Project work will be evaluated for an individual student based on individual students' contribution, progress report presented and submitted for the requirement of Project Phase-I. Those who remains absent for presentation will be marked as absent and they should repeat the project work in next year.

It is mandatory to present a progress in presence of Internal and External Examiners and submit project report based on work completed in first semester. The report shall contain finalization of topic, literature survey, objectives based on the gaps identified, methodology to be used, planning schedule / flow chart for completion of project. The report shall be printed and should submit in black colour hard/spiral bound with front page embossed. The project work to be taken up individually or in groups. The project group shall not include more than 4 students. Maximum 5 students will be permitted by HOD if project work includes experimental work, field surveys and interdisciplinary project or product development. Students need to take prior permission for extra member before registration for the project work.

### **Format of project report: Sequence of 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

(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).

### **Report printing details:**

1. Report shall be typed on A4 size Executive Bond paper with 1.5 spacing preferably on both the sides of paper.
2. Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm.
3. Give page number at bottom margin at center.
4. Size of Letters: Chapter Number and Name: 14 font size, Times New Roman in Capital Bold Letters, Main Titles (1.1, 2.5 etc): 14 Font size, Sub Titles (1.1.5, 4.5.1 etc): 14 Font size in Bold  
All other matter: Sentence case, 12 Font size Times New Roman sentence case.
5. No blank sheet be left in the report.
6. Figure name: 12 Font size in sentence case Bold- Below the figure.
7. Table title -12 font size in sentence case- Bold-Above the table.

## MC410- Mandatory Learning Course

<b>Teaching scheme</b>	<b>Evaluation scheme</b>
<b>Practical: 01 hours/week</b>	<b>Term Work: 00</b>
<b>Credits: 00</b>	<b>Total: 50 Marks</b>

**Prerequisites:** Basics of Project Management

### Course Objectives:

1. Understand the project planning through MS Project software.
2. Plan, Schedule, Monitor and Control projects through software

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

CO No.	Course Outcomes(COs):
CO1	Understand importance of MS Project software in civil engineering.
CO2	Categorize various project tasks.
CO2	Create any civil engineering project using MS Project software

### Mapping of COs

CO No.	Bloom's Taxonomy			POs/PSOs
	Level	Descriptor	Knowledge Category	
CO1	2	Understand	Conceptual, Procedural	PO1, PO2, PO4, PO6, PO12, PSO2
CO2	4	Analyze	Conceptual, Procedural	PO1, PO2, PO4, PO5, PSO1, PSO2
CO3	6	Create	Conceptual, Procedural	PO1, PO3, PO4, PO5, PO7, PO8, PSO2

### Mapping of COs with POs/PSOs:

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

### Course Contents

Unit No.	Topics	No. of Hrs.	CO
1	<b>Getting Started with Microsoft Project</b> Identify Project Management Concepts, Navigate the Microsoft Project Environment, Defining a Project, Create a New Project Plan, Define a Project and Assign a Project Calendar.	4	1



2	<p><b>Creating and Organizing Tasks</b></p> <p>Add Tasks to a Project Plan, Import Tasks from Other Programs, Create a Work Breakdown Structure; Define Task Relationships, Schedule Tasks.</p>	4	2
3	<p><b>Managing Project Plan Resources</b></p> <p>Add Resources to a Project Plan, Create a Resource Calendar, Enter Costs for Resources, Assign Resources to Tasks, Resolve Resource Conflicts, Finalizing a Project Plan, Optimize a Project Plan, Set a Baseline, Share a Project Plan</p>	4	3

**Semester-VIII**  
**PCC - (CE411) HIGHWAY ENGINEERING**

<b>Teaching Scheme:</b> <b>Lectures:</b> 03 Hrs. / Week  <b>Credits:</b> 03	<b>Evaluation Scheme:</b> <b>CIA</b> :20 Marks <b>In-Sem Exam</b> :30 Marks <b>End Sem Exam:</b> 50 Marks <b>Total:</b> 100 Marks
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**Prerequisites:** Concrete Technology, Material testing knowledge

**Course Objectives:**

1. To study the necessity of highway planning and classification of roads.
2. To study the various geometric elements and different cross-sectional elements of highway.
3. To study materials used in highway construction and related tests and standards.
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 types of bridges, component parts and various types of bearings.

**Course Outcomes (COs):** After successful completion of the course, student 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.	3	Apply
2.	Use the concept of highway alignment and geometric design of highway in road designing.	3	Apply
3.	Predict the materials properties and carry out related tests on the materials used in highway construction as per standard norms.	4	Analyze
4.	Carry out preliminary design of flexible and rigid pavement as per the site conditions using IRC and MORTH code.	4	Evaluate
5.	Design and analyze the traffic systems, traffic flow and decide the traffic capacity on the basis of types of highway.	4	Analyze
6.	Select the suitable bridges according to necessity in the field.	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	---	---	---	---	---	---	---	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-I	Introduction to Roads, Highway Development and Planning	No. of Hours	COs
	<p>Introduction, Necessity of Highway planning, Jaykar Committee recommendations and implementations. Road development in India Vision-2021 and Rural development in India 2025.</p> <p>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.</p> <p>Introduction to road development authorities like IRC, CRRI, NHAI, NHDP, MORTH, etc. Salient features of National and State Highways, Expressways in India.</p>	06	1
Unit-II	<p><b>Highway Geometric Design</b></p> <p>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.</p> <p>Design of vertical alignment, gradient and its type, IRC recommendations, 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.</p>	06.	2
Unit-III	<p><b>Pavement Materials and MORTH Standards</b></p> <p>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). MORTH Specifications for Road Works. Functions and applications of Geo-synthetics in roadways.</p>	06	3

<b>Unit-IV</b>	<p><b>Pavement Analysis and Design</b></p> <p>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</p> <p>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.</p>	06	4
<b>Unit-V</b>	<p><b>Traffic Engineering Studies and Analysis</b></p> <p>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.</p> <p>Categories of traffic flow, uninterrupted traffic flow model, Analysis of speed, flow and density relationship. Traffic signs, Types of intersections. Smart signal systems.</p>	06	5
<b>Unit-VI</b>	<p><b>Introduction to Bridge Engineering</b></p> <p>Types of bridges, selection of suitable types of bridges, economic span, aesthetics of bridges, IRC loads, Analysis of deck slab and IRC loads, Different components of bridge superstructure and substructure. Introduction to bridge bearings, Types of bridge bearings, suitable bearings for the bridges.</p>	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, 12<sup>th</sup> 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 to V
2. I.R.C. 58, IRC 37 3. Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.

**Hand Books:**

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

**e – Resources:**

1. [www.nptel.iitm.ac.in/courses/iitkanpur](http://www.nptel.iitm.ac.in/courses/iitkanpur)
2. [www.cdeep.iitb.ac.in/nptel](http://www.cdeep.iitb.ac.in/nptel)

## PCC - (CE412) Quantity Survey, Contracts and Tenders

<p><b>Teaching Scheme:</b>  <b>Lectures:</b> 03 Hrs. / Week   <b>Credits:</b> 03</p>	<p><b>Evaluation Scheme:</b>  <b>CIA</b> :20 Marks  <b>In-Sem Exam</b> :30 Marks  <b>End Sem Exam:</b>50 Marks  <b>Total:</b>100 Marks</p>
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**Prerequisites:** Basic Mathematics, Building Technology and Materials and Building Planning

### Course Objectives:

- 1 To study the methods of estimation and procedure of taking out quantities of various items of work for load bearing and RCC framed 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 various methods for carrying out valuation.
- 4 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,

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
Evaluate the estimate of proposed civil Engg. Project.	5	Evaluate
Perform all operations leading to quantity evaluation.	5	Evaluate
Perform the work according to specification, analyzing rate of items of work, to fill tender and check the tender document.	4	Analyse
Carry out the valuation of structure/ project.	4	Analyse
Complete tendering procedures.	3	Apply
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
<b>CO6</b>	<b>1</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>3</b>	<b>--</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>

## Course Contents

Unit	Topic	No.of Hours	CO
I	<p><b>a)Introduction to estimates and related terms:</b> 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&amp; prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R.</p> <p><b>b) Approximate Estimate:</b> 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</p>	5	CO1
II	<p><b>a) Methods of estimating-</b>P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing, Detailed estimates of R.C.C framed structures, Working out quantities of steel reinforcement and bar bending schedule</p>	8	CO2
III	<p><b>a)Specifications:</b> Meaning &amp; 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.</p> <p><b>b) Rate Analysis:</b> Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools &amp; plant, overheads &amp; profit. Task work or out turn, factors effecting task work.</p> <p>Working out Rate Analysis for the items mentioned in specifications above. Special rates concerning to mountainous, hilly, forest and urban areas.</p>	5	CO3

IV	<p><b>b) Valuation:</b> Purpose of valuation. Meaning of price, cost and value. Factors affecting 'value'. Concept of free hold and lease hold property.</p> <p><b>Types of value:</b> only Fair Market Value, Book Value, Salvage/Scrap Value, Distressed Value and Sentimental Value. Estimation versus valuation. Meanings of depreciation &amp; obsolescence</p> <p><b>Methods of Valuation:</b> Rental Basis , Land and Building Method, Profit based method, Reproduction and Replacement Method</p>	6	CO4
V	<p><b>Tendering and Execution of Works:</b> a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, Comparative statement, Pre-bid conference, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders.acceptance/ rejection of tenders, Various forms of BOT &amp;Global Tendering, E-tendering.</p> <p><b>b) Methods of Executing Works:</b> Procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD, Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour.</p>	6	CO5
VI	<p><b>Contracts and Arbitration a) Contracts:</b> Definition, objectives &amp; essentials of a valid contract as per Indian Contract Act (1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus.</p> <p><b>Conditions of contract:</b> General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final</p>	6	CO6



	<p>bill</p> <p><b>b)Arbitration:</b> Introduction to Arbitrations as per Indian Arbitration &amp; Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator,</p>		
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**Text Books:** NIL

**References Books:**

- 1 Estimating and Costing, B.N.Dutta, 2002, S Dutta& Company
- 2 Estimating and Costing, M Chakraborty, 1992, Published by Author
- 3 Estimating and Costing, G S Birdie, 1988, DhanpatRai Publication
- 4 Contract and Estimates, B.S.Patil, 7th Edition, 2019

**E-Resources:**

Sr. No.	Link
1	<a href="https://dsr.emahapwd.com">https://dsr.emahapwd.com</a>

## PCC: (CE413): Construction Management

Teaching scheme	Evaluation scheme
Lectures: 3 hours/week	CIA : 20 Marks In-Sem Exam : 30 Marks End Sem Exam : 50 Marks
Credits: 03	Total: 100 Marks

**Prerequisite Course:** Project management

### Course Objectives:

Sr. No.	Course Objectives
1	To understand importance of construction management, scheduling and work study in construction industry.
2	To impart knowledge of labour laws, risk management and financial aspects of construction projects.
3	To enhance knowledge about construction equipment's management on site, this can be used effectively.
4	To impart knowledge of value engineering and human resource management on construction projects.

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

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Understand role of construction management in construction sector.	2	Understand
2	Demonstrate use of scheduling, Primavera software and work study in construction projects.	3	Apply
3	Use of labour laws and value engineering in an organization.	3	Apply
4	Categorize construction equipment's as per their use, output and efficiency.	4	Analyze
5	Analyze the opportunities for recruitment, training, career planning in human resource management	4	Analyze
6	Appraise project on the basis financial aspects of construction management.	5	Evaluate

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

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

## Course Contents

Unit No.	Unit Title	No. of Hours	COs
<b>I</b>	<p><b>Introduction to Construction Management:</b></p> <p>Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, role in economic development, construction management: necessity, applications, and project management consultants: role, types, selection and appointment process, project overruns and means to combat them, Project Management Book of Knowledge (PMBOK), Project management Institute and Certified Project Management Professionals (PMP).</p>	<b>06</b>	<b>1</b>
<b>II</b>	<p><b>Construction scheduling and Work study</b></p> <p>Definition, objectives, factors affecting scheduling, line of balance technique, project monitoring controlling. Work study (time and motion study): definition, objectives, process of method study, symbols, multiple activity charts, two handed process chart, string diagram, Use of Primavera software in scheduling.</p>	<b>06</b>	<b>2</b>
<b>III</b>	<p><b>Labour Laws and Value Engineering</b></p> <p>Need and importance of labour laws, study of some important labour laws associated with construction sector, workman's compensation act 1923, building and other construction workers act 1996, child labour act, interstate migrant workers act, the minimum wages act 1948.</p> <p>Value Engineering: meaning of value, types of value, value analysis, value engineering and its application.</p>	<b>06</b>	<b>3</b>
<b>IV</b>	<p><b>Construction Equipment's Management:</b></p> <p>Introduction to construction Equipment's- Identification, Planning of equipment, Factors affecting selection of equipment, Management of equipment's in Projects- Equipment/Plant efficiency calculation viz. Scrapper, Dozer and RMC Plant, Equipment cost – Operating cost, Cost Control of Equipment, Depreciation Analysis, Replacement of Equipment</p>	<b>06</b>	<b>4</b>
<b>V</b>	<p><b>Human Resource Management:</b></p> <p>Human resource: introduction, nature and scope of human resource</p>	<b>06</b>	<b>5</b>

	management, human resource in construction sector, human resource management process, human resource development process, recruitment & selection, training & development, career planning, human resources information systems, role of ERP in human resource management.		
<b>VI</b>	<b>Financial Management and Risk Management</b> Capital investments: importance of finance and terms used in finance, means of finance, working capital , project balance sheet, profit loss account statements, project cash flow projections and statements. Risk Management: introduction, principles, types of risk in construction, use of mathematical models: Break even analysis, decision tree analysis, risk identification, mitigation of project risks.	<b>06</b>	<b>6</b>
<b>Text Books</b>			
<ol style="list-style-type: none"> <li>1. Construction Management and Planning, B. Sengupta and H. Guha, 1<sup>st</sup> Edition [2004], Tata McGraw Hill Publications.</li> <li>2. Projects: Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, 6<sup>th</sup> Edition [2008], Tata McGraw Hill Publications.</li> <li>3. Construction Project Management: Theory and Practice, Kumar NeerajJha, 1<sup>st</sup> Edition [2011], Pearson Education India.</li> <li>4. Construction Engineering and Management, S. Seetharaman, 2<sup>nd</sup> Edition [2006], Umesh Publications, New Delhi.</li> </ol>			
<b>Reference Books</b>			
<ol style="list-style-type: none"> <li>1. Principles of Construction Management, Roy Pilcher, 2<sup>nd</sup> Edition [1976], McGraw Hill</li> <li>2. Human Resource Management, BiswajeetPattanayak, 3<sup>rd</sup> Edition [2005], Prentice Hall Publishers.</li> <li>3. Labour and Industrial Laws, S. N. Mishra, Classic Edition [2018], Central Law Pub.</li> <li>4. Construction Planning, Equipment, and Methods, R L Peurifoy, 7<sup>th</sup> Edition [2010], Tata McGraw Hill.</li> </ol>			
<b>e – Resources:</b>			
<ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/105106149">https://nptel.ac.in/courses/105106149</a></li> <li>2. <a href="https://www.pmi.org/pmbok-guide-standards/">https://www.pmi.org/pmbok-guide-standards/</a></li> <li>3. <a href="https://www.youtube.com/channel/UC35NsIdqUF3RPCM_J7djCYg">https://www.youtube.com/channel/UC35NsIdqUF3RPCM_J7djCYg</a></li> </ol>			

## Professional Elective –IV: CE414

### (PE414-a): Design of Earthquake Resistant Buildings

<b>Teaching Scheme</b> <b>Lectures: 03 Hrs. / Week</b>	<b>Evaluation Scheme</b> <b>CIA : 20 Marks</b> <b>In- Sem Exam : 30 Marks</b> <b>End - Sem Exam : 50 Mark</b>
<b>Credits: 03</b>	<b>Total: 100Marks</b>

**Prerequisite Course:** Engineering Mathematics, Design of Reinforced Concrete structures, Engineering Geology

#### Course Objectives:

1. To impart fundamental knowledge of earthquake engineering.
2. To impart knowledge of dynamic characteristics of buildings.
3. To study the codal provisions to analyze the earthquake resistant building.
4. To study the Seismic analysis & design of masonry buildings as per codal provisions.
5. To study the Seismic analysis & design of RC buildings as per codal provisions.
6. To introduce the concepts of ductile detailing and Seismic retrofitting techniques of buildings.

#### 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	Explain the fundamental knowledge of Earthquake Engineering.	2	Understanding
2	Apply knowledge of dynamic characteristics of buildings.	3	Applying
3	Apply the codal provisions to analyze the earthquake resistant building.	3	Applying
4	Seismic analysis & design of masonry buildings as per codal provisions.	4	Analyze
5	Seismic analysis & design of RC buildings as per codal provisions.	4	Analyze
6	Apply knowledge of ductile detailing and retrofitting techniques as per codal provisions.	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	PSO1	PSO2
CO1	2	3	1	--	---	2	1	1	1	1	--	2	2	2
CO2	2	1	3	--	--	2	1	1	1	1	--	2	2	2
CO3	2	3	1	1	--	2	1	1	1	2	--	2	2	2
CO4	2	3	3	1	--	2	1	1	1	2	--	2	2	2
CO5	2	3	3	1	--	2	1	1	1	2	--	2	2	2
CO6	2	2	2	1	--	2	1	1	1	2	--	2	2	2

## Course Contents

	Unit Title	No.of Hours	COs
<b>Unit-I</b>	<p><b>Element of Seismology:</b> Fundamentals of earthquake engineering, plate tectonics, Causes of earthquakes, types of earthquakes, important earthquake parameters such as magnitude, intensity and measurement, Seismic Zones in India, Seismic Effects on Structures, Concept of seismic load.</p>	06	1
<b>Unit-II</b>	<p><b>Dynamic Characteristics of Buildings:</b> Concepts of floor diaphragms and lateral load resisting systems, Importance of strength, stiffness, ductility and configuration, various structural irregularities, calculation of centre of mass, centre of stiffness and eccentricity. Undamped and damped Single Degree of Freedom System (SDOF), Equation of motion, Natural frequency, Logarithmic Decrement.</p>	06.	2
<b>Unit-III</b>	<p><b>Philosophy of earthquake resistant buildings:</b> Introduction to Indian seismic codes, seismic coefficient method-base shear and distribution among height, introduction to response spectrum and Time history analysis.</p>	06	3
<b>Unit-IV</b>	<p><b>Seismic analysis &amp; design of masonry buildings</b> Seismic detailing of masonry buildings as per IS: 4326, Provision of various types of bands and vertical reinforcements, Calculation for rigidity of masonry wall, Concept of lateral load analysis of masonry building.</p>	06	4
<b>Unit-V</b>	<p><b>Seismic analysis &amp; design of RC buildings</b> Effect of earthquake on reinforced concrete building, Design strategy and detailing, effect on beam-column joint, effect of soft storey and openings on stiffness of frame, short column behaviour and Shear wall concept and base isolation, Analysis of RC building using any suitable software.</p>	06	5
<b>Unit-VI</b>	<p><b>Ductile detailing and Introduction to retrofitting of structures</b> Importance of ductile detailing, capacity design concept, strong column weak beam theory, Concepts of ductile detailing and design of beams and columns as per IS: 13920:2016.</p>	06	6

	Retrofitting of Structures, Sources of weakness in framed buildings, Classification of retrofitting techniques, Conventional and non-conventional methods, Comparative study of various methods and case studies. IS code provisions for retrofitting of masonry structures, failure modes of masonry and RC structures and repairing techniques.		
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### Text Books:

1. P. Agarwal and M. Shrikhande – Earthquake Resistant Design of Structures, Prentice-Hall Publications. **ISBN-13: 978-8120328921**
2. Clough and Penzin – Dynamics of Structures, Mc-Graw Hills Publications. **ISBN-10: 0071132414; ISBN-13: 978-0071132411**
3. Jai Krishna, A.R. Chandrashekharan and B Chandra – Elements of Earthquake Engineering, South Asian Publishers Pvt. Ltd. **ISBN-108170031834 ISBN-10:8170031834**
4. S.K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press, New Delhi, 2007. **ISBN-13: 9780198083528**
5. C. V. R. Murty, “*Earthquake Tips*”, Indian Institute of Technology Kanpur and Building Materials and Technology Promotion Council, New Delhi.

### Reference Books

1. Vinod Hosur, ‘Earthquake Resistance Design of Building Structures’, Wiley India Pvt. Ltd. Publication, 1<sup>st</sup> Edition, 2013. **ISBN-13. 978-8126538591.**
2. Park, R. & Paulay, "Design of Reinforced Concrete Structure Elements", John Wiley & sons, 2009.
3. A. K. Chopra, “Dynamics of Structures: Theory and Applications to Earthquake Engineering”, Prentice-Hall of India, New Delhi, 1998. **ISBN-13:855214-2.**
4. Mario Paz, “Structural Dynamics - Theory and Computations”, Pearson Education. **ISBN-13: 9788131713297**

### IS Codes: (Use as per latest revision of IS codes)

1. IS 1893, “Criteria for Earthquake Resistant Design of Structures (Part 1): General Provisions and buildings”, Bureau of Indian Standard; New Delhi.
2. IS 13920, “Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces-Code of Practice”, Bureau of Indian Standard; New Delhi.
3. IS:4326 – Earthquake Resistant Design and Construction of Buildings – Code of Practice.
4. IS:13935 – Repair and Seismic Strengthening of Buildings – Guidelines.
5. IS:13828 – Improving Earthquake Resistance of Low Strength Masonry Buildings.
6. IS:13827 - Improving Earthquake Resistance of Earthen Buildings.
7. IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
8. SP 22 - Explanatory Handbook on Codes for Earthquake Engineering.

## PCC: (CE414-B): Solid Waste Management

<b>Teaching Scheme</b> Lectures: 03 Hrs. / Week	<b>Evaluation Scheme</b> CIA : 20 Marks In-Sem Exam: 30 Marks End-Sem Exam: 50 Marks
<b>Credits: 03</b>	<b>Total : 100 Marks</b>

**Prerequisite Course:** Environmental Engineering

### Course Objectives:

1.	To introduce the necessary knowledge about the functioning elements of municipal solid waste management and sanitary landfilling
2.	To enhance the knowledge of solid waste related environmental legislation and government initiatives

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

COs No	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Explain solid waste management systems in terms of their composition, rate of generation, sampling, and characteristics.	2	Understand
CO2	Select appropriate vehicle routes and sites for municipal solid waste storage and disposal.	3	Apply
CO3	Identify the suitable technique for processing municipal solid waste.	3	Apply
CO4	Identify feasible treatment and disposal options for leachate.	3	Apply
CO5	Select the suitable method of treatment and disposal for biomedical and hazardous waste.	4	Analyse
CO6	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.	Solid Waste Management	No. of Hours	COs
I	<b>Introduction to solid waste management:</b> 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	<b>Solid Waste Handling, Collection and Storage:</b> Waste handling and separation, waste storage at source, processing at source, <b>Collection of Solid Waste-</b> Primary collection, Secondary collection – Hauled container system, and stationary container system. Analysis of collection system, Collection routes, route balance. PS based VTMS <b>Transfer station:</b> Meaning, Necessity and types Location, Economic analysis, <b>Transportation of solid waste:</b> Means and Methods. Waste Transportation Model for Metropolitan cities.	06	2
III	<b>Processing of Municipal solid waste:</b> 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	<b>Disposal:</b> 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	<b>Special waste:</b> Construction and Demolition waste and its management, <b>Biomedical waste:</b> Definition, Sources, and generation of Biomedical waste, classification, and management technologies. <b>E-waste:</b> Treatment and disposal, <b>Hazardous waste:</b> Characteristics and	06	5

	types, Treatment and disposal methods of Hazardous waste.		
VI	<b>Municipal Solid Waste Management Rules:</b> 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 Swatchha Bharat Mission, Case Study of a city.	06	6
<b>Text Books</b>			
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., (1 <sup>st</sup> 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. (2 <sup>nd</sup> Edition, 1995), ISBN: 0130791873.		
4	<b><i>Jagbir Singh and Al Ramanathan</i></b> ,Solid Waste Management Present And Future Challenges, Dreamtech Press, (1 <sup>st</sup> Edition- Nov 2019)ISBN: 9789389447927		
<b>Reference Books</b>			
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," McGraw Hill Book Company, 1989, ISBN 0070692912, 9780070692916		
3	Tchobanoglous, G. and Kreith, F., HANDBOOK OF 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](https://onlinecourses.nptel.ac.in/noc22_ce82/course)

## PE: (PE414-C): Metro Construction Technology

<b>Teaching scheme</b>	<b>Examination scheme</b>
<b>Lectures: 3 hours/week</b>	<b>CIA : 20 Marks</b> <b>In-Sem Exam : 30 Marks</b> <b>End Sem Exam : 50 Marks</b>
<b>Credits: 03</b>	<b>Total: 100 Marks</b>

**Prerequisite Course: Geology, Geotechnical Engineering, Concrete Technology.**

### Course Objectives:

Sr. No.	Course Objectives
1	To impart knowledge of metro construction
2	To impart knowledge of fundamentals of railway construction.

### Course Outcomes:

Cos No.	Course Outcomes (COs)	Bloom's Taxonomy	
		Level	Descriptor
1	Demonstrate railway technology for metro projects	3	Apply
2	Analyze needs of metro construction project	4	Analyze
3	Prepare construction schedules and manage metro construction projects	3	Apply
4	Illustrate underground construction and tunnel boring technology	3	Apply
5	Adopt safety measures	3	Apply
6	Design precast concrete and Tunnel safety measures	5	Evaluate

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

## Course Contents

Unit No.	Unit Title	No. of Hours	COs
<b>I</b>	<p><b>METRO RAIL SYSTEMS, Metro acts and Codal Provisions</b></p> <p>Fundamentals of railway construction, terminology of railway and its components, Railway systems, Railway track construction, Components of railway track, Rail signaling, Introduction to electric supply for metro rail.</p> <p>a) Introduction of metro act, Report of Ministry of Urban Development on standardization of metro system</p> <p>b) Metro Policy 2017</p>	<b>06</b>	<b>1</b>
<b>II</b>	<p><b>FUNDAMENTALS OF METRO PROJECT</b></p> <p>Concept of rapid transit systems, requirements of rapid transit systems. types of rapid transit systems, concept of metro rail transit system, terminology of metro construction, advantages and disadvantages of metro, metro construction projects in India. Various organizations working for the development of metro rail transit system and vision of the governing bodies behind the development.</p>	<b>06</b>	<b>2</b>
<b>III</b>	<p><b>FUNDAMENTALS OF UNDERGROUND CONSTRUCTION</b></p> <p>Need for underground construction, fundamentals of underground constructions, planning for underground construction, site preparations, characteristics of soil and basics of geotechnical engineering,</p>	<b>06</b>	<b>3</b>
<b>IV</b>	<p><b>Underground Construction – Methods and Safety Provisions.</b></p> <p>Methods of underground construction, top-down construction method, bottom-up construction method, safety during underground construction, workers health and safety provisions, regulations of underground construction</p>	<b>06</b>	<b>4</b>
<b>V</b>	<p><b>TUNNEL CONSTRUCTION&amp; EQUIPMENTS</b></p> <p>Fundamentals theories of tunnel construction, types of tunnels, different cross-sections of underground tunnels, methods of tunnel boring, tunnel boring machine (TBM), parts of TBM, working procedure of TBM, procedure of tunnel construction using TBM, stations construction during tunnels, removal and</p>	<b>06</b>	<b>5</b>

	dumping of excavated materials		
<b>VI</b>	<p><b>USE OF PRECAST CONCRETE TECHNOLOGY IN METRO CONSTRUCTION, TUNNEL LIGHTING, VENTILATION AND SAFETY.</b></p> <p>Fundamentals of pre-cast concrete technology, Requirements of precast concrete elements in metro construction, Theories of formwork for precast concrete, curing of precast concrete, Admixtures and ingredients of precast concrete, Transportation of precast segments, Precast segments of tunnel, Precast bridge segments.</p> <p><b>Tunnel lighting, ventilation, and safety</b></p> <p>Tunnel lighting and types of tunnel lighting, spacing of lights, ventilation, methods of ventilation, permanent ventilation and noise pollution, dust control methods, pre drainage and dewatering in tunnels, permanent drainage, safety precautions in tunneling, health protection in tunnel construction</p>	<b>06</b>	<b>6</b>
<b>Text Books</b>			
K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015.			
<b>Reference Books</b>			
<p>1. MRamachandran, Metro Rail Projects in India: a Study in Project Planning, Oxford University Press, New Delhi, 2011.</p> <p>2. R K Goel, B Singh and J Zhao, Underground Infrastructures: Planning, Design and Construction, Butterworth-Heinemann, Oxford, 2012.</p> <p>3. S Chandra, Railway Engineering, Oxford University Press, New Delhi, 2008.</p> <p>4. K S Elliott, Precast Concrete Structures, CRC Press, Boca Raton, 2016.</p>			
<b>E Resources:</b> <a href="https://archive.nptel.ac.in/courses/105/105/105105212/">https://archive.nptel.ac.in/courses/105/105/105105212/</a>			



CO6	-	-	2	2	2	-	-	-	-	-	-	-	1	-
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## Course Contents

Unit No.	Topic	No. of Hours	Cos
I	<p><b>Introduction</b> Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures.</p> <p><b>Cracks in R.C. buildings</b> Various cracks in R.C. buildings, causes and effects</p> <p><b>Maintenance</b> Maintenance importance of maintenance, routine and preventive maintenance.</p> <p><b>Damage to masonry structures</b> Various damage to masonry structures and causes</p>	06	1
II	<p><b>Repair materials</b> Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials</p> <p><b>Special mortars and concretes</b> Polymer Concrete and Mortar, Quick setting compounds</p> <p><b>Grouting materials</b> Gas forming grouts, Sulfalumate grouts, Polymer grouts, Acrylate and Urethane grouts.</p> <p><b>Bonding agents</b> Latex emulsions, Epoxy bonding agents. <b>Protective coatings</b> Protective coatings for Concrete and Steel <b>FRP sheets</b></p>	06	2
III	<p><b>Damaged diagnosis and assessment</b> Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement</p> <p><b>Substrate preparation</b> Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcement steel cleaning</p>	06	3
IV	<p><b>Crack repair</b> Various method of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks.</p> <p><b>Corrosion of embedded steel in concrete</b> Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and column)</p> <p><b>Jacketing</b> Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing.</p> <p><b>Strengthening</b> Strengthening, Beam shear</p>	06	4

	strengthening, Flexural strengthening		
V	<p><b>Repair and Rehabilitation of Structures</b></p> <p>Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake-Transportation of Structures from one place to other – Structural Health Monitoring- demolition techniques-Engineered demolition methods- Case studies</p> <p><b>Seismic retrofit of concrete structures</b> :Local &amp; global deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures</p>	06	5
VI	<p><b>Materials for Repair:</b> concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferrocement, Fiber reinforced concrete. FRP wrap. Numerical problems on strengthening of concrete structures using above materials &amp; techniques.</p>	06	6

#### **TEXTBOOKS:**

1. Repair and protection of concrete structures by Noel P. Mailvaganam, CRC Press, 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. Dodge Woodson. R Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012.

#### **REFERENCE BOOKS:**

1. Failures and repair of concrete structures by S. Champion, John Wiley and Sons, 1961.
2. Diagnosis and treatment of structures in distress by R.N. Raikar Published by R&D Centre of Structural Designers and Consultants Pvt. Ltd, Mumbai.
3. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.
4. Handbook on seismic retrofit of buildings, A. Chakrabarti et al., Narosa Publishing House, 2010.



**PCC: (CE415): Highway Engineering Lab**

<b>Teaching scheme</b>	<b>Evaluation scheme</b>
<b>Practical:</b> 2 hours/week	<b>Term Work:</b> 50 Marks
<b>Credits:</b> 01	<b>Total:</b> 50 Marks

**Prerequisite Course:** Concrete Technology and material testing procedures

**Course Objectives:**

- To learn the principles and procedures of testing of coarse aggregates.
- To learn the principles and procedures of testing of bitumen bituminous mixes.
- 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.	4	Analyze
2	Perform the various tests and identify the suitability of bitumen for the road construction purposes.	5	Evaluating
3	Suggest the good quality materials like aggregate, bitumen and various mixes used for road constructions with sustainable solutions.	5	Creating

**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)
	<b>A) TEST ON AGGREGATES</b>
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>B) TEST ON BITUMEN</b>
5	Penetration Test
6	Ductility Test
7	Viscosity Test (Tar Viscometer)
8	Softening Point, Flash and Fire Point
9	Specific Gravity Test
	<b>C) TESTS ON BITUMINOUS CONCRETE MIXES</b>
10	Marshall Stability Test
11	Bitumen Extraction Test or Stripping value Test
	<b>D) SITE VISITS (ANY ONE VISIT MANDATORY)</b>
12	Visit to road under construction State highway or National Highway OR MDR (Nearby area)
13	Visit to Crushing and Hot mix Plant
	<b>E) ASSIGNMENT ON SOFTWARE</b>
14	Pavement analysis and design using IIT PAVE software

**Text Books:**

1.Highway Engineering – S.K. Khanna, C.E.G. Justo & A. Veeraragavan, Nem Chand and Brothers, Roorkee.

2.Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat).

**I.S. Codes and Testing Manual:**

3. Indian Standard Specifications for Course and Fine Aggregate from Natural Sources for Concrete, IS: 383, I.S. 1201 TO 1220-1978, IS 2386 PART I to V, Indian Standards Institution.

4. I.R.C. 58, IRC37 3. Specifications for Road and Bridge works (MORTH)-IRC, New Delhi.

5. S.K. Khanna, C.E.G. Justo, Highway Material Testing Laboratory Manual, Nem Chand & Bros., Roorkee.

6. MORTH (Ministry of Road Transport and Highway ) Code latest revision, Govt. of India

## PCC: (CE416): Quantity Survey, Contracts and Tenders Lab

<b>Teaching scheme</b>	<b>Examination scheme</b>
<b>Practical:</b> 2 hours/week	<b>Oral:</b> 50 Marks
<b>Credits:</b> 01	<b>Total:</b> 50 Marks

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

### Course Objectives:

1. To perform the procedure of taking out quantities of various items of work for load bearing and RCC framed structure.
2. To analyze the rate of items, and drafting specification of items of works.
3. To carry out the valuation of existing building in consultation with registered valuer.
4. To execute the procedure of tendering and draft condition of contracts.

**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	Perform all operations leading to quantity evaluation and estimate of the proposed Civil Engineering works using District Schedule of Rates.	5	Evaluate
2	Draft specifications and perform the work according to it, analyze rates of items of works and prepare bar bending schedule for different RCC elements.	5	Evaluate
3	Execute tendering procedures, to decide the genuine contractor for particular work and perform valuation of a property.	4	Analyse

### Mapping of COs with POs/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

### Term Work:

**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 by preparing bar bending schedule.
5. Working out rate analysis for the items as in the specifications of Assignment No. 2 using appropriate software.
6. Estimating quantities for any one of the following using appropriate software.
  - a) A Factory Shed of Steel Frame
  - b) Underground Water Tank
  - c) Pipe Culvert
  - d) Road / Railway Track/ Runway
7. Preparation of valuation report of existing building using O-1 Form.
- 8 A. Drafting of tender notice, Preparation of Schedule A & B and Conditions of Contract: regarding time, labor payment, damages for RCC Framed Structure (Assignment No. 3) and collecting minimum of 3 tender notices of Civil Engineering Works.  
B. Drafting a detail procedure of E-tendering

**Oral Examination: Based on the Term Work.**

**Text Books:** NIL

**References Books:**

1. Estimating and Costing, B. N. Dutta, 2002, S Dutta & Company
2. Estimating and Costing, M Chakraborty, 1992, Published by Author
3. Estimating and Costing, G S Birdie, 1988, DhanpatRai Publication
4. Contract and Estimates, B. S. Patil, 7th Edition, 2019

**e-Resources:**

<b>Sr. No.</b>	<b>Link</b>
1	<a href="https://dsr.emahapwd.com">https://dsr.emahapwd.com</a>

## PCC: (CE417): Project Stage II Lab

<b>Teaching scheme:</b>	<b>Evaluation scheme:</b>
<b>Practical:</b> 8 hours/week	<b>Oral:</b> 50 Marks
<b>Credits:</b> 04	<b>Term Work:</b> 100
	<b>Total:</b> 150 Marks

**Prerequisite Course:** Knowledge of all BTech subjects from I<sup>st</sup> to VIII<sup>th</sup> semester, Computer Basics, MS office, Project stage-I

### 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 engineering solutions using the latest technology.
6. To present the use of project topic for society, civil engg. Field and helps for sustainable development.

**Course Outcomes (COs):** On the successful completion of the project work student 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.	5	Analyse

CO4	Design, develop, and analyze civil engineering structures through proper scheduling.	4	Evaluate
CO5	Identify social problems and provide viable / sustainable engineering solutions for development of society.	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	---	---	2	--
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 Stage-II Guidelines:

Project Work will be evaluated for an individual student based on the presentation of the work done in a year [**Project Stage-I** (Sem-I) + **Project Stage-II** (Sem-II)] and submission of the report. The project work shall consist of any one of the following demanding area in Civil Engineering related subjects.

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.

It is recommended to promote the students to present a paper based on project work in appropriate conference / journal.

**II. Evaluation of Project work:** Evaluation of Project work in final exam will be done by the pair of experienced internal guide and external Examiner.

**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: Paper presented / Published on project work in appropriate conference / journal.

**III. Format of project report:** The report shall contain finalization of topic, literature survey, objectives based on the gaps identified, methodology to be used, planning schedule / flow chart for completion of project. The report must be printed and submitted in **black color hard bound** with front page embossed. The report must be submitted as 2 Copies (1 College + 1 Guide) + each individual copy of student.

**IV. Sequence of 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

**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 standards of international journals of professional body).**

**V. Report printing details:**

**Report shall be typed on A4 size Executive Bond paper with 1.5 spacing preferably on both the sides of paper.**

**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 & Type:**

- a. **Chapter Number and Name** - 14 Font size, Times New Roman in **Capital Bold Letters**.
- b. **Main Titles (1.1, 2.5 etc)** - 12 Font size, Times New Roman in **Bold Capital Letters**.
- c. **Sub Titles (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, **Bold** Times New Roman **sentence case** below the figure.
- 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 below the figure.
- e. **Table & Table title** - **Table should be at** Centre of page and **Table title should be at** centre of page Above the Table.



## Mandatory Course: (MC418): Energy Studies

<b>Teaching Scheme:</b>  Lectures: 1 Hrs./Week	<b>Evaluation Scheme:</b> CIA: -- Marks In-Sem Exam : -- Marks End Sem Exam: -- Marks
Credits: Non Credit (00)	Total: -- Marks

**Prerequisite Course:** Energy Sources, Energy Conversion, Energy Policy

### Course Objectives:

To achieve and maintain optimum energy procurement and utilization, throughout the organization.
To apply modern energy generation in techniques in civil engineering.
To minimize environmental effects by sustainable energy management and audit.

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

Co No.	Course Outcomes(COs)	Bloom's Taxonomy	
		Level	Descriptor
1.	Understand the advanced engineering in renewable and modern energy and its procurement.	2	Understand
2.	Use of the Modern energy sources in civil engineering.	3	Apply
3.	Analyze the application of energy management & audit in conservation of energy.	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	PSO3
CO1	2	1	1	--	2	2	3	2	--	--	2	2	1	2	1
CO3	2	2	2	--	3	2	3	2	--	--	2	2	1	2	1

<b>CO2</b>	2	1	1	1	1	2	3	2	2	1	2	2	2	2	1
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## Course Contents

Unit No	Topic	No of Hrs	COs
I	<b>Introduction to energy studies-</b> Introduction, Energy science and Technology, Advanced engineering in renewable energy, Conventional Energy Resources, Non-Conventional Energy Resources, Roles and responsibility of Govt. to promote new and non-conventional Energy Sources, Needs of renewable energy.	2	1
II	<b>Alternative Energy Sources</b> - Definition, need, types, sources and application of -Solar Energy, wind energy, Geothermal energy, Bio energy, Green hydrogen energy, Ethanol energy.	2	2
III	<b>Energy Management &amp; Audit-</b> Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments. public involvement to save energy, GRIHA criteria's for building energy.	2	3

### Text Books:

1. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, Wiley Eastern, 2005.
2. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.
3. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.

### Reference Books:

1. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.
2. TEDDY Year Book, the Energy Research Institute (TERI), 2011.
3. International Energy Outlook, EIA Annual Publication, 2011

### e-Resources:

1. <https://nptel.ac.in/courses/103103206>