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- 2020 PATTERN

## SECOND YEAR B. Tech

## Semester-III and IV

## 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 Second Year Civil Engineering Program Curriculum Structure and Syllabus for semester III & IV of Pattern 2020 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 | Director |
| Dr.A.B.Pawar | Dr.A.G.Thakur |

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- 2020 PATTERN**

## 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 Sprit through field study, expert talk etc. The department also, provides an opportunity to learn software like AUTOCAD, REVIT ARCHITECTURE, STAD- PRO, ETAB, MS-PROJECT etc. to make our students more digitalized.

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

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

# Civil Engineering Department

## VISION

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

## MISSION

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

## Program Educational Objectives: (PEOs)

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

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

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

## Program Outcomes (POs):

**Engineering Graduates will be able to:**

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

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

## Program Specific outcomes: (PSOs)

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

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

# COURSE STRUCTURE and SYLLABUS- 2020 PATTERN

## SECOND YEAR B. TECH., SEM-I

(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-III**

| Cat | Code | Course Title | Hrs./Week | | | Credits | Evaluation Scheme-Marks | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Theory | | | OR | PR | TW | Total |
| | | | | | | | ISE | ESE | CIA | | | | |
| BSC | BS202 | Engineering Mathematics-III | 3 | 1 | - | 4 | 30 | 50 | 20 | - | - | - | 100 |
| PCC | CE201 | Solid Mechanics | 3 | - | - | 3 | 30 | 50 | 20 | - | - | - | 100 |
| PCC | CE203 | Surveying | 3 | - | - | 3 | 30 | 50 | 20 | - | - | - | 100 |
| PCC | CE204 | Building Technology and Materials | 3 | - | - | 3 | 30 | 50 | 20 | - | - | - | 100 |
| HSC | HS205 | Universal Human Values and Ethics | 3 | - | - | 3 | 30 | 50 | 20 | - | - | - | 100 |
| PCC | CE206 | Solid Mechanics Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| PCC | CE207 | Surveying Lab | - | - | 2 | 1 | - | - | - | - | 50 | - | 50 |
| PCC | CE208 | Building Technology and Basics of AUTO CAD Lab | - | - | 2 | 1 | - | - | - | - | - | 50 | 50 |
| PCC | CE209 | Building Technology and Basics of AUTO CAD Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| MLC | MC210 | Mandatory Course - III | 2 | - | - | No Credits | - | - | - | - | - | - | - |
| | | **Total** | **17** | **01** | **08** | **20** | **150** | **250** | **100** | **100** | **50** | **50** | **700** |

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

# COURSE STRUCTURE and SYLLABUS- 2020 PATTERN

## SECOND YEAR B. TECH., SEM-II

(W.e.f 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-IV

| Cat | Code | Course Title | Hrs./Week | | | Credits | Evaluation Scheme-Marks | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Theory | | | OR | PR | TW | Total |
| | | | | | | | ISE | ESE | CIA | | | | |
| PCC | CE211 | Programming in Civil Engineering | 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 | - | - | 1 | 15 | 25 | 10 | - | - | - | 50 |
| PCC | CE216 | Programming in Civil Engineering (Lab) | - | - | 2 | 1 | - | - | - | - | - | 50 | 50 |
| PCC | CE217 | Concrete Technology Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| PCC | CE218 | Geotechnical Engg. Lab | - | - | 2 | 1 | - | - | - | - | 50 | - | 50 |
| PCC | CE219 | Computer Aided Architectural building drawing Lab | - | - | 4 | 2 | - | - | - | 50 | - | - | 50 |
| PRJ | CE220 | Seminar | - | - | 4 | 2 | - | - | - | 50 | - | - | 50 |
| MLC | MC221 | Mandatory Course-IV | - | - | 2 | No Credits | - | - | - | - | - | - | - |
| | | **Total** | 14 | 1 | 16 | **22** | 135 | 225 | 90 | 150 | 50 | 50 | **700** |

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

## BSC (BS202): Engineering Mathematics-III

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

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

**Course Objectives:**

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

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

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

# COURSE CONTENTS

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

**Text Book(s):**


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

# SUBJECT: (CE201): SOLID MECHANICS

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 03 Hrs. / Week** | **In-Sem Exam : 30 Marks**<br>**End Sem Exam: 50 Mark**<br>**CIA : 20 Marks** |
| **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): At the end of the course students will able to:**

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

**Mapping of COs to POs & PSOs:**

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

## Course Contents

| Unit No | Unit Title | No.of Hours | COs |
|---|---|---|---|
| I | **Simple Stresses and Strain:** Hook's Law, Stress-Strain Diagram for elastic, plastic materials and brittle material, Idealized stress-strain diagram, Concept of axial stresses(compression, tension),strains(linear, lateral, shear and volumetric). Elastic constants and their relations Stresses and strains due to change in temperature. Stresses, strains and deformations in determinate structures. | 06 | 1 |
| II | **Shear Force and Bending Moment Diagram:** Concept of determinate and indeterminate beams, Concept of Shear Force and Bending Moment, Shear force and bending moment diagrams for simply supported and cantilever beams subjected to point loads, udl and uvl, Concept of Fixed Beam. | 06 | 2 |
| III | **Bending and Shear Stresses:** Stress due to Bending: theory of simple or pure bending, Bending stress distribution diagrams, Moment of Resistance 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 | **Torsion:** Torsion of circular shafts: theory of torsion, assumptions, derivation of torsion formula Stresses, strains and deformations in determinate and indeterminate shafts of hollow, solid section. Stresses, strains and deformations in determinate and indeterminate shafts of homogeneous and composite cross-sections subjected to twisting moments. | 06 | 4 |
| V | **Principal Stresses and Strains:** Principal stresses and strains: concept of principal planes and principal stresses, concept of normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses, Maximum shear stress, Combined effect of axial stress, bending moment Combined effect of shear and torsion, Theories of failure: maximum normal stress, Maximum shear stress, maximum strain theory. | 06 | 5 |
| VI | **Axially and Eccentrically Loaded Columns:** Axially loaded columns: concept of critical load and buckling, Euler's formula for buckling load with hinged ends, concept of equivalent length for various end conditions, Rankine's formula, safe load on column limitations of Euler's formula. Direct and bending stresses for eccentrically loaded short column. Uniaxial and bi-axial bending. Concept of core of section for solid, hollow and rectangular section. | 06 | 6 |

**Text Books:**

1. 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. 4th 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.5th 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.

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

# PCC: (CE203): Surveying

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

**Prerequisite Course: Nil**

**Course Objectives:**

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

**Course Outcomes (COs): At the end of the course students will 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 countering. | 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 | 3 | 1 | 1 | 2 | - | - | - | - | 3 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | - | - | - | - | 3 | 2 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 1 | 2 | 2 | - | - | - | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 2 | - | - | - | - | 3 | 2 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO6 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |

## Course Contents

| Unit-I | Unit Title | No.of Hrs | COs |
|---|---|---|---|
| I | **Compass and Plane Table Ssurveying:** Introduction, Principles of surveying, Plans and maps, concept of Scale, Chain Surveying, use of Pprismatic Ccompass, Bearing of lines, Local attraction, Magnetic declination.<br>Plane Table survey: Instrument and accessories for plane table survey, Orientation of plane table, advantages and disadvantages, Errors in plane table surveying, Mmethods of plane table survey: Radiation and Intersection. | 06 | 1 |
| II | **Measurement of Vertical Distances:** Introduction, Types of levelling, Types of bench marks, Booking and Reducing levels, Study and use of Auto level, Digital level and Laser level. Reciprocal levelling, profile levelling, Cross-sectioning and their applications. Curvature and refraction corrections. Contouring: Introduction, Ccharacteristics of Contours, Methods and Interpolation of Contouring, Application of contours. Introduction to Golden Surfer software. | 06 | 2 |
| III | **Theodolite Surveying:** 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.<br>Theodolite Traversing: Ccomputations 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 | **Tachometry:** 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 | **Curves:** Introduction, classification of curves, simple circular curves, Definitions and Notations. Linear and Angular methods, (Rankine's method of deflection angles). Numerical on simple circular curves, Transition curves: necessity and types. | 06 | 5 |
| VI | **Modern Surveying Techniques:** Total Station- Ffundamental 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. Subramanium 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 (CE204): Building Technology and Materials

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

**Prerequisite Course: Engineering Graphics**

**Prerequisite Course: Engineering Graphics**

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

**Course Outcomes (COs): At the end of the course students will 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 | **Introduction to Building Construction and Masonry:**<br>**a) Introduction to building construction**– definition, types of building as per National Building Code. Building components and their basic requirements i.e. substructure and superstructure requirements. Superstructure: Concept and advantages of load bearing and framed structure, Introduction to Prefabricated construction.<br>RCC framed structures. Substructure – shallow and deep foundations and their suitability, plinth filling and soling.<br>**b) Masonry**– Stone masonry: Principal terms, types of stone masonry. Brick masonry: Characteristics of good building bricks, IS specification and tests, classification of bricks. Brick work, types of bonds: English, Flemish, Header, Stretcher, construction procedure, supervision. | 06 | 1 |
| II | **Block Masonry and Form work**: **a) Block Masonry** – Cellular lightweight concrete blocks, Autoclaved Aerated Concrete (AAC), hollow blocks, cavity wall construction. Requirement of a good partition wall: wooden partition, Glass sheet partition wall. Composite masonry: types, advantages, applications, materials required and construction procedure.<br>b) **Form work: C**asting procedure for reinforced concrete columns, beams and slabs, curing methods, precast and pre-stressed concrete construction and joints in concrete work, Slip form work, underpinning, Scaffolding: purpose, types and suitability. | 06 | 2 |
| II | **Flooring and Roofing Materials:**<br>**a) Flooring and Flooring Materials –** Functional requirement of flooring, types of floor finishes and their suitability. Types of flooring.<br>**b) Roofing Materials –**Types of roofing materials, fixing details of roof covering and construction procedure. Roof construction: types and their suitability, method of construction, types of trusses.<br>Types of shell structure: dome, translation shells, space and frame structure: pneumatic structures and prefabricated structures. | 06 | 3 |
| IV | **Doors, Windows, Arches and Lintels:**<br>**a) Doors and Windows** – definition of technical terms, installation of doors and window frames and their size specifications, fixtures and fastenings. Types of doors and windows. Ventilators: purpose and types.<br>**b) Arches and Lintels** – principle of arch action, types of arches, method of arch construction, centering and removal of centering. Lintels: necessity and types, chajja or weather shade necessity and types. | 06 | 4 |
| V | **Vertical Circulation and Protective Coatings:**<br>**a) Vertical Circulation** – Consideration in planning, design of staircase and types of staircase. Details and types of ramps, ladders, lifts, and escalator.<br>**b) Protective Coatings** – plastering types: lime plaster, cement plaster, gypsum plaster, textured plaster and their application. Pointing: purpose and types. Mortar preparation and types. Painting and varnishing, types and application. | 06 | 5 |
| VI | **Miscellaneous Materials and Green Building:**<br>**a) Miscellaneous Materials –** Properties, types and uses of following materials: lime, gypsum and glazed wares, Timber, aluminium, stainless steel, fibrous, laminated, particulate, glass claddings, aluminium composite panel | 06 | 6 |

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

**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

# HSC (HS205): UNIVERSAL HUMAN VALUES AND ETHICS

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

**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 staring from self and going towards family, society and nature. |
| 5 | To make the students aware about the correlation between engineering ethics and social experimentation in various situations. |
| 6 | To highlight the importance of professional ethics in the wake of global realities. |

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

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

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

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

## Course Contents

| Unit No | Unit Title | No.of Hrs | COs |
|---|---|---|---|
| I | **Introduction to Value Education:** Values, Morals and Ethics; Concept and need of value education; Self-exploration as the process for value education; Guidelines for value education; Basic human aspirations and their fulfillment | 06 | 1 |
| II | **Harmony in Human Being** : Human being as the coexistence of self and the body; Discrimination between the needs of the self and the body; The body as an instrument; Harmony in the self; Harmony of the self with the body | 06. | 2 |
| III | **Harmony in the family, Society and Nature:** Harmony in the family- The basic unit of human interaction; Values in the human to human relationship; Harmony in the society; Vision for the universal human order; Harmony in the nature; Realizing existence as coexistence at all levels | 06 | 3 |
| IV | **Professional Ethics** : Natural acceptance of human values; Definitiveness of ethical human conduct; Humanistic education and universal human order; Competence in professional ethics; Transition towards value-based life and profession | 06 | 4 |
| V | **Engineering Ethics and Social Experimentation** : Need of engineering ethics; Senses of engineering ethics; Variety of moral issues; Moral autonomy; Utilitarianism; Engineering as experimentation; Engineers as responsible experimenters; Codes of ethics | 06 | 5 |
| VI | **Global Issues**: Globalization and multi-national corporations; Cross-cultural issues; Business ethics; Environmental ethics; Computer ethics; Bio-ethics; Ethics in research; Intellectual property rights and plagiarism | 06 | 6 |

**Text Books:**


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


**Reference Books**


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

# SUBJECT: (CE206): SOLID MECHANICS LAB

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

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

| Sr. No. | Course Objectives |
|---|---|
| 1 | Students will know the various material testing methods. |
| 2 | Students will test bricks, tiles, timber and metal samples as per I.S. specifications method. |
| 3 | Students will able to identify the quality of material and can select suitable material for construction. |

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

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

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

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

**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: (CE207): Surveying Lab

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

**Prerequisite Course: Nil**

**Course Objectives:**

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

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

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

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

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

## List of Laboratory Work:

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

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

3. Plane table survey by radiation and Intersection method.

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

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

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

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

8. Determination of coordinates of the traverse using GPS

**a) Project I:** Road project using Auto level for a minimum length of 500 m including fixing of Alignment with at least one circular curve, Profile levelling, Cross-sectioning, Plotting of L-Section and Cross Section.

**b) Project II:** Traversing using a total station.

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

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

| Teaching Scheme<br>**Practical: 04 Hrs./ Week** | Examination Scheme<br>**Term work: 50 Marks** |
|---|---|
| **Credits: 02** | **Total: 50 Marks** |

**Prerequisite Course: Engineering Graphics**

## Course Objectives:

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

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

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

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

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

**List of Practical:**

It shall consist of the following exercises.

A) Measurement drawing exercise of a residential building (G+1)
Draw a detailed plan, elevation and section using suitable scale on same sheet.
Following sketches pertaining to the above plan (with Standard Dimensions).
a. Door- Panelled door b. Window c. Stair

B) Draw sketches using AutoCAD of the following:
1. Details of the shallow footings.
2. Details of arch showing different components

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

D) Site visits and technical report on the visit.
1. Site visit based on existing residential building (G+1) as noted in part A above.
2. Any on-going construction site (visit report should contain: details of the project, stage of construction, sketches of components with cross section and dimensions, materials used and site plan, etc.).

E) Detailed report on basics of AutoCAD.

F) Market survey of various construction materials and tools.

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

# PCC: (CE209): Building Technology and Basics of AutoCAD Lab

| Teaching Scheme<br>**Practical: 04 Hrs./ Week** | Examination Scheme<br>**Oral Exam: 50 Marks** |
|---|---|
| **Credits: 02** | **Total: 50 Marks** |

**Prerequisite Course: Engineering Graphics**

**Course Objectives:**

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

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

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

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

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

**List of Practical:**

It shall consist of the following exercises.

A) Measurement drawing exercise of a residential building (G+1)
Draw a detailed plan, elevation and section using suitable scale on same sheet.
Following sketches pertaining to the above plan (with Standard Dimensions).
b. Door- Panelled door b. Window c. Stair

B) Draw sketches using AutoCAD of the following:
3. Details of the shallow footings.
4. 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.
3. Site visit based on existing residential building (G+1) as noted in part A above.
4. 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.).

G) Detailed report on basics of AutoCAD.

H) Market survey of various construction materials and tools.

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

# MLC: (CE210): Mandatory Course – III

## Constitution of India

| Teaching Scheme<br>Lectures: 02 Hrs. / Week | Examination Scheme<br>Audit Course |
|---|---|

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

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

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

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

## COURSE CONTENTS

| Unit No. | Unit Title | No. of Hrs. | COs |
|---|---|---|---|
| I | **Introduction to Constitution of India**<br>a. Historical background b. Salient features c. Preamble of constitution | 07 | 1 |
| II | **Fundamental rights**<br>a. Features of fundamental rights<br>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 | **(A) Directive principle of state policy:**<br>a. Features of directive principle<br>b. Classification of directive principle<br>c. Criticism of directive principle<br>d. Utility of directive principle<br>e. Conflict between Fundamental rights and directive principle<br>**(B) Fundamental duties:**<br>a. List of fundamental duties<br>b. Features of fundamental duties<br>c. Criticism of fundamental duties<br>d. Significance of fundamental duties<br>e. Swaran Singh Committee Recommendations | 05 | 3 |
| IV | **System of Government**<br>a. Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system<br>b. Federal system: Federal features of constitution, unitary features of constitution<br>c. Centre and state relation: Legislative relation, administrative relations and financial relation.<br>d. Emergency provision: National emergency, Financial emergency and criticism of emergency provision | 05 | 4 |
| V | **Central government**<br>a. President: Election of president, powers and functions of president, and Veto power of president<br>b. Vice-president: Election of vice-president, powers and functions of vice-president<br>c. Prime minister: Appointment of PM, powers and functions of PM, relationship with president<br>d. Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees<br>e. Parliament: Organization of parliament, composition of the two houses , duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament.<br>f. Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court | 05 | 5 |
| VI | **State government**<br>a. Governor: Appointment of governor, powers and functions of governor, constitutional position<br>b. Chief minister: Appointment of CM, powers and functions of CM, relationship with governor<br>c. State council of ministers: Appointment of ministers, responsibility of ministers, cabinet.<br>d. High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC<br>e. Sub-ordinate court: Structure and jurisdiction, LokAdalats, Family court, Gram Nyayalayas | 05 | 6 |

**Reference Books**


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

# (CE211): Programming in Civil Engineering

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

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

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

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

| CO No. | Course Outcomes (COs): | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| **CO1** | To understand the basics of Python Programming | 2 | Understand |
| **CO2** | To understand the different types variables and data types. | 2 | Understand |
| **CO3** | To use Python data structures: lists, tuples, dictionaries. | 3 | Apply |
| **CO4** | To apply different operators in Python Programming. | 3 | Apply |
| **CO5** | To create Python programs using conditionals and loops. | 6 | Create |
| **CO6** | To understand object oriented programming concept in python. | 2 | Understand |

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

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

## Course Contents

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

**Text Books:**


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


**Reference Books**


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

# PCC: (CE212): Concrete Technology

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

**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): At the end of the course students will 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 |
|---|---|---|---|
| I | **Ingredients of Concrete:**<br>**Cement:** -Historical background, Manufacturing of Portland cement, Chemical composition, chemistry of cement Hydration, Classification and types of cement, Tests on cement.<br>**Aggregate**: - Classification, Mechanical and Physical properties, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial (crushed sand) and Recycled aggregate.<br>**Water**:-Mixing Water, Curing water. | 06 | 1 |
| II | **Admixtures and Additives in concrete:**<br>**Admixtures**: Functions, Classification, Types; Mineral and Chemical.<br>**Chemical Admixtures:** Plasticizers, Super plasticizers, Retarders, Air entraining agents.<br>**Mineral Admixtures:** Fly ash, Silica Fume, GGBS, Rice husk ash, Metakeoline, etc., compatibility test,<br>**Fibres:** natural, artificial and Synthetic, etc. | 06 | 2 |
| III | **Properties of Fresh Concrete:**<br>**Workability:** Definition, Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete,<br>**Curing**: Methods of curing, Influence of temperature, Maturity rule, Steam curing. | 06 | 3 |
| IV | **Properties of Hardened Concrete:**<br>**Properties of concrete:**– General, Factors affecting strength, Micro cracking and stress strain relationship, Relation between tensile and compressive strength, modulus of elasticity, Poisson's Ratio.<br>**Non Destructive Testing**:- Rebound hammer, Ultra Sonic Pulse Velocity, Impact echo test, core test, Resonance frequency, Rebar locator**.** | 06 | 4 |
| V | **Concrete Mix Design:**<br>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.<br>Introduction to Performance based Mix design using artificial and natural sand. **(Site visit is recommended to learn this topic)** | 06 | 5 |
| VI | **Future Concretes and Durability:**<br>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.<br>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

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

**Prerequisite Course: Engineering Chemistry, Solid Mechanics, Mathematics**

## Course Objectives:

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

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

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

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Properties of Soil:** Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil. Soil structures and clay mineralogy | 08 | 1 |
| **II** | **Permeability and Seepage:** Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils, Seepage forces, Quick Sand Condition, Capillary Phenomena, and General flow equation. Flow Net, properties and application, Flow Net construction for flow under sheet pile and earthen dam. | 08 | 2 |
| **III** | **Compaction:** Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils. | 08 | 3 |
| **IV** | **Shear Strength of Soil:** Concept of Shear strength, Mohr's circle, Mohr-coulomb failure criteria, Effective stress concept. Peak and residual shear strength. Factors affecting shear strength. Thixotrophy and Sensitivity, Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test. | 08 | 4 |
| V | **a) Lateral Earth Pressure:** Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory.<br>**b) Stability of Slopes:** Slope classification, slope failure, modes of failure. Finite and Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method. | 08 | 5 |
| **VI** | **SOIL EXPLORATION AND BEARING CAPACITY:** Objectives and methods of explorations-Sampling and its design features, SPT, Cone penetration test and in-situ vane shear test, Bearing Capacity | 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
2. www.cdeep.iitb.ac.in/nptel

# PCC: (CE214): Analysis of Structures

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

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

**Course Objectives:**

| Sr. No | Course Objectives |
|---|---|
| 1 | To impart knowledge about Fundamental concept and various methods involved in the analysis of determinate structures. |
| 2 | To Apply the strain energy, Three moment theorem and Castigliano's first theorem. for statically indeterminate Beams and Frames. |
| 3 | To solve the problem of the influence line diagrams for the analysis of Beam and Truss under Moving load. |
| 4 | To Illustrate the problem of two and three hinged arches. |
| 5 | To analyze the problems in plastic analysis for determinate and indeterminate structures by limits state method. |

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

| COs No | Course Outcomes | Blooms Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Demonstrate the fundamental concepts of Structural Analysis; Apply the concept of moment area method, conjugate beam method and Castigliano's first theorem to determine slope and deflection of Determinate Beams. | **3** | **Understand Apply** |
| CO2 | Illustrate the strain energy method, Three moment theorem and Castigliano's first theorem for statically indeterminate Beams and Frames. | **3** | **Apply** |
| CO3 | Apply influence Line Diagrams for Beam under moving Loads. | **3** | **Apply** |
| CO4 | Apply influence Line Diagrams for Truss under moving Loads. | **3** | **Apply** |
| CO5 | Illustrate the problems two and three hinged arches. | **3** | **Apply** |
| CO6 | Analyze determinate and indeterminate structures problems in plastic analysis. | **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 | --- | --- | 2 | --- | --- | --- | --- | 2 | --- | --- | 1 | --- |
| CO2 | 2 | 3 | --- | 1 | 2 | --- | --- | --- | --- | 2 | --- | --- | 2 | --- |
| CO3 | 2 | 3 | --- | 1 | 2 | --- | --- | --- | --- | 2 | --- | --- | 2 | --- |
| CO4 | 2 | 3 | --- | 1 | 2 | --- | --- | --- | --- | 2 | --- | --- | 2 | --- |
| CO5 | 2 | 3 | --- | 1 | 2 | --- | --- | --- | --- | 2 | --- | --- | 2 | --- |
| CO6 | 2 | 3 | --- | 1 | 2 | --- | --- | --- | --- | 2 | --- | --- | 2 | --- |

## COURSE CONTENTS

| Unit No. | Unit Title | No.of Hrs | COs |
|---|---|---|---|
| I | **SLOPE AND DEFLECTION METHODS:** Introduction, Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy.<br>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 | **ANALYSIS OF INDETERMINATE BEAMS:** 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 | **INFLUENCE LINE DIAGRAM FOR BEAMS:** Basic concept, Muller: Breslau's principle, influence line diagram for reaction, shear and moment to simply supported and overhanging beams, application of influence line diagram to determine reaction, shear and moment in beams. | 06 | 3,4 |
| IV | **INFLUENCE LINE DIAGRAM FOR TRUSSES:** Influence line diagram for axial force in trusses, application of influence line diagram to determine of axial forces in the members of plane determinate trusses under dead load and Live load. | 06 | 3,4 |
| V | **ANALYSIS OF ARCHES :- THREE HINGED ARCHES -** 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.<br>**TWO HINGED ARCHES –** 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 | **PLASTIC ANALYSIS OF STRUCTURE:** 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.<br>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", 6th Edition, Pearson Education.2006 **ISBN: 9788131721414.**
2. C. S. Reddy, "Basic Structural Analysis", 3rd Edition, Tata McGraw Hill. 2010. **ISBN: 9780070702769.**
3. Devadoss Menon, Structural Analysis, 2nd 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.**

# (CE215): Computer Aided Architectural Building Drawing

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 1Hr/Week** | **In-Sem Exam : 15 Marks**<br>**End Sem Exam: 25 Marks**<br>**CIA : 10 Marks** |
| **Credits: 01** | **Total: 50 Marks** |

**Prerequisite Course:** Building Technology and Materials

**Course Objectives:**

| Sr. No. | Course Objectives |
|---|---|
| 1 | To understand necessity of Town planning, principles of planning, principles of architecture and bye-laws. |
| 2 | To study the planning for building services such as ventilation, noise and acoustics. |
| 3 | Analyze the available data and plan different types of structures considering futuristic need of a building. |

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

| COs | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| **1** | Apply use of principles of planning and principles of architectural Planning. | 2 | Understand |
| **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 | **Town Planning**: 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.<br>**Legal Aspects**: 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. | 06 | 1 |

| | | | |
|---|---|---|---|
| II | **Architectural Planning and Building bye laws**<br>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.<br>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. | 06 | 2,3 |

**Text Books:**

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.)
2. Building science and planning by Dr. S. V. Deodhar, Khanna Publishers.
3. Building Services Engineering by David V. Chadderton, sixth edition, London & New York.
4. Drawing for Civil Engineering by Jan A. Van Der Westhuizen

**Reference Books**

1. National Building Code (latest).
2. Building Design and construction by Frederick Merrit, Tata McGraw Hill.
3. Times Saver standards of Architectural Design Data by Callender, Tata McGaw Hill.
4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
5. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.
6. Maharashtra Real Estate Regulatory Authority Act.

**e-Resources :**

1. http://www.grihaindia.org/
2. http://new.usgbc.org/
3. http://www.hcd.ca.gov/hpd/green_build.pdf
4. http://ncict.net/Examples/Examples1.aspx
5. http://www.igbc.in/site/igbc

# (CE216): Programming in Civil Engineering (Lab)

| Teaching Scheme<br>Lectures: 02 Hrs. / Week | Examination Scheme<br>Term work: 50 Marks |
|---|---|
| Credits: 01 | Total: 50Marks |

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

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

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

| CO No. | Course Outcomes (COs): | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | To understand the basics of Python Programming | 2 | Understand |
| CO2 | To understand the different types variables and data types. | 2 | Understand |
| CO3 | To use Python data structures: lists, tuples, dictionaries. | 3 | Apply |

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

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

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

# PCC: (CE217): Concrete Technology Lab

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

| Sr. No | Course Objectives |
|---|---|
| 1 | To know the properties of various ingredients of concrete. |
| 2 | To learn the behaviour and properties of fresh concrete. |
| 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

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

**Course Objectives:**

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

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

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

**Mapping of COs with POs**

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

## List of Laboratory Experiments

1. Water content determination by any two methods a) Oven drying method, b) Infrared moisture method, c) calcium carbide method
2. Specific gravity determination by Pychnometer /density bottle
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of Consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) Core cutter b) Sand Replacement and c) Clod method
6. Determination of coefficient of permeability by a) Constant head and b) Variable head method.
7. Direct shear test.
8. Unconfined compression test.
9. Vane Shear test.
10. Standard Proctor test / Modified Proctor test.
11. Differential free swell test.
12. Triaxial test
13. Collection of sample soil investigation report for any construction project and write report about interpretation of index properties of soil.
14. Assignments on the following topics: a) Rebhann's and Cullman's graphical method for determination of earth pressure. b) Solution of problems on shear strength parameters using graph. c) Flow net construction for sheet pile or earthen dam.

# PCC: (CE219): Computer Aided Architectural Building Drawing Lab

| Teaching Scheme<br>**Practical: 04 Hrs./ Week** | Examination Scheme<br>**Oral: 50 Marks** |
|---|---|
| **Credits: 02** | **Total: 50 Marks** |

**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 COs with POs

| 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 | - |

## 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.

# PRJ: (CE220): Seminar

| Teaching Scheme<br>**Practical: 04 Hrs./ Week** | Examination Scheme<br>**Oral Exam: 50 Marks** |
|---|---|
| **Credits: 02** | **Total: 50 Marks** |

**Prerequisite Course:** Basic knowledge of Fundamentals in Civil Engineering

**Course Objectives:**

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

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

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

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

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

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

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

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

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

## MLC: (MC221): Mandatory Course –IV

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

| Teaching Scheme | Examination Scheme |
|---|---|
| **Lectures: 02 Hrs. / Week** | **Audit Course** |

**Course Objectives:**

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

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

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

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

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

## COURSE CONTENTS

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

Two types of activities may be undertaken under this

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

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

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

SANJIVANI RURAL EDUCATION SOCIETY'S

**SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603**

***(An Autonomous Institute Affiliated to SPPU Pune)***

# DEPARTMENT OF CIVIL ENGINEERING

## COURSE STRUCTURE

## and

## SYLLABUS- 2020 PATTERN

## SECOND YEAR B. Tech

## Semester-V and VI

## W.e.f June 2022

## Board of Studies in Civil Engineering, June 2022

# Sanjivani College of Engineering, Kopargaon

**(An Autonomous Institute affiliated to SPPU, Pune)**

## D E C L A R A T I O N

We, the Board of Studies (Civil Engineering), hereby declare that, we have designed the Curriculum of Third Year Civil Engineering Program Curriculum Structure and Syllabus for semester V & VI of Pattern 2020 w.e.f. from A.Y 2022-23 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

**Submitted by**

(Dr.M.V.Jadhav)

BoS Chairman

**Approved by**

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

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- 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 June 2025. Besides high quality teaching and instruction at UG, PG and Ph. D., the department is actively involved in basic and applied research and consultancy services. The department is providing quality technical and advisory support through consultancy to various private construction agencies, State Government, Central Government projects.

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

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

The Infrastructure development in India is growing at a faster rate and there are many career paths for civil engineers. Civil engineers are essential in government sector, public and private sector and Multinational companies, to build various mega projects like highways, Industrial

structures, smart cities, and reservoirs etc. The next decade will be most demanding and rewarding for Civil engineers.

## Civil Engineering Department

### VISION

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

### MISSION

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

## Program Educational Objectives: (PEOs)

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

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

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

## Program Outcomes (POs):

**Engineering Graduates will be able to:**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

## Program Specific outcomes: (PSOs)

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

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

## COURSE STRUCTURE and SYLLABUS- 2020 PATTERN

### THIRD YEAR B. TECH.

(W.e.f June 2022)

Board of Studies in Civil Engineering

| 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 | Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Theory | | | OR | PR | TW | Total |
| | | | | | | | CIA | ISE | ESE | | | | |
| PCC | CE301 | Design of Steel Structures | 4 | - | - | 4 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE302 | Fluid Mechanics | 4 | | - | 4 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE303 | Project Management and Economics | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE304 | Engineering Geology | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PEC | PE305 | Professional Elective-I | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE306 | Design of Steel Structures Lab | - | - | 2 | 1 | - | - | - | 50 | - | | 50 |
| PCC | CE307 | Fluid Mechanics Lab | - | - | 2 | 1 | - | - | - | 50 | | - | 50 |
| PCC | CE308 | Engineering Geology Lab | - | - | 2 | 1 | - | - | - | - | 50 | -- | 50 |
| PROJ | CE309 | Mini Project Based on Skill based credit course | - | - | 2 | 1 | | | - | | | 50 | 50 |
| MLC | MC310 | Mandatory Course-V: (Field Practices in Civil Engineering) | (1) | - | - | Non Credits | - | - | - | - | - | - | Pass / Fail |
| | | **Total** | **18** | **---** | **08** | **21** | **150** | **250** | **100** | **100** | **50** | **50** | **700** |

## Professional Elective- I : (PEC305)

I. **(PE305-a):** Advanced Analysis of Structures
II. **(PE305-b):** Advance Foundation Engineering
III. **(PE305-c):** Infrastructure Engineering and Construction Techniques
IV. **(PE305-d):** Sustainable Building Planning

## COURSE STRUCTURE and SYLLABUS- 2020 PATTERN

### THIRD YEAR B. TECH.

(W.e.f June 2022)

Board of Studies in Civil Engineering

| 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-VI

| Cat | Code | Course Title | Hrs./Week | | | Credits | Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Theory | | | OR | PR | TW | Total |
| | | | | | | | CIA | ISE | ESE | | | | |
| PCC | CE311 | Hydrology and Water Resource Engineering | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE312 | Design of Reinforced Concrete Structures | 4 | - | - | 4 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE313 | Advance Analysis of Structures | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PEC | PE314 | Professional Elective-II | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| HSMC | HS315 | Corporate Readiness | 2 | - | - | 2 | 50 | - | - | - | - | - | 50 |
| PRJ | PR316 | IPR and EDP | 2 | - | - | 2 | 20 | - | 20 | - | - | - | 50 |
| PCC | CE317 | Hydrology and Water Resource Engineering Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| PCC | CE318 | Design of Reinforced Concrete Structures Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| PEC | PE319 | Professional Elective-II (Lab) | - | - | 2 | 1 | - | - | - | - | - | 50 | 50 |
| PRJ | CE320 | Creational Activity | - | - | 2 | 1 | - | - | - | - | - | 50 | 50 |
| MLC | MC321 | Mandatory Course-VI: (Formwork in Constructions) | 1 | - | - | No Credits | - | - | - | - | - | - | Pass / Fail |
| | | **Total** | **18** | **-** | **08** | **21** | **120** | **230** | **150** | **100** | **-** | **100** | **700** |

| EC | PE314 | Professional Elective-II |
|---|---|---|

PE314-a: Water Treatment and Distribution

PE314-b: Hydraulics and Hydraulic Machinery

PE314-c Advanced Surveying

PE314-d: Advanced Concrete Technology

# PCC (CE301): Design of Steel Structures

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

| Unit No. | Topic | No. of Hours | Cos |
|---|---|---|---|
| I | **Introduction to steel structure and Design of Connection:** Grades, properties and use of structural steel, Types of steel structures, Role of the designer, Introduction and use of IS: 800-2007, IS: 808-1989, IS: 875 Parts I, II, III. Introduction to rolled steel sections, Limit state philosophy in design for strength and serviceability. Partial safety factor for load and resistance, Load combinations, Classification of cross section such as plastic, compact, semi-compact and slender. Design of Bolted connections, Bolt grade and types of Bolts, Design of staggered bolting, Welding, Types of welding, Design of welded Connections, Introduction to eccentric connections. | 08 | 1 |
| II | **Design of Tension Member**: Introduction to Tension members, Practical utility, Modes of failure, Cross sections used, Limit strength due to yielding, rupture and block shear. Design of tension member using single and double angle sections. Design of connection with gusset plate by bolting and welding. Introduction to different tensile structures. | 08 | 2 |
| III | **Design of Compression Members:** Introduction to compression members, Common cross sections, Effective length, Slenderness ratio, causes of failure, Buckling classification as per geometry of cross section, Buckling curves, Compression members in trusses and its design with single and double angles, Connections with gusset plate by bolts and welds. Design of axially loaded column using beam sections (I-sections). Introduction to tubular compression members. | 08 | 3 |
| IV | **Design of Bracing systems and Bases:** Introduction to lacing and battening, Necessity, Design of built-up column, Design of lacing and battening, Connection of lacing / battening with bolting and welding. Design of column bases such as slab base and gusseted base. Introduction to moment resistant bases (concept only). | 08 | 4 |
| V | **Design of Flexural members:** Introduction to flexural members, Types flexural members, Modes of failure, Design of laterally supported beams, | | 5 |

| | | | |
|---|---|---|---|
| | 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 | |
| **VI** | **Design of Industrial roof trusses:** Types of industrial trusses, Uses, Components parts, Assessment of dead load, live load and wind load using relevant I.S. codes, Various loads in combination, External and internal wind pressure coefficients, Design of purlin, Spacing of Purlins, Plan area, Design of different types of trusses used in industrial building, Drawing including the detailing of all the joints and supports. Introduction to light gauge structures, Introduction to trusses using box or hollow sections, Introduction to Pre-Engineering Building (PEB) structures. | 08 | 6 |

**Text Books:**


1. Design of Steel Structure by Limit State Method, by S.S. Bhavikatti S S, I.K. International Publishing House, 5th Edition, New Delhi.
2. Limit state design of Steel Structure by Ramchandra & V. Gehlot, 7th 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, 2nd Edition, 2016, New Edi. New Delhi.
2. Limit state design of steel structures by S. K. Duggal, Tata McGraw Hill, 3rd Edition, New Delhi.
3. Structural Design in Steel by Sarwar Alam Raz, New Age International Publishers. Ltd. 3rd Edition, 2019
4. Fundamentals of structural steel design M. L. Gambhir, Tata McGraw Hill Education Private limited, First Edition, New Delhi.
5. Design of Steel Structures by K. S. Sai Ram, Pearson Publication, 3rd Edition, New Delhi.
6. Limit State Design of Steel Structures by S. Kanthimathina - WILEY, Dream tech Press, 1st Edition, New Delhi

## Indian Standard Codes:

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

## e – Resources:

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

# PCC (CE302): Fluid Mechanics

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

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

**Course Objectives:**

| | |
|---|---|
| 1 | To learn and understand the physical properties of fluids and use of pressure measuring devices |
| 2 | To learn and understand the concept of hydrostatic law, buoyancy and its application |
| 3 | To study principles of continuity, momentum and energy as applied to fluid motion |
| 4 | To learn and understand the dimensional analysis for design of models |
| 5 | To learn and understand the fundamental design of pipe and pipe network analysis in terms of flow and losses |
| 6 | To understand the development of boundary layer |

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

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Understand the physical properties of fluids and the use of pressure measuring devices for pressure measurement | 2 | Understand |
| CO2 | Solve problems involving hydrostatic pressure and buoyancy forces | 4 | Analyze |
| CO3 | Examine Kinematics and Dynamics related to fluid flow conditions | 4 | Analyze |
| CO4 | Apply the principles of dimensional analysis using Buckingham's π theorem method | 3 | Apply |
| CO5 | Discover the major and minor losses in pipe flow | 4 | Analyze |
| CO6 | Examine the growth of the Boundary layer over a flat plate | 4 | Analyze |

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

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

## Course Contents

| Unit No | Topics | No. of Hrs. | COs |
|---|---|---|---|
| I | **a) Fluid Properties:** Introduction to fluid mechanics, Scope and importance, Fluid as a continuum, Physical properties of fluids, Newton's law of viscosity, Classification of fluids, Rheological diagram.<br>**b) Fluid Statics:** Pressure at a point, Equation of hydrostatics, Pascal's law, Types of pressure, Hydrostatic paradox, Pressure measuring devices and their applications, | 06 | 1 |
| II | **a) Hydrostatic forces on surfaces** - Concept of total pressure and centre of pressure, Total pressure on a horizontal, vertical and inclined plane surface, Total pressure on curved surfaces.<br>**b) Buoyancy:** Archimedes' principle, Concept of buoyancy, Metacenter, Equilibrium of floating and submerged bodies, Determination of metacentric height by analytical and experimental method. | 06 | 2 |
| III | **a) Fluid Kinematics:** Velocity and total acceleration of a fluid particle, Streamline, Path lines, Streak lines and Stream tubes, Open system and control volume analysis, Classification of fluid flow, Continuity equation for 3D flow in Cartesian coordinates, Velocity potential, Stream function, Concept of flow net.<br>**b) Dynamics:** Forces acting on the fluid in motion, Euler's equation of motion along the stream line, Bernoulli's equation (or energy equation) by integration of Euler's equation, Modified Bernoulli's equation, Measurement of discharge and velocity. | 06 | 3 |
| IV | **Dimensional Analysis:** Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using Buckingham's $\pi$ theorem method, Geometric, Kinematic and Dynamic similarity, Dimensionless parameters. | 06 | 4 |
| V | **Flow-through Pipes:** Major and Minor losses in pipe flow, Darcy – Weisbach equation for head loss due to friction in a pipe, Variation of | 06 | 5 |

| | | | |
|---|---|---|---|
| | friction factor for laminar flow and turbulent flow, Equivalent pipe and Pipe network analysis. | | |
| **VI** | **Boundary Layer Theory:** 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. | 06 | 6 |

**Text Books:**


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


**Reference Books:**


1. V. L. Streeter and E. B. Wylie, "Fluid Mechanics", 9th Edition, McGraw Hill Publications, New York, 2010. (ISBN – 10 : 0070625379)
2. P.N. Modi and S.M. Seth, "Hydraulics & Fluid Mechanics" 22nd Edition, Standard Book House, Unit of Rajsons Publications Pvt Ltd., 2019.
3. D. S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K.Katariya and Sons, New Delhi, 8th Edition, 2013. (ISBN-13: 978-9350143926)
4. Y. Cengel and J. Cimbala, "Fluid Mechanics", Tata McGraw Hill, New Delhi, 3rd edition, 2017. (ISBN-13: 978-9339204655)
5. S K Som, Gautam Biswas, S Chakraborty, "Introduction to Fluid Mechanics & Fluid Machines", 3rd 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:**

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

# PCC (CE303): Project Management and Economics

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

**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): At the end of the course students will 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 | Illustrate Planning, Scheduling, and Executin of Construction Projects using CPM, PERT | 3 | Apply |
| 3 | Interpret the activities of materials manager like purchasing, inventory analysis, and storage in a scientific manner, Managing the material using ABC, EOQ analysis. | 3 | Apply |
| 4 | Analyze the techniques for Project planning, scheduling and Execution Control. | 4 | Analyze |
| 5 | Distinguish principles of Economics used in Civil Engineering projects. | 4 | Analyze |
| 6 | Appraise a project alternative on the basis of methods of economics such as NPV, IRR, BCR, Payback period method. | 5 | Evaluate |

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Introduction to Management-** Significance, Objectives, Functions, Principles of Management, hierarchy of organization, People management skills such as conflict management and effective communication, Categories of Project, Project Failure, Project- Life cycle.<br>**Overview of Project Management**- 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 |
| II | **Project Planning & Scheduling-** 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 |
| III | **Material Management-** Objectives, Material classification and Material Codification, 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), Concept of Supply Chain Management (SCM), Quality Control- Defination, Necessity, applications in Material Management. | 06 | 3 |
| IV | **Project Monitoring and Control**-Project Monitoring- Methods-Updating and Earned Value, Network crashing, Resource Allocation and scheduling, Leveling and Smoothening, Construction Safety measures for Roads, Dams, Industrial/commercial buildings, disputes and resolution techniques | 06 | 4 |
| V | **Introduction to Project Economics-** 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, Foreign Direct Investment in | 06 | 5 |

| | | | |
|---|---|---|---|
| | Construction Projects. | | |
| **VI** | **Project Finance And Appraisal-** 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, [ISBN-10:9780198066903].
2. B. Sengupta and H. Guha, Construction Management and Planning, Tata McGraw Hill Publishing Company, New Delhi, 2021, *[*ISBN-10:0074623982*]*
3. S. Seetharaman, Construction Engineering and Management, Umesh Publications 5th Edition. [ ISBN-13:9789382533092]


**Reference Books:**


1. S C Sharma, S V Deodhar, Construction Engineering And Management, Khanna Publishing House, 1st Edition ,2019.[ ISBN- 9789386173980]
2. K N Jha, Construction Project Management: Theory and Practice, Pearson Education, New Delhi, 2015. [ISBN-13*:* 9788131732496]
3. K K Chitkara, Construction Project Management: Planning, Scheduling & Controlling, Tata McGraw - Hill Publishing Co. Ltd., New Delhi, 3rd Edition, 2014.[ ISBN: *9789339205447*]
4. P Chandra, Projects: Planning, Analysis, Selection, Financing, Implementation, and Review, Tata McGrawHill, New Delhi, 2017, [ ISBN 10: 9332902577]
5. R L Peurifoy, Construction Planning, Equipment, and Methods, Tata McGraw-Hill, New Delhi, 7 th edition, 2002 , [ ISBN-10. 9780070706996]


**e – Resources:**

1. https://nptel.ac.in/courses/105/102/105102199/
2. https://www.pmi.org/pmbok-guide-standards/
3. https://www.youtube.com/channel/UC35NsIdqUF3RPCM_J7djCYg

# PCC (CE304): Engineering Geology

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

**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): At the end of the course students will 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 | **Mineralogy and Petrology**<br>**Mineralogy** Introduction to subject, Scope and sub divisions, Rock forming minerals and their properties. Silicate & non silicate minerals<br>Primary and secondary minerals. Felsic and mafic minerals. Essential and accessory minerals<br>**Petrology-** Rock cycle and main divisions of rock.<br>**Igneous rocks-** Mineral composition Texture and structure of plutonic, Hypabyssal and volcanic rocks. Classification of igneous rock, study of common rocks.<br>**Sedimentary rocks-** Rock weathering, decomposition, Disintegration, Classification and Grain size Classification. Texture of secondary rocks, Features of shallow marine deposits, Study of common rocks and their Engineering. Applications.<br>**Metamorphic rocks:** Agents and types of metamorphism, Texture and Structure, Study of common rocks and their Engineering. Applications. | 06 | 1 |
| **II** | **Structural Geology and Tectonics**<br>**Structural geology**: Out crop ,Dip Strike, Conformable and unconformable series and over lap<br>**Fault** and their types, Inliers and outlier.<br>**Fold** and their types, Structural features resulted due to igneous intrusions.<br>Concordant and Discordant igneous intrusions, Joints and their types. Stratification and lamination, | 06 | 2 |

| | | | |
|---|---|---|---|
| | **Introduction to plate tectonics.** Plate boundaries.<br>Geological Maps, its interpretation and its applications in solving of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges. | | |
| **III** | **Preliminary Geological Studies.**<br>**Preliminary geological Investigations:** reconnaissance survey, Desk Study, surface and subsurface Geological Investigation: methods, significance and limitations. Techniques of correlation for surface and subsurface exploration, engineering significance of geological structures and relevant case studies.<br>**Geophysical Techniques:** Importance of geophysical methods, classification, principles of geophysical method by, Gravity, Magnetic, Electrical, and Seismic methods in prospecting economic ores, minerals and locating groundwater potential zones and thickness of overburden. | 06 | 3 |
| **IV** | **Role of Geology in Reservoirs, Dams and Tunneling**<br>**Geology of Dam site**, Preliminary geological work on dam sites ,case studies Types of dam<br>**Geology of Reservoir sites**, Physical properties and rock structure<br>Condition likely to cause leakage through reservoir rim. Reservoir Induced Seismicity R.I.S.<br>Importance of ground water studies and effect of rising the water table and case studies.<br>**Tunnelling,** Preliminary geological investigation for tunnels, Important geological consideration while choosing alignment. Suitability of common rock types for excavation and tunnelling, unlined tunnels and case studies. | 06 | 4 |
| **V** | **Geomorphology, Remote Sensing and G.I.S.**<br>**Geomorphology**: Geological action of river, Rejuvenation, Land forms resulted due to river, Land forms due to river deposition,<br>Application of Remote Sensing and GIS Techniques in Civil Engineering Projects –GPS (Global Positioning System) and its uses,<br>Remote sensing Satellites and their characteristics, GIS Spatial data models and data editing. Introduction to DEM (Digital Elevation Modelling) analysis. | 06 | 5 |

| | | | |
|---|---|---|---|
| **VI** | **Geological Hazards & Hydrogeology**<br>**Geological hazards**: Volcanism, Earthquakes and Seismic zones of India, Landslides and stability of hill slopes and preventive measures.<br>**Groundwater**: 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. | 06 | 6 |

**Text Books:**


1. K.V.G.K. Gokhale and D. M. Rao, "Geology and Engineering" 4th edition, Tata McGraw-Hill.2017
2. R.B. Gupte "Text Book of Engineering Geology" 7th Edition, P.V.G. Publications, Pune. 2015, ISBN 10: 0471034363.
3. N. Chenna Kesavulu "A Text Book of Engineering Geology" 2ndEdition, Mc –Millan India, 2010. ISBN 033392707


**References Books**


1. F.G.H. Blyth and M.H.deFreitas,"A Geology for Engineers" 7th Edition ElsevierScience, 2018 ISBN 9780415502917
2. F. G. Bell, "Fundamentals of Engineering Geology", 2nd edition, BS Publications, 2005. ISBN 9780408011693,
3. D. P. Krynine & W. R. Judd "Principles of Engineering Geology and Geotechniques", 4th 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
2. Free online course-swayam-https//swayam.gov.in

# Professional Elective- I : (PEC305)

1. **(PE305-a):** Advanced Analysis of Structures
2. **(PE305-b):** Advance Foundation Engineering
3. **(PE305-c):** Infrastructure Engineering and Construction Techniques
4. **(PE305-d):** Sustainable Building Planning

## PEC (PE305-a): Professional Elective-I): Advanced Analysis of Structures

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

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

**Course Objectives:**

| |
|---|
| 1. To analyze the statically Determinate and Indeterminate 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): At the end of the course students will able to:**

| **COs No.** | **Course Outcomes (COs)** | **Bloom's Taxonomy** | |
|---|---|---|---|
| | | **Level** | **Descriptor** |

| | | | |
|---|---|---|---|
| CO1 | Apply the Castigliano's first and second theorem to find deflection of determinate and indeterminate trusses. | **3** | **Apply** |
| CO2 | Apply slope deflection method to sketch Shear force and bending moment of statically Indeterminate Structures. | **3** | **Apply** |
| CO3 | Apply moment distribution method to sketch Shear force and bending moment of statically Indeterminate Structures. | **3** | **Apply** |
| CO4 | Apply Flexibility method to sketch Shear force and bending moment of statically Indeterminate Structures | **3** | **Apply** |
| CO5 | Apply stiffness method to sketch Shear force and bending moment of statically Indeterminate Structures | **4** | **Analyze** |
| CO6 | Analyze the multi-storeyed building frames by approximate methods. | **4** | **Analyze** |

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Analysis of pin jointed plane Trusses**: 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** | **Slope-Deflection Method:** 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** | **Moment Distribution Method:** 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** | **Flexibility Matrix Method:** 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** | **Stiffness Matrix Method:** 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 |
| **VI** | **Approximate Methods of Analysis:** Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed fames by substitute frame method, cantilever method and portal method. | 06 | 6 |

**Text Books:**


1. S. Ramamrutham and N. Narayan, “Theory of Structures”, 9th 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)”, 2nd edition Tata McGraw Hill Publishing Ltd.(2008), ISBN: 13:978-0070667358.
3. B.C.Punmia, Ashokkumar Jain and Arunkumar Jain, “Theory of Structures”, 13th Edition, Laxmi Publication. (2017), ISBN : 81-7008-618-3


**Reference Books:**

1. S.P. Timoshenko and Young D.H., "Theory of Structures", 2nd Edition Tata McGraw Hill. (2002) ISBN: 978-0070648685.
2. C K Wang, "Intermediate Structural Analysis", Tata McGraw-Hill Education Pvt. Ltd., (2014), ISBN 13: 9780070702493.
3. Gere and Weaver, "Matrix Analysis of Framed Structures", 2nd Edition CBS Publication Delhi,(1998) ,ISBN No. ISBN-13. 978-8123911519
4. Jain, A.K., "Advanced Structural Analysis",4th Edition, Nem Chand & Bros, Roorkee(2015), ISBN: 9788185240817.

**E – Resources:**

1. http://nptel.iitm.ac.in
2. https://onlinecourses.nptel.ac.in

## PEC (PE305-b): Professional Elective I-b): Advanced Foundation Engineering

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

**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): At the end of the course students will 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 | Analyze |
| 5 | Design of deep foundations as per the prevailing site conditions | 4 | Analyze |
| 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 | **Subsurface Investigations for Foundations:** Purpose -planning of subsurface exploration. Methods of Investigation: Trial pits, borings, depth and number of exploration holes, core recovery, RQD, Core Log. Geophysical methods– Seismic refraction and Electrical resistivity method. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field tests- SPT, N value correction and significance, DCPT, SCPT, Pressure meter test. | 06 | 1 |
| II | **Bearing capacity and Shallow Foundation:** Basic definitions, Modes of shear failure, bearing capacity analysis- Terzaghi, Hanson's, Meyerhof's, Skempton's, basic 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** | **a) Settlement and Consolidation Settlement: -** Introduction, Causes of settlement. Pressure bulb, Contact pressure, Significant Depth of foundation, Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, Consolidation settlement. Use of Plate Load test and SPT in settlement analysis.<br>**b) Consolidation** - Introduction, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- Square root of time fitting method and logarithm of time fitting method. Time factor. Introduction of Normal consolidation, over consolidation and Preconsolidation pressure. | 06 | 3 |
| **IV** | **Design of shallow foundations:** Shallow foundation- Types and Applications. Floating foundation,– Depth of Footing – Foundation loading – Principle of design of footings – Proportioning for equal settlement – Design of simple footing, combined footings, mat foundation, Numerical examples with codal Provisions for safety and serviceability. Introduction to STAAD foundation. | 06 | 4 |
| **V** | **Design of Deep foundations**: Introduction, Pile classification, Pile installation- Cast in-situ, driven and bored pile, Load carrying capacity of pile by static method, Dynamic methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action- Feld rule. Rigid Blocks method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition, Types and uses. Well foundation: components, sand Island method. | 06 | 5 |
| **VI** | **(a) Introduction to soil stabilization:** Mechanical Stabilization cement Stabilization – Lime Stabilization –Bituminous Stabilization – Chemical Stabilization– Stabilization by geosynthetics<br>**b) Foundation on Black Cotton Soils:** Characteristics, swelling potential and its evaluation methods, Engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed piles-Design principles and its construction Techniques. Stone Columns prefabricated vertical Drains, Preloading technique, and vibro flotation technique. | 06 | 6 |

**Text Books:**

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

**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 edition, 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. Practical Handbook of Grouting: Soil-Rock and Structures---James Warner-- Wiley 15. IS 1892, 1893, 2911, 6403, SP36 (PART-II)

## PEC (PE305-c): Professional Elective-I-c): Infrastructure Engineering & Construction Techniques

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

**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): At the end of the course students will 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 | 2 | Understand |

| | | | |
|---|---|---|---|
| | construction project. | | |
| **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 |

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| **I** | **Infrastructure:** 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** | **Railway:** Permanent way, Requirements and functions of basic components viz. Rails, Sleepers, Ballast, Formation. Super elevation, Equilibrium cant, Equilibrium speed, Maximum permissible limits for cant, Cant deficiency, Cant excess. Points, crossings & Turnouts, Concept of Negative cant, Railway Signals. | 06 | 2 |

| | | | |
|---|---|---|---|
| **III** | **Construction Techniques-** 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** | **Underground & Underwater construction-**<br>a) **Underground construction**- 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<br>b) **Underwater construction**- Underwater drilling, blasting, underwater concreting using Tremie method | 06 | 4 |
| **V** | **Docks & Harbors-** 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** | **Construction Equipment:** Operations, Applications and performance of dozers, excavators, graders, compactors, pavers, haulers, crawler, wheel tractors, power shovels, Cranes, hauling equipment, Concrete Pumps, Economic Maintenance and repair of construction Equipment, | 06 | 6 |

**Text Books:**


1. Satish Chandra and M. M. Agrawal, "Railway Engineering", Oxford University Press, 2nd edition, 2013, ISBN 13: 9780198083535, ISBN 10: 019808353X.
2. S.C Sharma, "Construction Equipment and its Management", Khanna Publication. 1st edition, 2014, ISBN: 978-81-7409-267-0
3. R. Srinivasan, "Harbour, Dock & Tunnel Engineering "28th edition, 2016, ISBN: 978-93-85039-19-5.


**Reference Books:**

1. Puerifoy, “Construction Planning Methods & Equipment”, Tata McGraw Hill. 7th edition, 2010, ISBN:**9780070706996,**
2. Chandra , “ Railway Engineering”, Oxford University Press, ISBN: **9780198083535,**
3. J. S. Mundrey , “ Railway Track Engineering” , Tata McGraw Hill, 5th edition, 2007,ISBN:0070680124
4. Hasmukh P. Oza & Gautam H. Oza , “ Dock & Harbour Engineering” , Charoter Book Stall, 8th edition, 2016, ISBN: 9789385039256.

**e – Resources:**

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

## PEC (PE305-d): (Professional Elective I-d): Sustainable Building Planning

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

**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): At the end of the course students will able to:**

| **COs No.** | **Course Outcomes (COs)** | **Bloom’s Taxonomy** | |
|---|---|---|---|
| | | **Level** | **Descriptor** |

| | | | |
|---|---|---|---|
| 1 | Explain environmental impact on buildings and its assessment. | 2 | Understand |
| 2 | Interpret sustainable building planning policies for implementation. | 2 | Understand |
| 3 | Apply modern architecture, green building concept and global practices. | 3 | Apply |
| 4 | Evaluate impact of urbanization on sustainability. | 4 | Analyzing |
| 5 | Apply modern eco-friendly material practices for national rating systems. | 3 | Apply |
| 6 | Explain energy conservation and its importance for urban sustainability. | 2 | Understand |

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Sustainable Development and Design:** Concept, perspectives, need, importance, Environmental impact. Concept of sustainable planning for building industry, past perspectives on planning, Planners role in sustainable building design. | 06 | 1 |
| **II** | **Ssustainable Building Policies:** Introduction to sustainable building policies, exploring implementation gaps, Environment protection, site planning, energy conservation concept, water use reduction, Rain water harvesting, solar system, indoor air quality, barriers to implementation of sustainable building measures, checklist for sustainability. | 06 | 2 |

| | | | |
|---|---|---|---|
| **III** | **Innovative Low Cost Building Material:** Innovative building material for rural and urban areas, Low Cost Infrastructure in rural Areas, Cost Cutting of housing Infrastructure, Green materials. | 06 | 3 |
| **IV** | **Urban Housing And Infrastructure:** Vernacular Architecture; Urban climate, effect of built environment, Impact of urbanization on sustainability, growth, issues related to sustainability. | 06 | 4 |
| V | **Green Buildings:** Concept, need, design principles, benefits, construction techniques, planning, and case studies of residential, commercial, and industrial buildings. Green building Evaluation Systems, LEED Certification, Green Globe Certification. | 06 | 5 |
| **VI** | **Building Performance Assessment:** Concept, tools at internationall-national level, process of green building certification, comparison of different tools like USGBC , LEED INDIA, GRIHA, IGBC, SB Tool etc. Recent researches on sustainable building development, assessment tools. | 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 maldova, 2018.
3. 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

## PCC (CE306): Design of Steel Structure Lab

| | |
|---|---|
| **Teaching Scheme**<br>**Practical: 02 Hrs./ Week** | **Evaluation Scheme:**<br>**Oral Exam : 50 Marks** |
| **Credits: 01** | **Total: 50 Marks** |

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

| CO | Course Outcomes (COs): | Bloom's Taxonomy |
|---|---|---|

| No. | | 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 (CE307): Fluid Mechanics Lab

| Teaching Scheme<br>Practical : 02 Hrs / Week | Evaluation Scheme:<br>Oral : 50 Marks |
|---|---|
| Credits: 01 | Total : 50 Marks |

**Prerequisites:** Physics, Engineering Mechanics and Mathematics

**Course Objectives:**

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

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

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

**Mapping of COs**

| CO No. | Bloom's Taxonomy | | | POs/PSOs |
|---|---|---|---|---|
| | Level | Descriptor | Knowledge Category | |
| CO1 | 3 | Apply | Conceptual, Procedural | PO1, PO2, PSO1 |
| CO2 | 3 | Apply | Conceptual, Procedural | PO1, PO4, PSO1, PSO2 |
| CO3 | 3 | Apply | Conceptual, Procedural | PO1, PO2, PO4, PSO1, PSO2 |
| CO4 | 4 | Analyse | Conceptual, Procedural | PO1-PO4, PSO1 |

**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 | - |
| CO2 | 3 | - | - | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO3 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | - |

Term work will consist of the detailed report on 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. Determination of friction factor for a pipe using any programming language.

**Text Books:**


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


**Reference Books:**


1. V. L. Streeter and E. B. Wylie, *"Fluid Mechanics"*, 9th Edition, McGraw Hill Publications, New York, 2010. (ISBN – 10 : 0070625379)
2. P.N. Modi and S.M. Seth, *"Hydraulics & Fluid Mechanics"* 22nd Edition, Standard Book House, Unit of Rajsons Publications Pvt Ltd., 2019.
3. D. S. Kumar, *"Fluid Mechanics and Fluid Power Engineering"*, S.K.Katariya and Sons, New Delhi, 8th Edition, 2013. (ISBN-13: 978-9350143926)
4. Y. Cengel and J. Cimbala, *"Fluid Mechanics"*, Tata McGraw Hill, New Delhi, 3rd edition, 2017. (ISBN-13: 978-9339204655)
5. S K Som, Gautam Biswas, S Chakraborty, *"Introduction to Fluid Mechanics & Fluid Machines"*, 3rd 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:**

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

# PCC (CE308): Engineering Geology Lab

| Teaching Scheme<br>**Practical: 02 Hrs./ Week** | **Evaluation Scheme:**<br>**Practical : 50 Marks** |
|---|---|
| **Credits: 01** | **Total: 50 Marks** |

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

| 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 (CE309): Mini Projects based on Skill Based Credit Course

| Teaching Scheme | Evaluation Scheme: |
|---|---|
| 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): At the end of the course students will 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 | **Preparing Global Data of Project and Project Data**<br>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** | **Preparing Project Plan and Monitoring and Controlling**<br><br>Different Types of Relationships**,** Assigning Relationship between Activities**,** Critical Path Analysis, Defining and Assigning Work Products and Documents, Customizing Timescale**,** Customizing Bars**,** Creating Baseline Project and Monitoring the project. | 06 | 2 |
| **III** | **Creating a Project Case study and Project Reporting**<br><br>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, 1st Edition
2. Prof. Sham Tickoo, "Exploring Oracle Primavera P6 version", BPB Publications, ISBN 9789388511292, 2nd 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 (Text Content)
2. www.youtube.com/Primavera P6 ( Videos and Tutorials)

# MLC (MC310): Mandatory Course -Field Practices in Civil Engineering

| Teaching Scheme<br>Lectures: 01 Hrs. / Week | Evaluation Scheme:<br>CIA : Nil |
|---|---|
| Credits: 00 | Total : Nil |

**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): At the end of the course students will 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 | **Site clearance and plinth construction:** Clearing the site considering sustainability, Plot demarcation, Stacking of materials on site. Excavation for foundation trenches considering site conditions, foundation, and refilling and plinth construction. (Note: Site visit is recommended) | 03 | 1,2 |
| II | **RCC Elements and Formwork:** Footing, Column, Beam and Slab-quality check of materials such as steel, cement, sand and Aggregates (only field tests), along with quality of Concrete and workmanship.<br>**Form work:** Types, component parts and installation as per design and specifications. Scaffolding and types. (Note: Site visit is recommended) | 03 | 1,2 |

| | | | |
|---|---|---|---|
| III | **Masonry and Flooring work:** Brick and block masonry- quality check and workmanship, Requirements of a good partition wall, Composite masonry, **Flooring-** Materials, Types and construction. (Note: Site visit is recommended) | 03 | 1,2 |
| IV | **Finishing works:** Plastering- Types, ground work and methods of execution. Coloring - Types, surface preparation and methods of application. (Note: Site visit is recommended) | 03 | 1,2 |

**Reference Books:**


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

## Semester-VI Syllabus

## (CE311): Hydrology and Water Resource Engineering

| **Teaching Scheme**<br>**Lectures: 03 Hrs. / Week** | **Evaluation Scheme:**<br>**CIA : 20 Marks**<br>**In - Sem Exam : 30 Marks**<br>**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 (COs): At the end of the course students will able to:**

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

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Introduction to Hydrology:** Hydrological cycle, Practical applications. Hydrological data- classification of data and sources. Introduction to Government organizations: IMD, CWPRS, MERI, HDUG, WALMI, NIH, CWC.<br>**Precipitation:** 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.<br>**Abstractions of Precipitation:** Interception, Depression storage, Evaporation: Concept, Factors affecting, measurement. Transpiration and Evapotranspiration: Process, measurement, Modified Penman method. Infiltration: Concept, Technical terms, Factors affecting, Measurement of infiltration, Horton's infiltration model, and Infiltration indices. | 06 | 1 |
| II | **Run-off:** Introduction, Catchment characteristics affecting the runoff, Rainfall-Runoff relationships and Empirical methods to determine runoff.<br>**Runoff hydrograph:** Introduction, Factors affecting flood hydrograph, Components of hydro-graph, Base flow separation and Effective rainfall. Unit hydrograph: Uses and Limitations of unit hydrograph, S-curve hydrograph and Concept of Synthetic unit hydrograph.<br>**Stream Gauging:** Selection of site, methods of discharge measurement and Stage discharge relationship. | 06 | 2 |
| III | **Floods:** 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.<br>**Hydrologic Flood Routing:** Introduction, Reservoir Routing and Channel Routing. Q-GIS software application in Hydrologic Studies- (Watershed Delineation). | 06 | 3 |
| IV | **Reservoir Planning:** Introduction, Term related to reservoir planning, Investigation for reservoir planning, Significance and applications of mass and | 06 | 4 |

| | | | |
|---|---|---|---|
| | demand curves, Fixation of 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. | | |
| **V** | **Introduction to Irrigation:** Definition, Necessity and Advantages. Methods of Irrigation. Piped distribution network for irrigation (PDN) - Concept, Advantages and Disadvantages of PDN over conventional canal distribution network.<br>**Water Requirements of Crops:** Soil moisture and Crop water relationship, Classes and availability of soil water, Factors governing Consumptive use of water, Principal Indian crops, Duty and delta. Irrigation water requirement: Design discharge of canal and Storage capacity of reservoir based on irrigation requirement.<br>**Assessment of Canal Revenue:** Introduction, Various methods of assessment | 06 | 5 |
| **VI** | **Ground Water Hydrology:** Occurrence and distribution of ground water. Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well and Numerical on design of well.<br>**Water logging and Drainage:** Causes, Effects, Preventive and curative measures of water logging, Land drainage and types, Reclamation of water logged areas, Alkaline and saline lands.<br>**Water Management:** Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Co- operative water distribution systems- Water Users Association (WUA). | 06 | 6 |

**Text Books:**


1. Irrigation Engineering and Hydraulic Structures- S. K. Garg, Khanna Publishers, New Delhi, 2011. (36th Edition). ISBN – 13: 978-81-7409-047-8.
2. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Laxmi Publications, 2021, (17th Edition), ISBN: 9788131807637.
3. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House, New Delhi, 2020. ISBN: 978-81-87401-29-0.
4. Engineering hydrology-K. Subramanya, Tata McGraw Hill, 2020, (5th Edition). ISBN – 10: 9390177502.

**Reference Books:**


1. Elementary Engineering Hydrology- M.J. Deodhar-Pearson Education, New Delhi, 2008, (3rd Edition).
2. Irrigation Engineering, H. M. Raghunath, Wiley Publication, 2011, ISBN: 9788126528813.
3. A Textbook of Hydrology by Dr. P. Jaya Rami Reddy, USP Publisher. 2016 (3rd edition).
4. A Guide to Prepare Chapter on Irrigation Planning Aspects of Detailed Project Report by Central Water Commission (Irrigation Management Organization), September 2018. pp 1-64.
5. A Guide for Estimating Irrigation Water Requirements by Govt. of India, Ministry of Irrigation (Water Management Division), May 1984. pp 1-115.


**e – Resources:**

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

www..iitb.ac.in/nptel

# (CE312): Design of Reinforced Concrete Structures

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

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

**Course Objectives:**

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

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

| Cos No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | 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 | **a) Introduction to design philosophies**: Historical development, Concept of working stress method, stress block parameters, Moment of Resistance (M.R.) of singly and doubly reinforced rectangular section.<br>**b) Limit state method:** Concept of Partial safety factors, load factors, stress-strain relationship, stress block parameters, failure criteria, Use of I.S. 456-2000, M.R. of singly, doubly reinforced rectangular section and flanged section. | 06 | 1 |
| **II** | **a) Design of One way slab:** simply supported, cantilever and continuous slabs.<br>**b) Design of two way slab**: simply supported, continuous and restrained. | 06 | 2 |
| **III** | **a) Design of staircase:** Dog legged, open well and concept of stringer beam.<br>**b) Design of rectangular beam sections only for flexure:** Cantilever, simply supported, continuous beams (singly reinforced, doubly reinforced section). | 06 | 3 |
| **IV** | **a) Design of flanged beam sections only for flexure:** Cantilever, simply supported, continuous beams (Flanged section).<br>**b) Design of secondary reinforcement in beams:** Concept of Shear, Bond and torsion. | 06 | 4 |
| **V** | **a) Design of axially loaded short Column:** Introduction, strain and stress variation diagrams, minimum eccentricity requirements. Lateral ties, helical reinforcement, Design of short column for axial load.<br>**b) Design of short Column subjected to bending:** effect of uni-axial and bi-axial bending, interaction curves, SP 16 guidelines, Design of column for uni-axial and bi-axial bending. | 06 | 5 |
| **VI** | **a) Design of isolated footing:** Critical section for B.M., Single and double shear, design of isolated pad footing and slopped footing.<br>**b) Introduction to Ductile detailing**: Guidelines for ductile detailing of slab, staircase, beam, column and footing as per IS 13920, SP34. Introduction to earthquake resistant design. | 06 | 6 |

**Text Books:**

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

**Reference Books:**

1. S. U. Pillai and D. Menon, "Reinforced Concrete Design", 3rd edition, Tata Mc Graw Hill Publication Ltd, 2017, ISBN: 978-0070141100.
2. P. Dayaratnram, "Limit State Analysis and Design" 5th edition, Wheeler Publishing company', 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 13920-2000 Code of practice for ductile detailing of RC Structures subjected to seismic forces, Bureau of Indian Standards, New Delhi.
3. S.P. 16-1978: Design aids for reinforced concrete. (Interaction Charts Only) Bureau of Indian Standards, New Delhi.
4. 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

# CE313-: Advanced Analysis of Structures

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

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

**Course Objectives:**

| |
|---|
| 1. To analyze the statically Determinate and Indeterminate 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): At the end of the course students will able to:**

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Apply the Castigliano's first and second theorem to find deflection of determinate and indeterminate trusses. | **3** | **Apply** |
| CO2 | Apply slope deflection method to sketch Shear force and bending moment of statically Indeterminate Structures. | **3** | **Apply** |
| CO3 | Apply moment distribution method to sketch Shear force and bending moment of statically Indeterminate Structures. | **3** | **Apply** |
| CO4 | Apply Flexibility method to sketch Shear force and bending moment of statically Indeterminate Structures | **3** | **Apply** |
| CO5 | Apply stiffness method to sketch Shear force and bending moment of statically Indeterminate Structures | **4** | **Analyze** |
| CO6 | Analyze the multi-storeyed building frames by approximate methods. | **4** | **Analyze** |

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Analysis of pin jointed plane Trusses**: 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** | **Slope-Deflection Method:** 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** | **Moment Distribution Method:** 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** | **Flexibility Matrix Method:** 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 | 06 | 4 |

| | | | |
|---|---|---|---|
| | diagram. (Numerical Problem not Involving more than three Unknown) | | |
| **V** | **Stiffness Matrix Method:** 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 |
| **VI** | **Approximate Methods of Analysis:** Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed fames by substitute frame method, cantilever method and portal method. | 06 | 6 |

**Text Books:**


1. S. Ramamrutham and N. Narayan, "Theory of Structures", 9th 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)", 2nd Edition Tata McGraw Hill Publishing Ltd.(2008), ISBN: 13:978-0070667358.
3. B.C.Punmia, Ashokkumar Jain and Arunkumar Jain, "Theory of Structures", 13th Edition, Laxmi Publication. (2017), ISBN : 81-7008-618-3


**Reference Books:**


1. S.P. Timoshenko and Young D.H., "Theory of Structures", 2nd Edition Tata McGraw Hill. (2002) ISBN: 978-0070648685.
2. C K Wang, "Intermediate Structural Analysis", Tata McGraw-Hill Education Pvt. Ltd., (2014), ISBN 13: 9780070702493.
3. Gere and Weaver, "Matrix Analysis of Framed Structures", 2nd Edition CBS Publication Delhi,(1998) ,ISBN No. ISBN-13. 978-8123911519
4. Jain, A.K., "Advanced Structural Analysis",4th Edition, Nem Chand & Bros, Roorkee(2015), ISBN: 9788185240817.


**E – Resources:**

1. http://nptel.iitm.ac.in
2. https://onlinecourses.nptel.ac.in

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

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

**Course Objectives:**

| |
|---|
| 1. To impart knowledge about various methods involved in the analysis of indeterminate structures. |
| 2. To apply different methods for analyzing the indeterminate structures. |
| 3. To analyze the multistoried frame subjected to lateral load using approximate methods. |

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

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Apply the Castigliano's first theorem to find deflection of determinate trusses. | 3 | Applying |
| 2 | Apply slope deflection method to sketch Shear force and bending moment of statically Indeterminate Structures. | 3 | Applying |
| 3 | Apply moment distribution method to sketch Shear force and bending moment of statically Indeterminate Structures. | 3 | Applying |
| 4 | Apply Flexibility method to sketch Shear force and bending moment of statically Indeterminate Structures | 3 | Applying |
| 5 | Apply stiffness method to sketch Shear force and bending moment of statically Indeterminate Structures | 3 | Applying |
| 6 | Analyze the multi-storeyed building frames by approximate methods. | 4 | Analyze |

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

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

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **Analysis of pin jointed plane Trusses**: Joint displacement of determinate trusses by Castigliano's first theorem.<br>Analysis of redundant trusses by Castigliano's second theorem, lack of fit, sinking of support, temperature changes (indeterminacy up to second degrees). | 06 | 1 |
| **II** | **Slope-Deflection Method:** 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** | **Moment Distribution Method:** 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** | **Flexibility Matrix Method:** 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** | **Stiffness Matrix Method:** 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 |
| **VI** | **Approximate Methods of Analysis:**<br>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 |

**Text Books:**

1. S. Ramamrutham and N. Narayan, "Theory of Structures", 9th 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)", 2nd edition Tata McGraw Hill Publishing Ltd.(2008), **ISBN: 13:978-0070667358.**
3. 3. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures", 13th Edition, Laxmi Publication. (2017), **ISBN : 81-7008-618-3**

**Reference Books:**

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

**E – Resources:**

1.http://nptel.iitm.ac.in

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

3.https://www.udemy.com/course/staadpro-cs/

## (PE314): Professional Elective-II

## (PE314-a): Water Treatment and Distribution

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

**Prerequisite Course:** Environmental Engineering

**Course Objectives:**

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

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

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

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

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

## Course Contents

| Unit No. | Water Treatment and Distribution | No. of Hours | COs |
|---|---|---|---|
| I | **Introduction to water supply scheme:** Components and layout of water supply scheme, Design period and Factors affecting design period, Sources of water and Intake structures. **Water Quality parameters:** Physical, Chemical and microbiological, principles of their analysis, Drinking water Standards as per IS: 10500 (2012). **Water demand:** types of demand, Factors affecting rate of demand, Population forecasting. | 06 | 1 |
| II | **Water treatment:** Necessity and objectives, Principles of water treatment operations and processes, Water treatment plant flow sheet. **Aeration:** Process details and design consideration of aeration unit. **Sedimentation:** Types of sedimentation, efficiency of an ideal settling basin, Types of sedimentation tanks, Design of sedimentation tank. Introduction of tube settlers. | 06 | 2 |
| III | **Coagulation and flocculation:** Principle of coagulation, Common coagulants, other coagulant aids like bentonite clay, Lime stone, Silicates and Polyelectrolytes and natural coagulants, Mean velocity gradient —G and Power consumption, Design of Clari-flocculator. | 06 | 3 |
| IV | **Filtration:** Theory of filtration, Mechanism of filtration, Filter media, Types of sand filters, Components, working, back-washing and operational troubles of Rapid sand gravity filter, Design of Rapid sand gravity filters. | 06 | 4 |
| V | **Disinfection:** Mechanism, factors affecting disinfection, methods of disinfection, Chlorination- types and methods, Bleaching powder estimation. **Advanced water treatments-** Water softening, base exchange or Zeolite process, Demineralisation, Desalination, membrane filtration and Reverse osmosis. | 06 | 5 |
| VI | **Water distribution system:** Continuous and intermittent system. Different types of distribution network and their limitations. ESR- | 06 | 6 |

| | | | |
|---|---|---|---|
| | Design of ESR capacity. Packaged treatment plants. Household water treatment methods. **Plumbing:** common plumbing fixtures, water efficient fixtures, pipe materials and roughness coefficients, types of fittings, types of valves, types of traps, equivalent lengths for fittings and valves as per standards, types of drainage systems in buildings. **Government of India initiatives** such as SMART city mission and AMRUT mission for improvement of water infrastructure sector, Introduction to Jal Jeevan mission and its implications in rural India. | | |

| | **Text Books** |
|---|---|
| 1 | S. K. Garg, Water Supply Engineering, Khanna Publishers, New Delhi. |
| 2 | G. S. Birdie and J. S. Birdie, Water Supply and Sanitary Engineering: DhanpatRai Publishing Company, New Delhi. |
| 3 | B. C. Punmia, Ashok Jain and Arun Jain, Environmental Engineering 1: Water Supply Engineering: Laxmi Publications (P) Ltd. |
| 4 | Water Supply and Treatment Manual: Govt. of India Publication |
| | Reference Books |
| 1 | Peavy and Rowe, Environmental Engineering, McGraw Hill Publications |
| 2 | P. R. Bhave, Optimal Design of Water Distribution Networks: Narosa Publishing House. |
| 3 | CPHEEO Manual on Water Supply & Treatment. |
| 4 | Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association) |

# (PE314-b): Hydraulics and Hydraulic Machinery

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

**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 | Understand the fundamental knowledge of open channel | 2 | Understand |
| 2 | Apply the knowledge of uniform flow formulae to identify the economical channel sections | 3 | Apply |
| 3 | Apply the energy concepts to open channel flow | 3 | Apply |
| 4 | Analyze the water surface profiles under different flow conditions | 4 | Analyze |
| 5 | Analyze the performance of turbine working under different operating conditions | 4 | Analyze |
| 6 | Analyse the performance of pump working under different operating conditions | 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 | -- | --- | -- | -- | -- | --- | -- | -- | 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 | 3 |

## Course Contents

| Unit No | Topics | No of Hrs | COs |
|---|---|---|---|
| I | **a) Introduction to Open Channel Flow:** 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.<br>**b) Measurement of Discharge**: Notches and Weirs<br>**c) Measurement of Velocity**: Floats, Current meter and Pitot tube | 06 | 1 |
| II | **Uniform Flow in Open Channel:** 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 |
| III | **Rapidly Varied Flow (Hydraulic Jump):** 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 |
| IV | **Gradually Varied Flow:** 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 |
| V | **a) Impact of Jet:** Impact of jet on stationary and moving flat and curved vanes.<br>**b) Turbines:** 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 |
| VI | **Centrifugal Pump:** Classification and selection criterion, Classification of centrifugal pumps, Work done, Losses and efficiencies, Minimum starting speed , Priming, Design considerations, Net positive suction head (NPSH), | 06 | 6 |

| | | | |
|---|---|---|---|
| | Multistage pumps, Performance characteristics of Centrifugal pump. Introduction to reversible pump. | | |

**Text Books:**

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

**Reference Books:**

1. V. L. Streeter and E. B. Wylie, *"Fluid Mechanics"*, 9th Edition, McGraw Hill Publications, New York, 2010.
2. P.N. Modi and S.M. Seth, *"Hydraulics & Fluid Mechanics"* 22nd Edition, Standard Book House, Unit of Rajsons Publications Pvt. Ltd., 2019.
3. M Hanif Chaudhry, *"Open-Channel Flow",* 2nd Edition, Springer US.
4. S K Som, Gautam Biswas, S Chakraborty, *"Introduction to Fluid Mechanics & Fluid Machines",* 3rd 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-c): Advanced Surveying

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

**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): At the end of the course students will able to:**

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Demonstrate the techniques of triangulation and trilateration in geodetic surveying. | 2 | Understanding |
| 2 | Demonstrate the classification and to identify topographical maps of the existing features on the Ground. | 2 | Understanding |
| 3 | Interpret the problem and remedial measures for hydrographic Survey. | 3 | Applying |
| 4 | Compute an azimuth, declination etc. of celestial bodies using principle of astronomy. | 4 | Analyzing |
| 5 | Utilize the theory of error with measured quantities in surveying | 3 | Applying |
| 6 | Use 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 | **Geodetic Surveying:** Introduction, Classification of Triangulation Systems, Triangulation figures, Concept of well-conditioned Triangle, Types of signals and towers. Intervisibility and height of stations.Introduction to trilateration, Advantages and disadvantages of Trilateration. | 06 | 1 |
| II | **Aerial Surveying:** 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 | **Hydrographic Surveying:** 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 | **Trigonometric Levelling:** Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations.<br>**Field Astronomy:** Introduction, purposes, astronomical terms, determination of azimuth, latitude, longitude and time corrections to the observations. | 06 | 4 |
| V | **Theory of Errors:** Introduction, types of errors, definitions, laws of accidental errors, laws of weights, Theory of least squares: Principle, rules for assigning weights and distribution of errors to the field observations, determination of the most probable values (MPV) of quantities. | 06 | 5 |
| VI | **Modern Surveying Techniques:**<br>**Drone Technology**- Introduction and its application<br>**Digital land Survey**-Introduction and its applications<br>**Remote Sensing** - Electromagnetic spectrum, Atmospheric windows, Importance of satellite data, digital elevation model (DEM) and application | 06 | 6 |

| | | | |
|---|---|---|---|
| | **Geographical Information System (GIS)** - Applications of GIS, Preparation of thematic maps. Quantum-GIS interface. | | |

**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. 5th Edition, 2019, ISBN :13:978-0-07-0151352.
3. Peter A. Burrough and R. A. McDonnell, "Principles of Geographical Information System", Oxford University Press.4th 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, 3rd 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. 15th Edition 2018,ISBN-13: 9788189401245.
3. Subramanian, "Surveying and Levelling", Oxford University Press. 2nd edition 2012, ISBN-13: 978-0198085423.
4. A. M. Chandra and S. K. Ghosh, "Remote sensing and Geographical Information System", Narosa Publication,2nd 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, 4th Edition 2014, ISBN-13: 978-0071761123.
6. Lilles and, T. L., and Kiefer, R.W., "Remote Sensing and Image Interpretation", 7th Edition 2015, John Wiley and Sons publication .ISBN: 978-1-118-34328-9.


**e – Resources:**

1. www.nrsa.gov.in
2. www.iirs-nrsa.gov.in
3. www.surveyofindia.gov.in
4. https://nptel.ac.in/courses/105/107/105107158

# (PE314-d): Advanced Concrete Technology

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

**Prerequisite Course: Material Science, Concrete Technology.**

| Sr. No | Course Objectives |
|---|---|
| 1 | To introduce the ingredients of Standard concrete, Special Concrete, Fibre reinforced concrete. |
| 2 | To learn the Concrete Mix Design for Special Concrete. |
| 3 | To understand the strength and durability related properties of concrete. |

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

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Recognize the basic ingredients of standard concrete. | 2 | Understanding |
| 2 | Analyze the effect of admixtures used to improve properties of fresh and hardened concrete. | 4 | Analyze |
| 3 | Analyze the Strength Characteristics of concrete with advanced non-destructive testing (methods) on concrete. | 4 | Analyze |
| 4 | Mix Design of special concrete. | 6 | Creating |
| 5 | Know the properties of Fibre Reinforced Concrete and Ferro-cement. | 2 | Understanding |
| 6 | Study the Durability aspects of concrete and 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 | 1 | - | - | 2 | - | - | - | - | - | 2 | 3 |
| CO2 | 1 | 2 | 3 | - | - | - | - | - | - | - | 1 | - | 2 | 3 |
| CO3 | 1 | - | - | 3 | 2 | - | - | 2 | - | - | - | - | 2 | 3 |
| CO4 | - | 1 | - | - | 2 | 1 | - | - | 1 | - | - | - | 2 | 2 |
| CO5 | 2 | - | 3 | - | - | 3 | - | 2 | - | - | - | 1 | 2 | 2 |
| CO6 | 2 | - | 2 | 2 | 1 | - | 3 | - | - | - | - | - | 2 | 2 |

(Specify values as: 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos, Pos and PSOs)

# Course Contents

| Unit | Topic | No. of Hours | COs |
|---|---|---|---|
| I | **Ingredients of Concrete**<br>**Cements:** Hydration of cement, water requirements for hydration, microstructure development, types of cements.<br>**Aggregates:** Grading curves of aggregates, Aggregate concrete interactions, alkali aggregate reaction.<br>**Concrete:** properties of concrete, W/C ratio, gel space ratio, Consolidation, cohesion and segregation, bleeding, Rheological modeling of fresh concrete, maturity concept, Steam Curing. | 06 | 1 |
| II | **Admixtures**<br>**Mineral Admixtures:** Fly ash, ground granulated blast furnace slag, Metakaolin, rice-husk ash and Silica fume. Chemical composition; physical characteristics; effects on properties of concrete; advantages and disadvantages.<br>**Chemical Admixtures:** types and classification; compatibility, usage; effects on properties of concrete. IS: 456, IS 9103; requirements, provisions and Specifications. | 06 | 2 |
| III | **Strength Characteristics and Advanced NDT**<br>**Strength of concrete:** Aggregate to cement ratio, bond strength, Factors affecting strength, Micro cracking and stress-strain relationship. Compressive Strength, indirect tensile strength, Flexural strength, Modulus of elasticity, Poisons ratio.<br>**Advanced non-destructive testing methods:** ground penetration radar, probe penetration, stress wave propagation method, electrical / magnetic methods, nuclear methods and infrared thermography, dynamic resonance frequency tests. | 06 | 3 |
| IV | **Concrete Mix Design for Special Concrete**<br>Statistical quality control, Design of high strength concrete, design of light weight aggregate concrete, design of cement concrete with | 06 | 4 |

| | | | |
|---|---|---|---|
| | Pozzolonic materials, design of high density concrete, Acceptance criteria for concrete as per IS specifications. | | |
| **V** | **Fibre Reinforced Concrete (FRC)and Ferro-cement**<br>**Fibre reinforced Concrete:** basic concepts, Types of Fibre, role of Aspect ratio, Mechanical properties of FRC, Types of FRC; Glass FRC (GFRC), Steel FRC (SFRC).<br>**Ferro-cement:** Methods, Applications, weight to strength ratio, Structural behavior Ferro-cement elements. | 06 | 5 |
| **VI** | **Durability Aspects of concrete and New Generation Concrete**<br>**Durability Aspects of concrete:** Creep, factors affecting creep, effect of creep on concrete; shrinkage, factors affecting shrinkage, plastic shrinkage, drying shrinkage, autogeneous shrinkage and carbonation shrinkage. Electrical resistivity, permeability, Rapid chloride penetration test (RCPT).<br>**New Generation Concrete**: Light weight concrete, ultra light weight concrete, No fines concrete, Ready mixed concrete, Pumpable concrete, high volume fly ash concrete, Self compacting concrete, Geo-polymer concrete. | 06 | 6 |

**Text Books:**


1. M. S. Shetty and A.K. Jain, "Concrete Technology: Theory and Practice", 8th edition, 2018, ISBN: 9789352533800, S. Chand Publications.
2. M. L. Gambhir, "Concrete Technology: Theory and Practice", 5th edition, 2013, ISBN: 9781259062551, Tata McGraw Hill Publications.
3. A. R. Santhakumar., "Concrete Technology", 2nd edition, 2018, ISBN: 9780199458523, Oxford Universities Press.

**Reference Books:**


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


**e-Resources:** NPTEL course videos

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

**IS Codes:**

1. IS 269: 2015 Specification for ordinary Portland cement (*sixth revision*).
2. IS 455: 2015 (Reaffirmed 1995) Specifications for Portland slag Cement.
3. IS 650: 1991 Specification for standard sand for testing of Cement.
4. IS 1489 (Part 1): 2015 Specification for Portland pozzolana cement-Flyash based.
5. IS 1489 (Part 2): 2015 Specification for Portland-pozzolana cement-Calcined clay based.
6. IS 1727: 1967 Methods of test for Pozzolonic Materials.
7. IS 383: 2016 Specification for coarse and fine aggregates for concrete (*second revision*).
8. IS 456: 2000 (Reaffirmed 1995) Code of practice for plain and reinforced concrete (*fourth revision*).
9. IS 1199 (Part 1 to 6): 2018 Fresh concrete-Methods of sampling, testing and analysis.

(*first revision*).

10. IS 516 (Part 1 to 6): 2018 Method of test for strength of concrete.
11. IS 2386 (Part 1 to 8): 1963 Methods of test for aggregates for concrete.
12. IS 3812 (Part 1): 2013 Specification for pulverized fuel ash-For use as pozzolana in cement, cement mortar and
13. Concrete (*third revision*).
14. IS 3812 (Part 2): 2013 Specification for pulverized fuel ash-For use as admixture in cement mortar and concrete (*third revision*).
15. IS 9103: 1999 Specification for admixtures for concrete (*first revision*).
16. IS 15388: 2003 Specification for silica fume.
17. IS 16714: 2018 Ground granulated blast furnace slag for use in cement, mortar and concrete- Specification.

# HSMC (HS315): Corporate Readiness

| Teaching Scheme | Evaluation Scheme: |
|---|---|
| **Lectures: 02 Hrs. / Week** | **CIA: 50 Marks** |
| **Credits: 02** | **Total: 50 Marks** |

**Prerequisite Course: (Quantitative aptitude, Verbal and non-verbal communication)**

## Course Objectives:

| Sr. No | Course Objectives |
|---|---|
| 1 | To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path. |
| 2 | To develop required aptitude skills. |
| 3 | To design the functional and chronological resume. |
| 4 | To demonstrate the importance of critical thinking ability and expression in group discussions |
| 5 | To prepare students for the various professional interviews. |
| 6 | To develop different soft skills necessary to get success in their profession. |

## Course Outcomes:

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

| Course Outcome (s) | | Bloom's Taxonomy | |
|---|---|---|---|
| | | **Level** | **Descriptor** |
| **CO1** | Remember placement processes of various organizations and modern job search approach. | **1** | Remember |
| **CO2** | Understand Industry Specific skill set with a view to design an Ideal Resume. | **2** | Understand |
| **CO3** | Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc. | **3** | Apply |
| **CO4** | Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests. | **4** | Analyse |
| **CO5** | Evaluate Technical/General Dataset to interpret insights in it. | **5** | Evaluate |
| **CO6** | Create an ideal personality that fits Industry requirement. | **6** | Create |

**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 | -- | -- | -- | -- | -- | -- | -- | 02 | 00 | 02 | 01 | 01 | -- | -- |
| CO2 | -- | -- | -- | -- | -- | -- | -- | 02 | 03 | 03 | 03 | 01 | -- | -- |
| CO3 | -- | -- | -- | -- | -- | -- | -- | 01 | 03 | 03 | 02 | 01 | -- | -- |
| CO4 | 01 | 01 | -- | -- | -- | -- | -- | -- | -- | 01 | 01 | -- | -- | -- |
| CO5 | 01 | 01 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO6 | -- | -- | -- | -- | -- | -- | -- | 02 | 03 | 03 | 02 | 03 | -- | -- |

| **Course Contents** | | | |
|---|---|---|---|
| **UNIT-I** | Placement Awareness | **Hrs.** | **Cos** |
| | Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude. | 06 | 1 |
| **UNIT-II** | Resume Writing | **Hrs.** | **CO** |
| | Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume. | 05 | 2 |
| **UNIT-III** | Group Discussion and Presentation skills | **Hrs.** | **CO** |
| | Why GDs are implemented commonly, Aspects which make up a Group Discussion, **Tips on group discussion, do's and don'ts of GD and** Presentation skills. | 05 | 3 |
| **UNIT-IV** | Logical Reasoning I | **Hrs.** | **CO** |
| | Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic. | 05 | 4 |
| **UNIT-V** | Logical Reasoning II | **Hrs.** | **CO** |
| | Data Interpretation, Data Sufficiency | 04 | 5 |
| **UNIT-VI** | Logical Reasoning III | **Hrs.** | **CO** |
| | Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle. | 05 | 6 |

| **Text Books:** |
|---|
| 1. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal.<br>2. Reasoning verbal and Non-Verbal by B. S. Sijwali.<br>3. Master the Group Discussion & Personal Interview - Complete Discussion on the topics asked by reputed B-schools & IIMs by Sheetal Desarda. |
| **References:** |
| 1. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical).<br>2. Analytical Reasoning by M. K. Panday.<br>3. Logical and analytical reasoning by K. Gupta.<br>4. Multi-dimensional reasoning by Mishra & Kumar Dr. Lal. |
| **E- Books :**<br>1.https://themech.in/quantitative-aptitude-and-logical-reasoning-books/<br>2.https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html |
| **E-learning Resources/MOOCs/ NPTEL Course Links**:<br>1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/<br>2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/<br>3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer<br>4. https://novoresume.com/career-blog/how-to-write-a-resume-guide |

1. **Resume [10 Marks]**
2. **GD [10 Marks]**
3. **Interview [10 Marks]**
4. **Logical Reasoning Test [10 Marks]**
5. **Attendance and Video resume [10 Marks]**

## PRJ (PR315): Intellectual Property Rights and Entrepreneurship development

### (HS315) IPR and EDP

**Teaching Scheme**

**Lectures:** 2 Hrs. / Week
**Practical:** 0
**Tutorials:** --
**Credits:** **2**

**Evluation Scheme**

**CIA** 20 Marks
**In-Sem Exam :** 00 marks
**End Sem Exam:** 30 Marks
**Total:** 50 Marks

==========

**Prerequisite Course: (if Any)- NIL**

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**Course Objectives:**

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

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

| CO's | Course Outcomes | Blooms Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Interpret the need and importance of intellectual property rights. | 2 | Understand |
| CO2 | Elaborate the process for Patent and Design registration. | 2 | Understand |
| CO3 | Explain the process for copy right and trademark registration. | 2 | Understand |
| CO4 | Select the IPR tool for protection of invention. | 3 | Apply |
| CO5 | Evaluating the Entrepreneurial abilities within an Individual. | 5 | Evaluate |
| CO6 | Identify the role of supporting agencies and Governmental initiatives to promote Entrepreneurship. | 2 | Understand |

## Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes:

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

## Course Contents

| Unit | **Contents** | No.of Hours | COs |
|---|---|---|---|
| 1 | **Introduction to IPRs** | 6 Hrs. | |
| | Introduction to Concept of Property, Types of Property, General Characteristics of Property Rights, Need of Intellectual property, Introduction to Intellectual Property, Philosophy of IPR, Different forms of Intellectual Property, IPR in India : Genesis and Development, International Organizational and Treaties, WIPO and its Role, International Treaties. | | 1 |
| 2 | **Patent and Design** | 6 Hrs | CO |
| | Definition of Patents, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter, Anticipation, Registration Procedure, Time Frame and Cost, Rights and Duties of Patentee, International Protection, Commercialization, Infringement, Patent Databases, IP protection of Semiconductors and Integrated Circuits, Case studies What is a Design, Difference from Patent, how can Designs be protected, Procedure for Registration, Effect of Registration and Term of Protection, Non-Patentable Subject Matter, Infringement, Patenting biotechnological invention, Case studies | | 2 |
| 3 | **Copyrights and Trademarks** | 8Hrs. | C0 |
| | Introduction to Copyright, what is covered by Copyright, How long does copyright last, Why Protect Copyright, Registration Procedure, Term of protection, Ownership of copyright, Related Rights - Distinction between related rights and copyrights, Infringement. Difference between copyrights and other IPRs, Case studies.<br>Introduction to Trademarks, Different kinds of marks: brand names, logos, signatures, symbols, well known marks, Non-Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement. Introduction to Geographical Indications. | | 3 |
| 4 | **Trade Secrets and IP Regime** | 6Hrs. | C0 |

| | | | |
|---|---|---|---|
| | What are trade secrets; how trade secrets are to be maintained; how trade secrets are used in trade and businesses, Case studies<br>Need of IP Valuation, IPR as an Instrument of Development, Impact of Intellectual Property System on Economic Growth, Role of Intellectual Property in Technology Transfer, Introduction to Biopiarcy and popular cases, Career opportunities in IPR. | | 4 |
| 5 | **Title of Unit-5 Entrepreneurship: Introduction** | 6 Hrs. | C0 |
| | **Concept and Definitions**: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, Typology of Entrepreneurs.<br>**5.2 Entrepreneurial Competencies:**<br>The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, Decision making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow.<br>**Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programs.<br>**Steps in Entrepreneurial Process:** Deciding Developing Moving**,** Managing Recognizing. | | 5 |
| 6 | **Title of Unit-6 DPR & Various Support Systems for Entrepreneurship** | 8 Hrs | CO |
| | **6.1 Project Report Preparation:**<br>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.<br>**6.2 Role of Support Institutions and Management of Small Business:**<br>Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, State Financial Corporation (SFC) EPC, ECGC.<br>**6.3 Various Governmental Initiatives:**<br>Make in India Start Up India, Stand Up India, Digital India, Skill India<br>**6.4 Case Studies of Successful Entrepreneurs** | | 6 |

## Text Books


1. Watal, Jayashree " Intellectual Property Rights in The WTO And Developing Countries ", Oxford University Press.
2. R. Anita Rao & Bhanoji Rao, Intellectual Property Rights- A Primer, Eastern Book Co.
3. Shiv Sahai Singh, The Law of Intellectual Property Right, Eastern Book Co
4. Prabuddha Ganguli Intellectual property right – Unleashing the knowledge economy, , Tate McGraw Hill Publishing company ltd.


## Reference Books and Acts:


1. Subbaram N.R, " Handbook of Indian Patent Law and Practice, S. Viswanathan Printers and Publishers Pvt. Ltd.,1998
2. Indian Patent Act, 1970 (With recent Amendments)
3. The Design Act 2020 (With recent Amendments)
4. The trademarks Act 1999 (With recent Amendments)
5. Copy right act 1957 ((With recent Amendments)


## CIA Activity

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

# (CE317): Hydrology and Water Resource Engineering Lab

| Teaching Scheme<br>Practical: 02 Hrs./Week | Evaluation Scheme:<br>Oral Exam : 50 Marks |
|---|---|
| Credits : 01 | Total Marks : 50 Marks |

**Prerequisite Course:** Physics, Fluid Mechanics

**Course Objectives:**

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

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

| Cos No | Course Outcomes | Blooms Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Estimate the rainfall data, and determine the precipitation/infiltration using various method. | 3 | Apply |
| 2 | Develop a hydrograph, analyze the data, estimate the flood, and evaluate the reservoir capacity. | 5 | Evaluate |
| 3 | Apply Q-GIS software in hydrology to draw the watershed structures. | 3 | Apply |
| 4 | State and understand the working process of meteorological station/government organization/irrigation project. | 2 | Understand |

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

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

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

**List of Laboratory Experiments**

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

1. Analysis of Rainfall Data –Double Mass Curve Technique.
2. Field Measurement of infiltration using double ring infiltrometer
3. Modeling the infiltration process using Horton Model

4. Delineation of Watershed- Q-GIS approach
5. Marking catchment area on toposheet and working out average annual precipitation and determining yield by various methods
6. Estimation of design storm using Gumbel's extreme value distribution
7. Determination of peak flood discharge in a basin using unit hydrograph method
8. Determination of storage capacity of reservoir using mass curve of inflow and outflow.
9. Site visit to meteorological station
10. Field visit to any Irrigation Project- Canal/Reservoir.

**Text Books:**


1. Irrigation Engineering and Hydraulic Structures- S. K. Garg, Khanna Publishers, New Delhi, 2011. (36th Edition). ISBN – 13: 978-81-7409-047-8.
2. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Laxmi Publications, 2021, (17th Edition), ISBN: 9788131807637.
3. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House, New Delhi, 2020. ISBN: 978-81-87401-29-0.
4. Engineering hydrology-K. Subramanya, Tata McGraw Hill, 2020, (5th Edition). ISBN – 10: 9390177502.


**Reference Books:**


1. Elementary Engineering Hydrology- M.J. Deodhar-Pearson Education, New Delhi, 2008, (3rd Edition).
2. Irrigation Engineering, H. M. Raghunath, Wiley Publication, 2011, ISBN: 9788126528813.
3. A Textbook of Hydrology by Dr. P. Jaya Rami Reddy, USP Publisher. 2016 (3rd edition).
4. A Guide to Prepare Chapter on Irrigation Planning Aspects of Detailed Project Report by Central Water Commission (Irrigation Management Organization), September 2018. pp 1-64.
5. A Guide for Estimating Irrigation Water Requirements by Govt. of India, Ministry of Irrigation (Water Management Division), May 1984. Pp 1-115.


**e – Resources:**

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

www..iitb.ac.in/nptel

## (CE318): Design of Reinforced Concrete Structures Lab

| Teaching Scheme<br>**Practical: 02 Hrs./ Week** | **Evaluation Scheme:**<br>**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): At the end of the course students will able to:**

| Cos No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Apply basic guidelines of IS 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$^2$.
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", 9th edition, Structures Publications, 2021, ISBN: 978819037172.

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

**Reference Books:**

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

**I.S. Codes:**

1. I.S.456-2000: 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

# (PE319-a): Water Treatment and Distribution Lab

| Teaching Scheme<br>**Practical: 02 Hrs. / Week** | **Evaluation Scheme:**<br>**TW: 50 Marks** |
|---|---|
| **Credits: 01** | **Total: 50 Marks** |

**Prerequisite Course: Chemistry, Environmental science, Fluid mechanics**

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

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Examining of various characteristics of raw water by using knowledge of chemistry and environmental science. | 4 | Analyze |
| 2 | Predicting hydraulic design parameters of different water treatment units using suitable software. | 5 | Evaluate |

**Term Work (**a, b & c are compulsory)

**a) Practicals.**

1. pH and Alkalinity of raw water and hot water.
2. Total hardness of raw water.
3. Chlorides in water.
4. Chlorine demand and residual chlorine.
5. Turbidity and optimum dose of alum.
6. Fluoride or Iron contents in water.
7. Most Probable Number (MPN).
8. Sodium or Potassium or Calcium using flame photometer.

**b) Site visit to water treatment plant and Detailed Report.**

**c) Complete Design of WTP using appropriate software/Exercise on design of water distribution network using any suitable software such as EPANE/tools.**

# (PE319-b): Hydraulics and Hydraulic Machinery Lab

| **Teaching Scheme**<br>**Practical: 02 Hrs. / Week** | **Evaluation Scheme:**<br>**TW: 50 Marks** |
|---|---|
| **Credits: 01** | **Total: 50 Marks** |

**Prerequisite Course:** **Fluid Mechanics**

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

| |
|---|
| 1. To produce civil engineers able of designing open channel systems. |
| 2. To comprehend the measurement of velocity and discharge under various flow conditions. |
| 3. To understand the working principles of hydraulic machinery. |

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

| **COs No.** | **Course Outcomes (COs)** | **Bloom's Taxonomy** | |
|---|---|---|---|
| | | **Level** | **Descriptor** |
| 1 | Apply knowledge of integrated mass continuity and energy/ momentum balance equations to open channel system | 3 | Apply |
| 2 | Use basic concepts of Hydraulics to analyse flow in open channel | 4 | Analyze |
| 3 | Analyse the performance of hydraulic machines, working under different operating conditions | 4 | Analyze |

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

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

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

1. Study of Uniform Flow formulae of Open channel.
2. Velocity Distribution in Open Channel Flow.
3. Calibration of Venturi flume
4. Study of Hydraulic Jump as Energy Dissipater
5. Impact of Jet on Flat Plate and Curved Vane
6. Characteristics of a Pelton Wheel Turbine.

7. Characteristics of a Centrifugal Pump.
8. Calibration of Notch.
9. Graphical determination of energy loss in Hydraulic Jump.
10. Assignment on GVF computation using Direct Step method.
11. Prepare a working model of any hydraulic machine.

**Text Books:**

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

**Reference Books:**

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

**e – Resources:**

https://nptel.ac.in/courses/105/103/105103096/

https://nptel.ac.in/courses/105/107/105107059/

https://www.energy.gov/eere/water/water-power-technologies-office

# SUBJECT: (PE319-c): ADVANCE SURVEYING LAB

| Teaching Scheme<br>**Practical: 02 Hrs./ Week** | **Evaluation Scheme:**<br>**Term Work: 50 Mark** |
|---|---|
| **Credits : 01** | **Total Marks: 50 Mark** |

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

| Sr. No. | Course Objectives |
|---|---|
| 1 | Students will learn to operate various advance surveying equipment. |
| 2 | Students will able to study the profile on ground, water and air by modern surveying methods. |
| 3 | Students will able to understand the RS and GIS tools in various surveying application. |

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

| CO's No. | COURSE OUTCOME (S) | BLOOM'S TAXONOMY | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Demonstrate the techniques to know ground profile by Geodetic surveying and Trignometrical leveling. | 3 | Applying |
| 2 | Appraise the basic concepts of hydrographic surveying for underwater surveying. | 4 | Analyze |
| 3 | Examine and Interpret the aerial photographs and remote sensing data for study of inaccessible ground profile. | 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 | --- | 2 | 2 | 2 | 1 | --- | --- | 2 | 2 | 2 | --- | 2 | 1 |
| CO2 | 1 | --- | --- | --- | 1 | --- | --- | -- | 1 | 1 | 1 | --- | 2 | --- |
| CO3 | 1 | --- | --- | --- | 2 | --- | --- | --- | 2 | 1 | --- | 2 | 1 | 1 |

## List of Experiments: Laboratory work

**A. Geodetic Surveying and Trigonometrical levelling (any three)**

1. Measurement of horizontal and vertical angles with One second
2. Determination of elevation of inaccessible objects by trigonometrical levelling.
3. Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout.
4. Establishing control station using single or dual frequency GPS receiver

**B. Hydrographic Surveying (any two)**

5. Study and use of nautical sextant and measurement of horizontal angles
6. Plotting of river cross-section by hydrographic surveying
7. Solution to three point problem by analytical method

**C. Aerial Survey (any two)**

8. Study of aerial photograph and finding out the scale of the photograph.
9. Determination of air base distance using mirror stereoscope.
10. Determination of difference in elevation by parallax bar.

**D. Remote Sensing (RS) and Geographical Information System (GIS) (any two)**

11. Study and applications of different RS data products available with National Remote Sensing Centre (NRSC)
12. Use of RS images and visual interpretation
13. Use of interface and tools in GIS software such as Golden Surfer or GRAM++ or QGIS.

# (PE319-d): ADVANCE CONCRETE TECHNOLOGY LAB

| Teaching Scheme<br>Practical: 02 Hrs./ Week | Evaluation Scheme:<br>Term Work: 50 Marks |
|---|---|
| Credits: 01 | Total: 50 Marks |

**Prerequisite Course:** **Engineering Mechanics, Solid Mechanics, Concrete Technology**

**Course Objectives:** **student will be able to:**

| | |
|---|---|
| 1 | To impart knowledge about various types of concrete and their properties. |
| 2 | To know the comparative study of various concrete mix method. |
| 3 | To understand special concrete and durability aspect of concrete. |

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

| CO No. | *Course Outcomes* (COs): | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Examine the various types of concrete and their properties | 3 | Applying |
| CO2 | Analyze the concrete mix design by different methods. | 4 | Analyse |
| CO3 | Evaluate the structural audit of an existing concrete structure by using NDT methods. | 5 | Evaluate |

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

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

**List of Laboratory Assignments/Experiments:**

The term work shall consist of a journal giving details of all the following experiments/Assignments.

1. Case studies on special concretes.
2. Comparative experimental study of ACI, DOE and IS methods of concrete mix Proportioning.
3. Experimental study on Compatibility of chemical admixture and its effect on workability of

concrete.

4. Experimental work on any one type of fibre reinforced concrete i.e. natural fibre, synthetic fibre reinforced concrete and steel fibre.
5. Determination of modulus of elasticity of normal and fibre reinforced concrete on cylindrical specimen.
6. Determination of permeability of concrete.
7. Determination of flexural strength of normal and fibre reinforced concrete
8. Report based on structural audit of an existing concrete structure to assessment the quality of Concrete by using NDT methods.

# (CE320): Creational Activities (Practical)

| Teaching Scheme<br>Lectures: 02 Hrs./ Week | Evaluation Scheme:<br>Term Work: 50 Marks |
|---|---|
| Credits: 01 | Total Marks: 50 |

**Prerequisite Course: Basic knowledge of Civil Engineering**

***Course Objectives:***

| |
|---|
| 1.To expose students to real-time life challenges |
| 2. To provide the opportunity to gather data, analyze data, propose solutions and implement solutions. |

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

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

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

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

**Course Contents**

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

1. Swachh Bharat Abhiyan

2. Awareness programme on the importance of education

3. Digital awareness programme

4. Rainwater Harvesting Awareness programme

5. Street Play on Road Safety, Water Conservation, Family relationships, Social Media Addiction

| Activity No. | Name of the Activity | Guidelines for the activities |
|---|---|---|
| 1 | Swachh Bharat Abhiyan | As part of All India Council for Technical Education (AICTE) creational activity programme, the students Civil Engineering will visit nearby village to contribute to Swatch Bharat a National level of initiative of Government of India. The swatch Bharath campaign will held at the nearby village. Swatch Bharath Abhiyana is one of the most significant and popular mission to have taken place in India. Swatch Bharath Abhiyana is a great step towards the Clean India.<br>Student teams will collect waste plastics, plastic bottles and many unwanted plastic materials from nearby village & clean the environment to creat awareness in the local residents. They will also spread the awareness on disposal of plastic & how plastic affect the human life & environment. Students team will motivate the locals towards clean India<br>This campaign is important for overall development of the citizens in terms of health & wellbeing. |
| 2 | Awareness programme on the importance of education | To spread awareness about the importance of education in villages through AICTE creational Activity Programme to be conducted. Aim of this programme is to create awareness toward the higher education for the student and the Parents. A group of students will visit nearby Government schools of Kopargaon and will guide the students toward the Quality education, how to prepare a Board exam and the importance of education and its impact.<br>Students will be given proper guidance about the evolving technologies their quarries regarding the career opportunities |

| | | |
|---|---|---|
| | | will be discuss during this awareness program .It will be a fruitful interaction which is blissful in terms of exchange of knowledge, ideologies between the engineering graduated & young budding talents.<br>The village students will also provide with other information on career opportunities available in field other than that related to technical ones, like Army Administrative services,IAS,IPS etc. Students will conduct this activity in each school & help village students to understand how education is important for their life & society. |
| 3 | Digital awareness programme | Digital Awareness Program, which was made compulsory by All India Council for Technical Studies (AICTE) for technical education and to promote development in the country in a coordinated and integrated manner by the upcoming generation.<br>Door to door "Digital awareness in nearby village<br>and make them aware about the various necessities of our country nowadays. It includes Aadhar card, Passport, CBSE education, EPFO, Pay Income tax, PMAY, Pan card and Bharat gas.<br>ALSO to aware them about the various necessities of our country like pan card, Aadhar card, passport, google pay, Digi locker, online gas booking etc. |
| 4 | Rainwater Harvesting Awareness programme | Students to be made aware about the water scarcity problem in tour area and shared different economically feasible options like rainwater harvesting.<br>water usages are increasing day by day, but awareness of water management for the people in the world are insufficient. Rainwater harvesting is the process of augmenting the natural filtration of rainwater into the underground formation by some artificial methods<br>Students will aware the villagers about the Rooftop rainwater harvesting (RTRWH) that it is the most common technique of rainwater harvesting (RWH) for domestic consumption in rural |

| | | |
|---|---|---|
| | | areas and this is most often done at small-scale. It is a simple, low-cost technique that requires minimum specific expertise or knowledge and offers many benefits |
| 5 | Street Play on Road Safety, Water Conservation, Family relationships, Social Media | Students will do street play on the topic how road safety is impotent in avoiding accidents and will make the people aware about road safety., Also what safety measures to be done for minimizing road accident |
| 6. | Civil Construction material related Market survey, Cost analysis | Construction material related Market survey, Cost analysis to be done by visiting the vendors who are selling the construction material. Also students are expected to do the cost analysis |
| 7. | Model Making related to low cost housing ,green building, NetZero Carbom,Ecofriendly construction material,& energy conservation | Making of models by students related to low cost housing ,green building, NetZero Carbom,Ecofriendly construction material,& energy conservation |

**References:**

Handbook by AICTE for creational activities

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

| Teaching Scheme | Evaluation Scheme |
|---|---|
| **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): At the end of the course students will able to:

| COs No. | Course Outcomes (COs) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Demonstrate the importance of formwork, types and their applications. | 2 | Understand |
| 2 | 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, 4th 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 Press, 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, 7th 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:**

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

SANJIVANI RURAL EDUCATION SOCIETY'S

**SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603**

***(An Autonomous Institute Affiliated to SPPU Pune)***

# 121 DEPARTMENT OF CIVIL ENGINEERING

## COURSE STRUCTURE

## and

## SYLLABUS- 2020 PATTERN

## FINAL YEAR B. Tech

## Semester-VII and VIII

## W.e.f August 2023

## Board of Studies in Civil Engineering, August 2023

# Sanjivani College of Engineering, Kopargaon

**(An Autonomous Institute affiliated to SPPU, Pune)**

## D E C L A R A T I O N

We, the Board of Studies (Civil Engineering), hereby declare that, we have designed the Curriculum of Final Year Civil Engineering Program Curriculum Structure and Syllabus for semester VII &VIII of Pattern 2020w.e.f. from A.Y 2023-24 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

**Submitted by**

(Dr.C.L.Jejurkar)

BoS Chairman

**Approved by**

Dr.A.B.Pawar
Dean Academics

Dr.A.G.Thakur
Director

SANJIVANI RURAL EDUCATION SOCIETY'S

**SANJIVANI COLLEGE OF ENGINEERING KOPARGAON-423603**

***(An Autonomous Institute Affiliated to SPPU Pune)***

# DEPARTMENT OF CIVIL ENGINEERING

**COURSE STRUCTURE and SYLLABUS- 2020 PATTERN**

## FINAL YEAR B. TECH

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

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

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

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

# Civil Engineering Department

## VISION

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

## MISSION

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

## Program Educational Objectives: (PEOs)

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

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

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

## Program Outcomes (POs):

**Engineering Graduates will be able to:**

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

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

## Program Specific outcomes: (PSOs)

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

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

# Sanjivani College of Engineering Kopargaon-423603
## Department of Civil Engineering
## COURSE STRUCTURE and SYLLABUS- 2020 PATTERN

**FINAL YEAR B. TECH.**

(W.e.f August 2023)

Board of Studies in Civil Engineering, August 2023

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

**SEMESTER-VII**

| Course | | Course Title | Teaching Scheme | | | | Evaluation Scheme / Marks | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cat | Code | | Hrs /Week | | | Credits | Theory | | | OR | PR | TW | Total |
| | | | L | T | P | | CIA | ISE | ESE | | | | |
| PCC | CE401 | Waste Water Treatment, Disposal and Recycling | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE402 | Transportation Engineering | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PCC | CE403 | Quantity Survey, Contracts & Tenders | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PEC | PE404 | Professional Elective - III | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| PEC | PE405 | Professional Elective - IV | 3 | - | - | 3 | 20 | 30 | 50 | - | - | - | 100 |
| LC | CE406 | Characterization of Wastewater Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| LC | CE407 | Transportation Engineering Lab | - | - | 2 | 1 | - | - | - | - | - | 25 | 25 |
| LC | CE408 | Professional Practice Lab | - | - | 2 | 1 | - | - | - | 50 | - | - | 50 |
| LC | CE409 | Professional Elective-III Lab | - | - | 2 | 1 | - | - | - | 25 | - | - | 25 |
| PROJ | CE410 | Project Stage-I | - | - | 6 | 3 | - | - | - | 50 | - | 100 | 150 |
| MLC | MC411 | Mandatory Learning Course-VII ( Financially Smart) | 1 | - | - | Non Credit | - | - | - | - | - | - | Pass/ Fail |
| | | **Total** | **16** | **-** | **14** | **22** | **100** | **150** | **250** | **175** | **-** | **125** | **800** |

Dr. C.L.Jejurkar
**Head of Department**

Dr. A. B. Pawar
**Dean Academics**

Dr. A.G. Thakur
**Director**

## FINAL YEAR B. TECH. SEM-I Electives

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

Dr. C.L. Jejurkar
**Head of Department**

Dr. A. B. Pawar
**Dean Academics**

Dr. A.G. Thakur
**Director**

**DEPARTMENT OF CIVIL ENGINEERING**

**FINAL YEAR B. TECH. SEM-II**

(W.e.f. Jan 2024)

Board of Studies in Civil Engineering, Jan 2024

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

**SEMESTER-VIII**

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

Dr.C.L. Jejurkar
**BOS Chairman**

Dr.A.B. Pawar
**Dean Academics**

Dr.A.G. Thakur
**Director**

**OEC-OE412- Professional Elective- 1 through NPTEL**

**OEC-OE413- Professional Elective- 2 through NPTEL**

**OEC-OE414- Professional Elective- 3 through NPTEL**

| Sr.No. | Name of NPTEL Courses | NPTEL Link | Duration |
|---|---|---|---|
| | **OEC-OE412-Open Elective-I** | | |
| 1) | Admixtures & Special Concrete | https://onlinecourses.nptel.ac.in/noc23_ce61/preview | 12 Weeks |
| 2) | Availability & Management of ground water | https://onlinecourses.nptel.ac.in/noc23_ce82/preview | 12 Weeks |
| 3) | Water Economics & Goverance | https://onlinecourses.nptel.ac.in/noc23_ce86/preview | 12 Weeks |
| 4) | Integrated Cities Water Management for Smart cities | https://onlinecourses.nptel.ac.in/noc23_ce89/preview | 12 Weeks |
| | **OEC-OE413-Open Elective-II** | | |
| 1) | Pavement Materials | https://onlinecourses.nptel.ac.in/noc23_ce99/preview | 12 Weeks |
| 2) | Geosynthetics & Reinforced Soil structures | https://onlinecourses.nptel.ac.in/noc23_ce60/preview | 12 Weeks |
| 3) | Bridge Engineering | https://onlinecourses.nptel.ac.in/noc23_ce81/preview | 12 Weeks |
| 4) | Soft Skills | https://onlinecourses.nptel.ac.in/noc23_hs145/preview | 12 Weeks |
| | **OEC-OE414-Open Elective-III** | | |
| 1) | Sustainable Engineering Concepts & Life Cycle Analysis | https://onlinecourses.nptel.ac.in/noc23_ce90/preview | 8 Weeks |
| 2) | Project Planning & Control | https://onlinecourses.nptel.ac.in/noc23_ce59/preview | 8 Weeks |
| 3) | Subsurface Exploration | https://onlinecourses.nptel.ac.in/noc23_ce69/preview | 8 Weeks |

# PCC (CE401): Wastewater Treatment, Disposal and Recycling

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

**Text Books**


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


**Reference Books**


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

# PCC (CE402) Transportation Engineering

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

| Unit No. | Topic | No. of Hours | COs |
|---|---|---|---|
| I | **Introduction to Roads, Highway Development and Planning**<br>Introduction, Various surveys, Necessity of Highway planning, Jaykar Committee recommendations and implementations. Road development in India Vision- 2021 and Rural development in India 2025.<br>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.<br>Introduction to road development authorities like IRC, CRRI, NHAI, NHDP, MORTH, etc. Salient features of National and State Highways, Expressways in India. | 06 | 1 |
| II | **Pavement Materials and MORTH Standards**<br>Materials used in highway construction and related tests: soil subgrade and CBR Test, stone aggregates, bituminous binders, bituminous paving mixes, viscosity-based gradation of bitumen, modified bitumen cutbacks, emulsions, crumbed rubber modified bitumen, polymer modified bitumen, foamed bitumen, Desirable properties of bituminous paving mixes, Marshall stability mix design and test (All 5 test parameters). Functions and applications of Geo-synthetics in roadways. | 06. | 2 |
| III | **Highway Geometric Design**<br>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.<br>Design of vertical alignment, gradient and its type, IRC recommendations, | 06 | 3 |

| | | | |
|---|---|---|---|
| | grade compensation on horizontal curve, vertical curves: crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria. Grade compensation. | | |
| IV | **Pavement Analysis and Design**<br>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<br>Rigid pavements: components and functions, factors affecting design, ESWL, Stresses in rigid pavements, wheel load stresses and temperature stresses, design guidelines for concrete pavements as per IRC 58-2015. Joints in CC pavements, problems, highway drainage: subsurface and surface drainage. | 06 | 4 |
| V | **Traffic Engineering Studies and Analysis**<br>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.<br>Categories of traffic flow, uninterrupted traffic flow model, Analysis of speed, flow and density relationship. Traffic signs, Types of intersections. Smart signal systems. | 06 | 5 |
| VI | **Pavement Construction and Maintenance:** Investigation of material for highway construction, Construction of subgrade, subbase, base layers, bituminous courses and MORTH specifications, routine maintenance, periodic maintenance, special repairs, responsive maintenance program, reconstruction, and treatment strategies. | 06 | 6 |

**Text Books:**


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


**Reference Books:**


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

Delhi.

**I.S. Codes:**

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

**Hand Books:**

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

**e – Resources:**

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

# PCC (CE403): Quantity Survey, Contracts and Tenders

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

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

**Course Objectives:**

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

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

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

**Mapping of COs with POs/PSOs:**

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

## Course Contents

| Unit No. | Topic | No. of Hours | CO |
|---|---|---|---|
| I | **a) Introduction to estimates and related terms:** Definitions of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, Civil Engineering projects. Data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum& prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R.<br>**b) Approximate Estimate:** Meaning, purpose, methods of approximate estimation of building, Other civil Engg. works projects like roads, Irrigation Water supply and Sanitary Engineering, Electrical works, Numerical on approximate estimate. | 5 | CO1 |
| II | **Taking out Quantities/Working-out quantities:** -P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing structure, underground water tanks. | 8 | 2 |
| III | **Estimate of RCC and other construction work:** Detailed estimates of R.C.C framed structures, working out quantities of steel reinforcement and bar bending schedule of building elements and retaining walls. Earthwork for road construction, steel roof truss, culvert, | 6 | 3 |
| IV | **a) Specifications**: Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.<br>**b) Rate Analysis**: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Task work or out turn, factors effecting task work. Working out Rate Analysis for the items mentioned in specifications above. Wages act, Special rates concerning to mountainous, hilly, forest and urban areas. | 5 | 4 |
| V | **Valuation:** Purpose of valuation. Meaning of price, cost and value. Factors affecting 'value'. Concept of free hold and lease hold property. **Types of value:** only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Estimation versus valuation. Meanings of depreciation & obsolescence. **Methods of Valuation:** Different methods of land and building valuation. | 6 | 5 |
| VI | **Tender Contracts and Arbitration**: **Tendering and Execution of Works:** Tenders: Definition, detailed tendering process and procedure, conditions regarding earnest money, security deposit, retention money, pre and post qualification of contractors, 3 bid, 2 bid and single bid system, qualitative and | 6 | CO5 |

| | | | |
|---|---|---|---|
| | quantitative evaluation of tenders, comparative statement, pre-bid conference, acceptance/ rejection of tenders, BOT & Global Tendering, E-tendering. PWD procedure for executing, works piecework, rate list and daily labor, administrative approval and technical sanction. Introduction to registration as a contractor in PWD.<br>**Contracts:** Definition, objectives & essentials of a valid contract as per Indian Contract Act (1872), types of contracts, conditions of contract- defective work, subletting, etc. termination of contract, defect liability period, liquidated damages, interim payment or running account bills, advance payment, secured advance, final bill. **Arbitration:** Introduction to arbitrations as per Indian Arbitration & Conciliation Act (1996) - meaning and need of arbitration, qualities and powers of an arbitrator. | | |

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

## Professional Elective-III

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

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

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

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

**TextBooks:**


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


**Reference Books:**


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


**I.S. Codes:**

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

#Latest Revision of IS Codes should be used.

**e – Resources:**

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

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

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

**Text Books:**


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


**Reference Books:**


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


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

# PEC (PE404-c): Advanced Concrete Technology

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

**Prerequisite Course: Building Technology and Materials, Concrete Technology.**

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

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

**Text Books:**


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


**Reference Books:**


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


**e-Resources:** NPTEL course videos

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

**IS Codes:**

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

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

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

# PEC (PE404-d): Structural Audit & Retrofitting

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

**Prerequisite Course:** **Concrete technology**

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

**Text Books:**

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

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

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

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

5. ACI 440.2R-08. Guide for the Design and Construction of Externally Bonded FRP Systems for

Strengthening Concrete Structures, American Concrete Institute

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

**Reference Books:**

1. FailuresandrepairofconcretestructuresbyS.Champion,JohnWileyandSons,1961.

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

**Handbooks & IS Codes:**

1. HandbookonrepairandrehabilitationofRCCbuildings,CPWD,Governmentof India.

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

**NPTEL courses:**

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

# PEC (PE404-e): Construction Safety Management

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

**Text Books**

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

**Reference Books**

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

**E-resources**

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

## Professional Electives -IV

## PEC (CE405-a): Dams and Hydraulic Structures

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

**Text Books:**


1. "Irrigation Engineering and Hydraulic Structures", by Garg S.K., Khanna Publishers ISBN-13: 978- 8174090478.
2. "Irrigation, Water Resources and Water Power Engineering", Modi, P.N., Standard Book House, New Delhi, Edition: 9th, Year-2014 edition (2014).
3. "Irrigation and Water Resources Engineering", by Asawa G.L., New Age International (P) Ltd. Publishers, 1st Ed., 2005.
4. "Irrigation and water power Engineering", by Punmia B. C.,Laxmi Publications; Revised edition (2016), ISBN-13: 978-8131807637.
5. "Hydraulic Structures", by P. Novak, and C. Nalluri, Taylor & Francis. Ed. 4th, 2007.
6. "Earth and rock fill dams", by J. L. Sherard, John Wiley.
7. "Slope Analysis", by R.N. Chowdhary and E.I. Sevier, London, 1978.

8. “Slope stability”, by M. G. Anderson and K. S. Richard, John Wiley, 1987.

**Reference Books:**


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


**e – Resources:**

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

# PEC (CE405-b): Foundation Engineering

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

**Prerequisite Course:** **Geotechnical Engineering**

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

**Text Books:**


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


**Reference Books:**


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

# PEC (PE405-c): Solid Waste Management

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

**Prerequisite Course:** **Environmental Engineering**

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

| **Text Books:** |
|---|
| 1.Matthew J. Franchetti, A System Approach, Solid Waste Analysis & Minimization, McGraw-Hill, (1st Edition, 2009), ISBN: 978-0071605243. |
| 2.S.C. Bhatia Solid and Hazardous Waste Management, Atlantic Publishers and Distributors Ltd., (1st Edition, 2007), ISBN-13: 978-8126908141.ISBN-10: 8126908149 |
| 3.Edward A. Mcbean, Frank A. Rovers, Grahame J. Farquhar Solid Waste Landfill Engineering and Design,Prentice Hall Inc. (2nd Edition, 1995), ISBN: 0130791873. |
| 4.Jagbir Singh and Al Ramanathan,Solid Waste Management Present And Future Challenges, Dreamtech Press, (1st Edition- Nov 2019)ISBN: 9789389447927. |
| **Reference Books** |
| 1.George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues (Civil Engineering), McGraw- Hill, New York, 2nd Edition (Indian Edition 28 Feb1993), ISBN:978-00706323700070632375. |
| 2.Charles A. Wentz, "Hazardous waste Management," Mc Graw Hill Book Company, 1989, ISBN 0070692912, 9780070692916. |
| 3.Tchobanoglous, G. and Kreith, F., Handbook on Solid waste Management, McGraw Hill, 2002, 2nd Edition, ISBN: 9780071356237. |
| 4.CPHEEO Manual on Municipal Solid Waste Management – 2000, Ministry of Housing and Urban Affairs, GOI. |
| **E-Resources:**https://onlinecourses.nptel.ac.in/noc22_ce82/course |

# PEC(PE405-d) Formwork Technology & Plumbing System

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

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

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

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

**Text Books:**


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


**Reference Books:**


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


**Indian Standards:**


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

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

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

**Prerequisite Course:** **-Nil-**

**Course Objectives:**

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

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

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

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

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

## Course Contents

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

**Text Books:**

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

**Reference Books:**

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

**E- Resources:**

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

# PCC (CE406): Characterization of Wastewater Lab.

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

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

**Course Objectives:**

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

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

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

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

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

## List of Laboratory Experiments:

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

**List of experiments (Any eight from 12)**

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

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

## Assignment

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

# PCC (CE407): Transportation Engineering Lab

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

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

**Course Objectives:**

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

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

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

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

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

## List of Laboratory Experiments

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

**A) TEST ON AGGREGATES**

1 Aggregate Impact Value and Crushing value Test

2 Los Angeles Abrasion Test

3 Shape Test (Flakiness Index and Elongation Index

4 Specific Gravity and Water Absorption Test by basket method

**B) TEST ON BITUMEN**

5 Penetration Test

6 Ductility Test

7 Viscosity Test (Tar Viscometer)

8 Softening Point, Flash and Fire Point

9 Specific Gravity Test

**C) TESTS ON BITUMINOUS CONCRETE MIXES**

10 Marshall Stability Test

11 Bitumen Extraction Test or Stripping value Test

**D) SITE VISITS (ANY ONE VISIT MANDATORY)**

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

13 Visit to Crushing and Hot mix Plant

**E) ASSIGNMENT ON SOFTWARE**

14 Pavement analysis and design using IIT PAVE software

# PCC (CE408) Professional Practice Lab

| **Teaching Scheme:**<br>**Practical:** 02 Hrs. / Week | **Evaluation Scheme:**<br>**Oral Exam**:50 Marks |
|---|---|
| **Credits:** 01 | **Total** **:**50 Marks |

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

**Course Objectives:**

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

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

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

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

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

**The following exercises should be prepared and submitted:**

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

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

# PE-409: Professional Elective-III Practical Labs

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

| Teaching Scheme<br>Practical: 02 Hrs./ Week | Evaluation Scheme:<br>Oral Exam : 25 Marks |
|---|---|
| Credits: 01 | Total : 25 Marks |

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

**Course Objectives:**

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

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

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

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

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

## List of Laboratory Work:

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

Note:

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

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

**Text Books:**


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


**Reference Books:**


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


**I.S. Codes:**

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

# Latest Revision of IS Codes should be used.

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

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

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

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

**Course Objectives:**

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

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

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

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

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

**List of Experiments:**

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

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

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

**Prerequisite Course: Building Technology and materials, Concrete Technology**

**Course Objectives:**

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

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

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

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

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

**List of Laboratory Work:**

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

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

C. Test on Fresh concrete.
   1. Effect of admixture on Workability of special concrete.

2. Effect of VMA on Workability of self-compacting concrete.
3. Effect of fiber content on Workability of FRC.

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

E. Durability of concrete by RCPT and permeability test.

F. Site visit.

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

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

**Prerequisite Course:** **Concrete technology**

**Course Objective:**

| Sr. No. | Course Objectives |
|---|---|
| 1 | Students will be aware of the various tests used to determine the quality of concrete |
| 2 | Students will be familiar with the various norms /standards set by Bureau of Indian Standards and assess the quality of concrete at a particular structural element. |
| 3 | Students will aware about the preparation of structural audit report |

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

| CO's No | Course Outcome (s) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Use instrument and methodologies to measure quality of concrete. | 3 | Apply |
| 2 | Comparison of observed reading characteristics with the IS code/standard limits. | 4 | Analyzing |
| 3 | Use of analyzed results/visual inspection for the preparation audit report of a structure. | 5 | Evaluating |

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

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

## List of Experiments:

1. To determine the strength of the concrete of columns by using rebound hammer
2. To determine the quality of concrete by using Ultra sonic pulse velocity by direct transmission method
3. To determine the quality of concrete by using Ultra sonic pulse velocity by indirect or surface transmission method
4. To determine the quality of concrete by using Ultra sonic pulse velocity by semi-direct transmission method
5. To determine the dynamic Young's modulus of elasticity of concrete using Ultra sonic pulse velocity equipment
6. To study the carbonation of concrete
7. Study of carbonation of concrete test by conducing the experiment.
8. Visit to any multi-storey ongoing construction building and preparation of its detail report with various NDT readings/preparation of report using visual inspection.

# PEC (PE 409- e): Construction Safety Management Lab.

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

**Prerequisite Course:** **Building Technology & Material, Infrastructure Engineering & Construction Techniques, Construction Project Management.**

**Course Objectives:**

| Sr. No. | Course Objectives |
|---|---|
| 1 | To enhance knowledge about personal protective equipment and safety practices about formwork, electrical, fireworks. |
| 2 | To learn applications of BIM in safety engineering. |
| 3 | To gain knowledge about safety legislation and OSHA guidelines. |

**Course Outcomes: This course will enable students to:**

| COs No. | Course Outcomes (s) | Bloom's Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| 1 | Understand role and importance of personal protective equipment in construction sector. | 2 | Understand |
| 2 | Apply fundamentals of BIM for safety. | 3 | Apply |
| 3 | Identify safety practices, safety legislation and OSHA guidelines for various construction activities with the help of site visit. | 3 | Apply |

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

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

**List of Assignments:**

It shall consist of the following exercises.

1. Assignment on personal protective equipment.
2. Assignment on Formwork safety practices.
3. Assignment on Electrical and Fire safety practices for construction sites.
4. Assignment on applications of BIM in safety engineering.
5. Assignment on safety implementation, safety legislation for construction activities.
6. Assignment on OSHA guidelines.
7. Site visit to a Construction project for study of Safety practices at construction sites, use of personal protective equipment with a detailed report.

(Term work: Based on the above syllabus.)

# PRJ: (CE410): Project Stage-I

| Teaching scheme | Evaluation scheme |
|---|---|
| **Practical: 06 hours/week** | **Oral Marks: 50 Marks**<br>**Term Work Marks: 100 Marks** |
| **Credits: 03** | **Total: 150 Marks** |

**Prerequisite Course:** Knowledge of all B. Tech subjects from I$^{st}$ to VIII$^{th}$ semester, Computer Basics, MS office.

**Course Objectives:**

| Sr. No. | Course Objectives |
|---|---|
| 1. | To know about the use of literature survey. |
| 2. | To identify the problem statement and frame the objectives based on gaps in literature survey. |
| 3.<br>4. | To select the proper methodology/experimentation/analysis technique, suitable software required for the project. |
| 5. | To design, develop and analyze civil engineering structures and schedule the activities. |
| 6.<br>7. | To identify social problems and provide viable / sustainable engineering solutions for development of society. |

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

| CO's | Course Outcomes | Blooms Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Understand the importance of literature survey. | 2 | Understand |
| CO2 | Formulate problem and frame the objectives based on gaps in literature survey. | 3 | Apply |
| CO3 | Use proper methodology / experimentation / analysis technique / suitable software for the project. | 4 | Analyse |
| CO4 | Design, develop, and analyze civil engineering structures through proper scheduling. | 5 | Evaluate |
| CO5 | Identify social problems and provide viable engineering solutions using the latest technology. | 5 | Evaluate |
| CO6 | Present the project for society, Civil Engineering field and helps for sustainable development. | 6 | Create |

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

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

**Project Guidelines:**

**Note: Student must complete the project work in the VII$^{th}$ semester only.**

## I. General:

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

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

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

**Some Advanced Projects:** Data Science Projects, Robotics and Automation Projects, Aerospace and Defense Projects, Materials Science and Engineering Projects, Civil Engineering Projects, Cyber security Projects

**The project work shall be consisting of any demanding area such as.**

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

**Additional weightage will be given if projects / research related to**

Option A: Industry Sponsored Project

Option B: Project as an Entrepreneur

Option C: Internal Product development

Option D: Interdisciplinary projects

Option E: National / International Journal paper publication

Option F: filling Patent based on project work.

## II. Project Allocation and Guide selection:

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

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

2. Students should identify a project of enough complexity, which has at least 4-5 major functionalities. Preferably, the projects must be industry sponsored or part of high level research / Sponsored research project / live industry problem, new product development or entrepreneurship project.
3. Each project group will submit the registration form along with synopsis or brief abstract including title of the project, key words and relevant mathematics associated with the project, review of conference/Journal papers (at least 15 International and 10 National papers, supporting the project idea, plan of project execution using planner or like project management tool. (Recommended in1 or 2 week after commencement of the term).
4. The students or project group should give presentations on the synopsis or abstract including title of the project and project progress made by them before the Review committee in the seventh semester's first week after commencement of the term.
5. Students should identify stakeholders and write a detailed problem statement for the system.
6. The review committee should revisit the "Feasibility Review" conducted by Examiners during Oral examination in the seventh semester to finalize the project title and scope of the project.
7. If a change in the project topic is unavoidable, then the students should complete the process of project re-approval the project title and scope of the project by submitting a synopsis along with the review of important papers. This new project topic should be approved by the review committee.
8. The record of the remarks/suggestions of the review committee should be properly maintained and made available at the time of examination.
9. Each student/group is required to give a presentation as part of the review for 10 to 15 minutes, followed by a detailed discussion.
10. Students should revisit and reassess the problem statement mentioned in the project-based seminar activity periodically and make appropriate changes if required.
11. By following these guidelines, students and faculty can ensure that the graduate engineering projects are well-structured, timely, and successful.
12. There shall be two project reviews to monitor Project progress in semester-I (VII$^{th}$) before final project exam.
13. The Project Review committee will be responsible for maintaining project standards, timely progress monitoring, conducting reviews, evaluating and final project examination.

**How to write Project objectives and the outcomes**:

1. **Define the problem:** Start by defining the problem that your project aims to solve. This should be a clear and concise statement that explains the issue that your project is addressing.
2. **Identify the project objectives:** Once you have defined the problem, identify the objectives of your project. These are specific, measurable, achievable, relevant, and time-bound (SMART) statements that outline what your project aims to achieve.
3. **List the project outcomes:** Outcomes are the tangible results or benefits that your project will produce. They should be specific and measurable, and demonstrate the impact of your project on the target audience or stakeholders.
4. **Use action verbs:** Use action verbs to describe the project objectives and outcomes. Action verbs convey a sense of urgency and purpose, and make it clear what actions will be taken to achieve the project objectives.
5. **Prioritize:** Prioritize the objectives and outcomes based on their importance and relevance to the project. This will help you focus your efforts and resources on the most critical aspects of the project.

6. **Review and revise:** Review and revise your project objectives and outcomes regularly to ensure they are still relevant and aligned with the project goals. Make adjustments as needed to reflect changes in project scope, timelines, or priorities.
7. Project objectives must be clear, concise and outcomes based. Also, essential for effective project planning and implementation. They help to stay focused on what and how to achieve or measure success.

**Sample Project Outcomes:**

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

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

## III. Evaluation Guidelines:

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

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

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

d) Project report should not be hard bound without final approval / permission of guide, Internal and external examiner.

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

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

## IV. Final Project Report:

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

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

**Chapter 2** Literature Review / Survey from minimum 15 articles published in International Journals and 10 articles published in national journals, books, I.S. Codes, etc. (It shall include details regarding

work done by various researchers in the area, methods established / used, any new approach. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.).

**Chapter 3** Methodology used / scientific approach used

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

**Chapter 4**Results and Discussion

**Chapter 5** Conclusions

**References and Bibliography**

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

## V. Report printing details:

**a)** Report must be typed as per the following format on **A4 size Executive Bond paper** preferably on one side of paper with 1.5 spacing.

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

**c)** Number of reports (**black color hard bound with front cover embossed**) to prepare / submitted are 1 College copy + 1 Guide copy + each individual copy of student.

**d) Format of project report:**

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

**Font size &font Type:**

a. **Chapter Number and Name -** 14 Font size, Times New Roman in **Capital Bold Letters**.
b. **Main Titles (e.g1.1, 2.5 etc) -** 12 Font size, Times New Roman in **Bold Capital Letters**.
c. **Sub Titles (e.g. 1.1.5, 4.5.1 etc) -** 12 Font size, Times New Roman in **Bold Title case**.
d. **All other matter / content -**12 Font size, Times New Roman sentence case.
e. **Figure name -** 12 Font size, Times New Roman below the figure **Bold** in sentence case.
f. **Table title** - 12 font size, **Bold** Times New Roman **sentence case** above the above the table.
g. No **blank sheet**/ **page** should be left in the report.

**Layout of typed content:**

a. **Chapter Number and Name –** Center of Page.
b. **Main Titles and Sub Titles -** Justified
c. **All other matter / content -** Justified
d. **Figure & Figure name – Figure should be at** Centre of page and **Figure name should beat** Centre of page and below the figure.
e. **Table & Table title - Table should be at** Centre of page and **Table title should beat centre** of page and Above the Table.

**# Refer sample Report format given below:**

**$Refer Engineering Project guidelines and rubrics 2022-2023 available with Department project coordinator and Institute Dean Academics.**

## MLC (MC-411): Financially Smart

| Personal Financial Literacy Program for Young Adults-Being Financially Smart | |
|---|---|
| •A-Google Survey–Pre-session (via email) | |
| **Unit1- Behavioural Finance- 3 hours** | **Unit 2-MoneyManagement Skills-3hours** |
| Section1 –Let's Talk Money | Section 1–Important Concepts |
| 1.Psychology of Money | 1.Savingvs Investing |
| 2. Your Relationship with Money | 2.Inflation |
| 3.Human Behaviour in Financial Markets | 3. Power of Compounding |
| Section2–Why Financial Literacy? | Section2–Money Management Techniques |
| 4.Importance of Financial Literacy | 4. S.M.A.R.T.E.R way to Wealth |
| 5. Costly Money Mistakes | 5.6- Money Jar Method |
| **Micro-Project1-Exercise** | |
| **Unit3- Steps of Financial Planning-** 3hours | **Unit 4–Risk &Investment Management-3hours** |
| Section1 –Let's Start Planning | Section1-Risk Management |
| 1.Need & Components of Financial Planning | 1.Understanding Risk Management |
| 2.Personal Income Statement–Cash flow Mgt & Net Worth Mgt. | 2.Life Insurance |
| 3.S.M.A.R.TGoal Setting | 3.HealthInsurance |
| Section2- Goal Based Investment Planning | Section 2- Investment Management |
| 4.Contingency/Emergency Fund Planning | 4. Asset Allocation |
| 5.Lifestyle/Retirement Planning | 5.Mutual Funds-Overview |
| 6. Estate Planning | 5.Review&Action |
| **Micro-Project2-CaseStudy** | |
| **Unit 5– Introduction to Business Finance- 3 hours** | |
| **H**ow to Read an Income Statement | |
| How to Read a Balance Sheet | |
| **Micro-Project3-CaseStudy** | |
| B-Google Survey(via email) | |
| Post -session: -1. Evaluation 2. Feedback 3. Certification | |

## Sem-VIII

| Sr.No. | Name of NPTEL Courses | NPTEL Link | Duration |
|---|---|---|---|
| | **OEC-OE412-Open Elective-I** | | |
| 5) | Air pollution and Control | https://onlinecourses.nptel.ac.in/noc24_ce03/preview | 12 Weeks |
| 6) | Environmental Remediation of Contaminated Sites | https://onlinecourses.nptel.ac.in/noc24_ce11/preview | 12 Weeks |
| 7) | Advanced Soil Mechanics | https://onlinecourses.nptel.ac.in/noc24_ce02/preview | 12 Weeks |
| 8) | Modern Construction Materials | https://onlinecourses.nptel.ac.in/noc24_ce44/preview | 12 Weeks |
| | **OEC-OE413-Open Elective-II** | | |
| 5) | Energy Efficiency, Acoustics and Daylighting in Building | https://onlinecourses.nptel.ac.in/noc24_ce47/preview | 12 Weeks |
| 6) | Maintenance and Repair of Concrete Structures | https://onlinecourses.nptel.ac.in/noc24_ce22/preview | 12 Weeks |
| 7) | Retrofitting and Rehabilitation of Civil Infrastructure | https://onlinecourses.nptel.ac.in/noc24_ce27/preview | 12 Weeks |
| 8) | Urban Transportation Systems Planning | https://onlinecourses.nptel.ac.in/noc24_ce37/preview | 12 Weeks |
| | **OEC-OE414-Open Elective-III** | | |
| 4) | Construction Methods and Equipment Management | https://onlinecourses.nptel.ac.in/noc24_ce07/preview | 8 Weeks |
| 5) | Development and Applications of Special Concretes | https://onlinecourses.nptel.ac.in/noc24_ce08/preview | 8 Weeks |
| 6) | Plastic Waste Management | https://onlinecourses.nptel.ac.in/noc24_ce25/preview | 8 Weeks |
| 7) | Earthquake Resistant Design of Foundations | https://onlinecourses.nptel.ac.in/noc24_ce09/preview | 8 Weeks |

# PRJ: (CE415): Professional Internship

| Teaching Scheme | Evaluation Scheme: |
|---|---|
| **Practical: 12 Hrs./ Week** | **Oral Exam : 50 Marks**<br>**Term Work : 100 Marks** |
| **Credits: 6** | **Total : 150 Marks** |

**Course Objectives:**

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

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

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

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

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

## Course Contents

### Guidelines for Internship

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

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

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

**2. Sanjivani College of Engineering Center of Excellence Placement cum Internship:**

| | |
|---|---|
| 1 | Two guides shall supervise the internship project work, one from the department and another one from industry. |
| 2 | Industry shall submit the month-wise satisfactory attendance of the students to the institute/department |
| 3 | Student must regularly use daily diary, which is to cultivate the habit of documenting and send the Geotag photo of each day to the concern faculty. |
| 4 | The presentation is way to evaluate student performance, so student must be ready as institute guide, internal and external examiner evaluates them. |
| 5 | Student must submit a comprehensive report to the department before presentation as per provided format. |
| **Steps to apply for internship** | |
| 1 | Students shall ask for permission letter from Civil Engineering Department office/office of Training & Placement cell of the college in consultation of guide (Institute) to allot Minimum 8 to 12weeks during as internship periods. |
| 2 | Students on joining Training at the concerned Industry must submit the permission letter from the office of Training & Placement cell of the college. |
| 3 | Students must regularly use dairy to record the details and submit attendance in internship report with the evidence (Geotag photo/Selfi). |
| 4 | Students shall be obtained Training Certificate from industry. |
| 5 | Students shall submit training report after completion of internship to guide (faculty). |
| **Evaluation process for internship** | |
| 1 | Students must submit training report and training certificate from industry after completion of internship to guide. |
| 2 | Guide will access performance of student through presentation, which is evaluated by institute guide and external examiner from institute itself. |

# PRJ: (CE416): Project Stage-II

| Teaching scheme | Examination scheme |
|---|---|
| **Practical: 04 hours/week** | **Oral: 50 Marks** |
| **Credits: 02** | **Total: 50 Marks** |

**Prerequisite Course:** Knowledge of all BTech subjects from I$^{st}$ to VII$^{th}$ semester, Computer Basics, MS office.

**Course Objectives:**

| Sr. No. | Course Objectives |
|---|---|
| 1 | To know about the use of literature survey. |
| 2 | To identify the problem statement and frame the objectives based on gaps in literature survey. |
| 3 | To select the proper methodology/experimentation/analysis technique, suitable software required for the project. |
| 4 | To design, develop and analyze civil engineering structures and schedule the activities. |
| 5 | To identify social problems and provide viable / sustainable engineering solutions for development of society. |

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

| CO's | Course Outcomes | Blooms Taxonomy | |
|---|---|---|---|
| | | Level | Descriptor |
| CO1 | Understand the importance of literature survey. | 2 | Understand |
| CO2 | Formulate problem and frame the objectives based on gaps in literature survey. | 3 | Apply |
| CO3 | Use proper methodology / experimentation / analysis technique / suitable software for the project. | 4 | Analyze |
| CO4 | Design, develop, and analyze civil engineering structures through proper scheduling. | 5 | Evaluate |
| CO5 | Identify social problems and provide viable engineering solutions using the latest technology. | 5 | Evaluate |
| CO6 | Present the project for society, Civil Engineering field and helps for sustainable development. | 6 | Create |

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

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

**Project Guidelines:**

**Note: Student must complete the project work in the VII$^{th}$ semester only.**

**I. General:**

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

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

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

**Some Advanced Projects:** Data Science Projects, Robotics and Automation Projects, Aerospace and Defense Projects, Materials Science and Engineering Projects, Civil Engineering Projects, Cyber security Projects

**The project work shall be consisting of any demanding area such as.**

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

**Additional weightage will be given if projects / research related to**

Option A: Industry Sponsored Project

Option B: Project as an Entrepreneur

Option C: Internal Product development

Option D: Interdisciplinary projects

Option E: National / International Journal paper publication

Option F: filling Patent based on project work.

## II. Project Allocation and Guide selection:

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

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

2. Students should identify a project of enough complexity, which has at least 4-5 major functionalities. Preferably, the projects must be industry sponsored or part of high-level research / Sponsored research project / live industry problem, new product development or entrepreneurship project.
3. Each project group will submit the registration form along with synopsis or brief abstract including title of the project, key words and relevant mathematics associated with the project, review of conference/Journal papers (at least 15 International and 10 National papers, supporting the project idea, plan of project execution using planner or like project management tool. (Recommended in 1 or 2 weeks after commencement of the term).
4. The students or project group should give presentations on the synopsis or abstract including title of the project and project progress made by them before the Review committee in the seventh semester's first week after commencement of the term.
5. Students should identify stakeholders and write a detailed problem statement for the system.
6. The review committee should revisit the “Feasibility Review” conducted by Examiners during Oral examination in the seventh semester to finalize the project title and scope of the project.
7. If a change in the project topic is unavoidable, then the students should complete the process of project re-approval the project title and scope of the project by submitting a synopsis along with the review of important papers. This new project topic should be approved by the review committee.
8. The record of the remarks/suggestions of the review committee should be properly maintained and made available at the time of examination.
9. Each student/group is required to give a presentation as part of the review for 10 to 15 minutes, followed by a detailed discussion.
10. Students should revisit and reassess the problem statement mentioned in the project-based seminar activity periodically and make appropriate changes if required.

11. By following these guidelines, students and faculty can ensure that the graduate engineering projects are well-structured, timely, and successful.
12. There shall be two project reviews to monitor Project progress in semester-I (VII$^{th}$) before final project exam.
13. The Project Review committee will be responsible for maintaining project standards, timely progress monitoring, conducting reviews, evaluating and final project examination.

**How to write Project objectives and the outcomes**:

1. **Define the problem:** Start by defining the problem that your project aims to solve. This should be a clear and concise statement that explains the issue that your project is addressing.
2. **Identify the project objectives:** Once you have defined the problem, identify the objectives of your project. These are specific, measurable, achievable, relevant, and time-bound (SMART) statements that outline what your project aims to achieve.
3. **List the project outcomes:** Outcomes are the tangible results or benefits that your project will produce. They should be specific and measurable, and demonstrate the impact of your project on the target audience or stakeholders.
4. **Use action verbs:** Use action verbs to describe the project objectives and outcomes. Action verbs convey a sense of urgency and purpose, and make it clear what actions will be taken to achieve the project objectives.
5. **Prioritize:** Prioritize the objectives and outcomes based on their importance and relevance to the project. This will help you focus your efforts and resources on the most critical aspects of the project.
6. **Review and revise:** Review and revise your project objectives and outcomes regularly to ensure they are still relevant and aligned with the project goals. Make adjustments as needed to reflect changes in project scope, timelines, or priorities.
7. Project objectives must be clear, concise and outcomes based. Also, essential for effective project planning and implementation. They help to stay focused on what and how to achieve or measure success.

**Sample Project Outcomes:**

1. **Project Title:** Designing a Sustainable Housing Project
2. **Project Outcomes:** By the end of the project, students will be able to:
    - Analyze the needs of the target community and develop a comprehensive design brief for a sustainable housing project.
    - Apply principles of sustainable design and construction to create a cost-effective and environmentally-friendly housing solution.

- Utilize design software and tools to create detailed architectural plans and specifications for the project.
- Collaborate effectively with project team members to manage project timelines, budgets, and resources.
- Present the project to stakeholders, including investors and community members, with clear and persuasive communication.

## III. Evaluation Guidelines:

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

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

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

d) Project report should not be hard bound without final approval / permission of guide, Internal and external examiner.

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

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

## IV. Final Project Report:

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

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

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

**Chapter 3** Methodology used / scientific approach used

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

**Chapter 4** Results and Discussion

**Chapter 5** Conclusions

**References and Bibliography**

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

## V. Report printing details:

**a)** Report must be typed as per the following format on **A4 size Executive Bond paper** preferably on one side of paper with 1.5 spacing.

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

**c)** Number of reports (**black color hard bound with front cover embossed**) to prepare / submitted are 1 College copy + 1 Guide copy + each individual copy of student.

**d)** **Format of project report:**

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

**Font size & font Type:**

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

**Layout of typed content:**

a. **Chapter Number and Name –** Center of Page.
b. **Main Titles and Sub Titles -** Justified
c. **All other matter / content -** Justified
d. **Figure & Figure name – Figure should be at** Centre of page and **Figure name should be at** Centre of page and below the figure.
e. **Table & Table title - Table should be at** Centre of page and **Table title should be at center** of page and Above the Table.