

**Curriculum
(Scheme of Examination)
&
Syllabus for**

**M.Tech
Structural Engineering**

Batch 2020 onwards



SGT University Gurgaon

Credit Based Scheme w.e.f. 2020-2021



Scheme of Examination for M.Tech–Structural Engineering Program

SEMESTER WISE COURSE STRUCTURE

First Semester

| S. NO. | Subject Code | Course Title | L | T | P | C | Examination marks | | Subject Total |
|--------|--------------|---|-----------|----------|----------|-----------|-------------------|------------|---------------|
| | | | | | | | Ext. | Int. | |
| 1 | 13160110 | Advance Pre-Stressed Concrete Design | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 2 | 13160111 | Structural Dynamics | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 3 | 13160103 | Research Methodology & IPR | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 4 | 13160112 | Design of Concrete Structural Systems | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 5 | 13160105 | Research Methodology & IPR Lab | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 6 | 13160113 | Design of Concrete and Structural Systems Lab (STAAD PRO) | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 7 | 13160106 | Seminar | 0 | 0 | 2 | 1 | 0 | 100 | 100 |
| | | Total | 12 | 0 | 6 | 15 | 320 | 380 | 700 |

Second Semester

| S. NO. | Subject Code | Course Title | L | T | P | C | Examination marks | | Subject Total |
|--------|--------------|---|-----------|----------|----------|-----------|-------------------|------------|---------------|
| | | | | | | | Ext. | Int. | |
| 1 | 13160212 | Finite Element Analysis | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 2 | 13160213 | Theory of Elasticity and Plasticity | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 3 | 13160214 | Limit State Design of Steel Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 4 | | Elective – I | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 5 | 13160215 | Structural Engineering lab (CASTING) | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 6 | 13160216 | Finite Element Analysis Lab (STAAD PRO) | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 7 | 13160206 | Seminar | 0 | 0 | 2 | 1 | 0 | 100 | 100 |
| | | Total | 12 | 0 | 6 | 15 | 320 | 380 | 700 |



Scheme of Examination for M.Tech–Structural Engineering Program

SEMESTER WISE COURSE STRUCTURE

Third Semester

| S.NO. | Subject Code | Course Title | L | T | P | C | Examination marks | | Subject Total |
|-------|--------------|---|-----------|----------|----------|-----------|-------------------|------------|---------------|
| | | | | | | | Ext. | Int. | |
| 1 | 13160310 | Earthquake Resistant Design | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 2 | 13160311 | Matrix Methods of Structural Analysis | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 3 | | Elective – II | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 4 | | Elective – III | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| | 13160312 | Matrix methods of Structural Analysis Lab (STAAD PRO) | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| 6 | 13160305 | Identification of Research Problem | 0 | 0 | 2 | - | - | | |
| | | Total | 12 | 0 | 6 | 14 | 280 | 220 | 500 |

Fourth Semester

| S.NO. | Subject Code | Course Title | L | T | P | C | Examination marks | | Subject Total |
|-------|--------------|--------------|----------|----------|-----------|-----------|-------------------|----------|---------------|
| | | | | | | | Ext. | Int. | |
| 1 | 13160401 | Dissertation | 0 | 0 | 20 | 20 | 100 | - | 100 |
| | | Total | 0 | 0 | 20 | 20 | 100 | - | 100 |

List of Program Electives

| S. NO. | Subject Code | Course Title | L | T | P | C | Examination marks | | Subject Total |
|---------------------|--------------|--|-----------|---|---|---|-------------------|------|---------------|
| | | | | | | | Ext. | Int. | |
| Elective I | | | | | | | | | |
| 1 | 13160239 | Advanced Foundation Engineering | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 2 | 13160240 | Design of Industrial Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 3 | 13160241 | Maintenance & Rehabilitation of Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 4 | 13160242 | Soil Structure Interaction | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| Elective II | | | | | | | | | |
| 1 | 13160329 | Design of Tall Buildings | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 2 | 13160330 | Energy Efficient Buildings | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 3 | 13160331 | Environmental Engineering Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 4 | 13160332 | Stability of Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| Elective III | | | | | | | | | |
| 1 | 13160333 | Design of Bridges | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 2 | 13160334 | Prefabricated Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 3 | 13160335 | Structural Optimization | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| 4 | 13160336 | Composite Structures | 3 | 0 | 0 | 3 | 60 | 40 | 100 |
| | | Total Credits | 09 | | | | | | |

SEMESTER -I

| | | | | | | |
|--|--|---------------------------------------|-----------|------------------------|----------------|--------------|
| 1.Name of the Department | | CIVIL ENGINEERING | | | | |
| 2.Course Name | Advanced Pre-stressed Concrete Structures | L | T | P | | |
| 3.Course Code | 13160110 | 3 | 0 | 0 | | |
| 4.Type of Course (use tick mark) | | Core ($\sqrt{\quad}$) | PE-() | OE() | | |
| 5.Pre-requisite (if any) | Fluid Mechanics | 6.Frequency (use tick marks) | Even () | Odd ($\sqrt{\quad}$) | Either Sem () | Every Sem() |
| 7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | Practical | | | |
| 8.Brief Syllabus: | | | | | | |
| In this course, student will learn about Pre-stressed concrete. Its advantages, different methods and its application. Different types of losses in pre-stressed concrete structure and design. | | | | | | |
| 9.Learning objectives: | | | | | | |
| 1. This subject is taught to give the concepts of pre-stress. | | | | | | |
| 10.Course Outcomes | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Know the concepts, methods and materials of pre-stressing systems. | | | | | | |
| 2. Design the pre-stressed concrete members. | | | | | | |
| 3. Calculate the deflections in pre-stressed concrete members. | | | | | | |
| 4. Design anchorage zones and composite pre-stressed concrete members. | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 10 | Materials and losses in pre stress | | | | |
| Difference between reinforced and pre-stressed concrete – Principles of pre-stressing – Methods and systems of pre-stressing – Principles of pre-stressing – Classification of pre-stressed concrete structures – Materials – High strength concrete and High strength steel – Stress-strain diagram - Losses in pre-stress. | | | | | | |
| Unit - 2 | Number of lectures = 11 | Design of pre-stressed concrete beams | | | | |
| Design of prismatic pre-stressed concrete members for bending at service load. | | | | | | |
| Unit - 3 | Number of lectures = 10 | Deflections | | | | |
| Simple cable profiles – Calculation of deflections – Design of beams for shear and torsion at working and ultimate loads. | | | | | | |
| Unit - 4 | Number of lectures = 05 | Anchorage design | | | | |
| Design of Anchorage zone by Guyon’s method – Concept of Magnel’s method – IS:1343 recommendations. | | | | | | |
| 13.Books Recommended | | | | | | |
| TEXT BOOKS | | | | | | |

1. Krishna Raju.N, (2010), Problems & Solutions Pre-stressed Concrete, Second Edition, CBS Publishers, ISBN-13: 9788123907154.

REFERENCE BOOKS

1. Dayarathnam P, (1996), Pre-stressed Concrete Structures, Fifth Edition, Oxford & IBH – Pubs Company, ISBN-13: 9788120400450.
2. Sinha N. C and Roy S. K., Fundamentals of Pre-stressed Concrete, Third Edition, S.Chand & Company, ISBN-13: 9788121924276.

| | | | | | | |
|--|--------------------------------|--|-------------|---|---------------------|--|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Structural Dynamics | L | T | | P | |
| 3. Course Code | 13160111 | 3 | 0 | | 0 | |
| 4. Type of Course | | <input checked="" type="checkbox"/> Core () | PE() | | OE() | |
| 5. Pre-requisite (if any) | | 6. Frequency (use tick marks) | Even () | <input checked="" type="checkbox"/> Odd () | Either Sem () | |
| | | | | | Every Sem () | |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 34 | | Tutorials = 00 | | Practical = 00 | | |
| Brief Syllabus: Study of Single degree of freedom system(SDOF Systems) , Study of structure under Harmonic and Impulse Loading, Vibration Analysis, Study of multi degree of freedom system (MDOF Continuous Systems) | | | | | | |
| 8. Learning objectives: | | | | | | |
| 1. To find the behaviour of structures subjected to dynamic loads such as wind, earthquake and blast loads. | | | | | | |
| 2. To study different dynamic analysis procedures for calculating response of structures | | | | | | |
| 9. Course Outcomes: | | | | | | |
| 1. Solve the problems on single degree of freedom system. | | | | | | |
| 2. Understanding concepts of harmonic loading and impulse loading and related analysis. | | | | | | |
| 3. Understanding the concepts of multi degree of freedom system. | | | | | | |
| 4. Evaluate the mode shapes for different structures. | | | | | | |
| 10. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: SDOF Systems | | | | |
| Single Degree of Freedom System - Introduction - Alembert's principle - Mathematical models for SDOF systems - Free vibration - Damped and undamped - Critical damping - Logarithmic decrement. | | | | | | |
| Unit - 2 | Number of lectures = 09 | Title of the unit: Harmonic and Impulse Loading | | | | |
| Response to Harmonic Loading and Impulse Loading - Analysis of undamped system - damped system - general dynamic loading. | | | | | | |
| Unit - 3 | Number of lectures =08 | Title of the unit: Vibration Analysis | | | | |
| Vibration Analysis - Rayleigh's method - Approximate Analysis - Improved Rayleigh method. | | | | | | |
| Unit - 4 | Number of lectures = 9 | Title of the unit: MDOF Systems | | | | |
| Multi degree of Freedom System - Evaluation of structural property matrices - Mode shape - Orthogonality conditions - Undamped and damped system - Mode superposition method | | | | | | |
| 11. Brief Description of self learning / E-learning component | | | | | | |
| 1. https://swayam.gov.in/course/3697-structural-dynamics | | | | | | |
| 2. https://onlinecourses.nptel.ac.in/noc16_ce08/course | | | | | | |
| 3. https://www.iitk.ac.in/nicee/wcee/article/WCEE2012_3202.pdf | | | | | | |
| 12. Books Recommended | | | | | | |

TEXT BOOKS

1. Mario Paz, (2004), Structural Dynamics - Theory and Computation, Second Edition, CBS Publishers, ISBN-13: 9788123909783.

REFERENCE BOOKS

1. J. Humar, (2012), Dynamics of Structures, Third Edition, CRC Press, ISBN-13: 9780415620864.

2. Anil K. Chopra, (2003), Dynamics of Structures - Theory and Applications to Earthquake Engineering, Third Edition, Pearson India, ISBN-13: 9788131713297.

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|--|------------------------------|--|---------------|---------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Research Methodology and IPR | L | T | P | | |
| 3. Course Code | 13160103 | 3 | 0 | 0 | | |
| 4. Type of Course (use tick mark) | | Core (✓) | PE(-) | OE() | | |
| 5. Pre-requisite (if any) | | 6. Frequency (use tick marks) | Even () | Odd (✓) | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 32 | | Tutorials = 00 | Practical = 0 | | | |
| 8. Brief Syllabus: | | | | | | |
| The aim of the course is to make students understand the importance of Research Paper Writing. Also, it covers all the concepts which involved in writing the Research Paper. | | | | | | |
| 9. Learning objectives: | | | | | | |
| The objectives of the course are: | | | | | | |
| <ol style="list-style-type: none"> 1. The students are able to recognize the steps involved in doing research work. 2. The students will be able to collect data using various media and using the best possible sample available. 3. The students would learn to propose their Hypothesis and build models for the problem. 4. The students would be able to correctly document their findings in the form of a report. | | | | | | |
| 10. Course Outcomes: | | | | | | |
| After completion of this course, the student will be able to: | | | | | | |
| <ol style="list-style-type: none"> 1. Recognize the various steps involved in research. 2. Collect data from samples, Examine and Analyze the data. 3. Develop models for problems. 4. Explain the entire process in the form of a report. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: Introduction | | | | |
| Research - Types, Research process and steps, Hypothesis, Research Proposal and aspects. Research Design- Need, Problem Definition, Variables, Research Design concepts, Literature survey and review, Research design process, Errors in research. Research Modeling- Types of models, model building and stages, Data consideration. | | | | | | |
| Unit - 2 | Number of lectures = 08 | Title of the unit: Sampling | | | | |
| Sampling and data collection- Techniques of sampling, Random, Stratified, Systematic, Multistage-sampling, Primary and secondary sources of data. Design of questionnaire. | | | | | | |
| Unit - 3 | Number of | Title of the unit: Data Collection and Experiments | | | | |

| | | |
|--|-------------------------|---|
| | lectures = 08 | |
| Design of Experiments- Objectives, strategies, Factorial experimental design, designing engineering experiments, basic principles-replication, randomization, blocking, guidelines for design of experiments. | | |
| Unit - 4 | Number of lectures = 08 | Title of the unit: Models and Hypothesis & Report writing |
| Single factor experiment- Hypothesis testing, analysis of Variance component (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effect model, estimation of variance components, Model adequacy checking. Structure and components of Scientific Reports, Types of Report, Technical Reports and Thesis; Different steps in the preparation – Layout, structure and Language of typical reports; Illustrations and tables, Bibliography, Referencing and foot notes. | | |
| 12. Brief Description of self learning / E-learning component https://research-methodology.net/research-methodology/ https://gradcoach.com/what-is-research-methodology/ | | |
| 13. Books Recommended Text Book: <ol style="list-style-type: none"> 1. Research Methodology – Methods and Techniques – C.R. Kothari, New Age International, New Delhi, 2004. Reference Book: <ol style="list-style-type: none"> 1. Design and Analysis of Experiments – Douglas C. Montgomery, Wiley India, 8th Edition, 2012. 2. Practical Research: Planning Design – Paul D. Leddy, London, 1980. | | |

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|--|--|--|-----------------------|------------|-------------------|------------------|
| 1. Name of the Department | | Civil Engineering | | | | |
| 2. Course Name | Design of Concrete Structural Systems | L | T | | P | |
| 3. Course Code | 13160112 | 3 | 0 | | 2 | |
| 4. Type of Course (use tick mark) | | Core (✓) | PE() | | OE() | |
| 5. Pre-requisite (if any) | | 6. Frequency (use tick marks) | Even () | Odd (✓) | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 42 | | Tutorials = 0 | Practical = 28 | | | |
| 8. Brief Syllabus : Student will study about limit state design method, Deep Beams, Flat Slab, Columns and shear walls and framed buildings | | | | | | |
| 9. Learning objectives: | | | | | | |
| 1. This subject is intended to teach the concept of advanced concrete design. | | | | | | |
| 2. The practical aspects of various designs of structure will be explained in the classes | | | | | | |
| 10. Course Outcomes (COs): On completion of this course, the students will be able to | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Analyse and design the deep beams. | | | | | | |
| 2. Design shears wall buildings and flat slabs. | | | | | | |
| 3. Design slender columns. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 9 | Title of the unit: Limit state design of beams | | | | |
| Limit state analysis and design of beams in flexure - Behaviour of reinforced concrete members in bending - Plastic hinge – Rotation capacity – Factors affecting rotation capacity of a section – Plastic moment – Moment curvature relationship – Redistribution of moments. | | | | | | |
| Unit – 2 | Number of lectures = 8 | Title of the unit: Deep Beams | | | | |
| Limit state design of deep beams | | | | | | |
| Unit – 3 | Number of lectures = 9 | Title of the unit: Flat Slab | | | | |
| Design of Flat Slabs using BIS 456 | | | | | | |
| Unit – 4 | Number of lectures = 8 | Title of the unit: Columns and shear wall buildings | | | | |
| Design of slender column subjected to combined bending moment & axial force using SP: 16 | | | | | | |
| 12. Brief Description of self learning / E-learning component | | | | | | |
| The students will be encouraged to learn using the SGT ELearning portal and choose the relevant lectures delivered by subject experts of SGT University. | | | | | | |
| The link to the E-Learning portal. | | | | | | |
| https://elearning.sgtuniversity.ac.in/course-category/ | | | | | | |
| Journal papers; Patents in the respective field. | | | | | | |
| 13. Books Recommended | | | | | | |

TEXT BOOKS

1. Krishnaraju N., (2013), Advanced Reinforced Concrete Design, Second Edition, CBS Publisher, **ISBN-13: 9788123912257.**

REFERENCE BOOKS

1. P. C. Varghese, (2009), Advanced Reinforced Concrete Design, Second Edition, Phi Learning Pvt. Ltd., ISBN-13: 9788120327870.
2. M. L. Gambhir, (2009), Design of Reinforced Concrete Structures, First Edition, Phi Learning Pvt. Ltd., ISBN-13: 9788120331938.
3. P. Dayaratnam, (2011), Design of Reinforced Concrete Structures, Fourth Edition, Oxford & IBH – Pubs Company, ISBN-13: 9788120414198.
4. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, (2006), R. C. C. Designs, Laxmi Publication (P) Ltd., ISBN-13: 9788131809426.

| | | | | | | |
|--|---|-----------------------------------|-------------|----------------------|---------------|-------------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Subject Name | Research Methodology and IPR Lab | L | T | | P | |
| 3. Subject Code | 13160105 | 0 | 0 | | 2 | |
| 4. Type of Subject | | Core (√) | PE() | | OE() | |
| 5. Pre-requisite (if any) | Research Methodology and IPR | Frequency (use tick marks) | Even () | Odd (√) | Either Sem () | Every Sem () |
| 6. Total Number of Lectures, Tutorials, Practical, Assuming 14 weeks in semester | | | | | | |
| Lectures = 00 | | Tutorials = 00 | | Practical =28 | | |
| <p>1. Learning objectives: The objectives of the course are:</p> <ol style="list-style-type: none"> The students are able to recognize the steps involved in Identifying research problem. The students will be able to collect data using various media and using the best possible sample available. The students would learn to propose their Hypothesis and build models for the problem. The students would be able to correctly document their findings in the form of a report. | | | | | | |
| <p>Outcomes: On completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Choose the topic for writing research paper. Develop models for problems. The students would learn to write the research paper. | | | | | | |
| 7. Lab Content | | | | | | |
| Sr. No. | Title | | | | | CO covered |
| 1 | How to choose topic for research | | | | | 1,2 |
| 2 | How to collect data for the particular research problem | | | | | 1,2 |
| 3 | Writing Abstract | | | | | 1,2 |
| 4 | Writing Literature review | | | | | 1,2 |
| 5 | Explaining and writing methodology | | | | | 1,2 |
| 6 | How to analyze the data collected | | | | | 1,2 |
| 7 | Presentation of analysis and findings | | | | | 1,2 |
| 8 | How to write result and conclusion | | | | | 2,3 |
| 9 | References in research article | | | | | 2,3 |

| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
|--|---|----------------------------|---------|---------------|---------------|--------------|
| 2. Subject Name | Design of Concrete Structural Systems Lab | L | T | | P | |
| 3. Subject Code | 13160113 | 0 | 0 | | 2 | |
| 4. Type of Subject | | Core (√) | PE() | | OE() | |
| 5. Pre-requisite (if any) | Design of Concrete Structural Systems | Frequency (use tick marks) | Even () | Odd (√) | Either Sem () | Every Sem () |
| 6. Total Number of Lectures, Tutorials, Practical, Assuming 14 weeks in semester | | | | | | |
| Lectures = 00 | | Tutorials = 00 | | Practical =28 | | |
| 7. Learning objectives: | | | | | | |
| <ol style="list-style-type: none"> 1. This subject is intended to teach the concept of advanced concrete design. 2. The practical aspects of various designs of structure will be explained in the classes | | | | | | |
| 8. Outcomes: | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| <ol style="list-style-type: none"> 1. Analyse and design the deep beams. 2. Design shears wall buildings and flat slabs. 3. Design slender columns. | | | | | | |
| 9. Lab Content | | | | | | |
| Sr. No. | Title | CO covered | | | | |
| 1 | Analysis of propped cantilever beam | 1 | | | | |
| 2 | Analysis of two span continuous beams | 1 | | | | |
| 3 | Analysis of statically determinate plane truss | 2 | | | | |
| 4 | Analysis of statically indeterminate plane truss | 2 | | | | |
| 5 | Analysis of kinematically indeterminate plane truss | 2 | | | | |
| 6 | Analysis of one bay – one storey plane frame | 1 | | | | |
| 7 | Analysis of multi bay – multi storied plane frame | 1 | | | | |
| 8 | Analysis of space truss | 3 | | | | |
| 9 | Analysis of grid | 2 | | | | |
| 10 | Analysis of space frame | 3 | | | | |

| | | | | | | |
|---|------------------------|--------------------------------------|---------|----------------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Seminar | L | T | P | | |
| 3. Course Code | 13160106 | 0 | 0 | 2 | | |
| 4. Type of Course | | ✓ Core () | PE() | OE() | | |
| 5. Pre-requisite (if any) | Nil | 6. Frequency (use tick marks) | Even () | Odd (√) | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 0 | | Tutorials = 00 | | Practical = 28 | | |
| 8. Brief Syllabus: | | | | | | |
| Depending upon their area of interest, students will choose any topic. | | | | | | |
| 9. Learning objectives: | | | | | | |
| 1. To make literature survey for various recently emerging technologies. | | | | | | |
| 2. To select any topic of interest and to review the related literature in detail. | | | | | | |
| 3. To compare and analyze the various topologies for the selected topic of interest. | | | | | | |
| 4. To conclude the advantages, drawbacks and future scopes of the technique. | | | | | | |
| 10. Course Outcomes: | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Get familiarity with the recently advanced techniques. | | | | | | |
| 2. Get detailed information about the topic of interest. | | | | | | |
| 3. Know how to do literature survey. | | | | | | |
| 4. Develop the interest in different research areas of Structures. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit | Number of lectures =28 | Title of the unit: Seminar | | | | |
| To make literature survey for various recently emerging technologies.To select any topic of interest and to review the related literature in detail.To compare and analyze the various topologies for the selected topic of interest. To conclude the advantages, drawbacks and future scopes of the technique. | | | | | | |
| 12. Brief Description of self learning / E-learning component: | | | | | | |
| i. https://www.sciencedirect.com/ | | | | | | |
| ii. https://www.elsevier.com/en-in | | | | | | |
| 13. Books Recommended | | | | | | |
| i. https://onlinecourses.nptel.ac.in/noc16_ge01/preview | | | | | | |
| ii. https://www.che.iitb.ac.in/online/resources/academic-resources/technical-guides-and-tools/report-writing/guidelines-presentation-seminar | | | | | | |

SEMESTER -II

| | | | | | | |
|---|--------------------------------|--------------------------------------|--------------|-----------------------|---------------|--------------|
| 1. Name of the Department – Civil Engineering | | | | | | |
| 2. Course Name | Finite Element Analysis | L - 3 | T – 0 | | P -2 | |
| 3. Course Code | 13160212, Lab: 13160216 | | | | | |
| 4. Type of Course (use tick mark) | | Core (√) | PE() | | OE() | |
| 5. Pre-requisite (if any) | | 6. Frequency (use tick marks) | Even (√) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 28 | | Tutorials = | | Practical = 28 | | |
| 8. Brief Syllabus | | | | | | |
| Basics of finite element analysis, study of different methods linear equations and matrix method, study by displacement models, analysis of structure such as frame and truss by finite element analysis, Basic study of Iso-parametric elements. | | | | | | |
| 9. Learning objectives: | | | | | | |
| 1. The course is intended to teach the basic concepts of finite element analysis. 2. The practical application of finite element method and their advantages and disadvantages will be explained in the class. | | | | | | |
| 10. Course Outcomes (COs): | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Calculate strain-displacement matrix and stress-strain matrix. 2. Know the analysis procedure and the matrix operations. 3. Know the concepts of isoparametric elements. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 8 | Introduction to FEM | | | | |
| Introduction - Background - General description of the method – Analysis procedure - Stress and strain vectors – Stain displacement equations – Linear constitutive equations – Overall stiffness matrix – Overall load matrix - Analysis of beams. | | | | | | |
| Unit – 2 | Number of lectures = 8 | Displacement models | | | | |
| Theory of Finite Element - Concept of an element - Various elements shapes - Displacement polynomials - Convergence requirements - Shape functions - Element strains and stresses - Direct formulation of element stiffness matrix for beam element and plane truss element | | | | | | |
| Unit – 3 | Number of lectures = 4 | Analysis of structures by FEM | | | | |
| Overall Problems - Discretization of a body or structure - Minimization of band width - Construction of stiffness matrix and loads for the assemblage - Boundary conditions - Analysis of plane truss, space truss, plane frame and grid. | | | | | | |
| Unit – 4 | Number of lectures = 4 | Plane stress and plane strain | | | | |
| Plane stress - Plane strain - CST, LST & QST elements – Rectangular element - solutions of problems | | | | | | |
| 12. Brief Description of self learning / E-learning component | | | | | | |
| 13. Books Recommended | | | | | | |

TEXT BOOKS

1. C. S. Krishnamoorthy, (2008), Finite Element Analysis, Second Edition, Tata McGraw Hill Education Pvt. Ltd., **ISBN-13: 978007462100.**

REFERENCE BOOKS

1. Cook R. D., Malkas D. S. & Plesha M. E, (2008), Concepts and applications of Finite element analysis, Fourth Edition, Wiley India Pvt. Ltd., **ISBN-13: 9788126513369.**
2. Reddy, (2005), An Intro. To The Finite Element Methods, Third Edition, Tata McGraw Hill Education Pvt. Ltd., **ISBN-13: 9780070607415.**
3. Singiresu S. Rao, (2010), The Finite Element Method in Engineering, Fifth Edition, Elsevier Science, ISBN-13: 9780080952048.

14. Lab component components

| Sr. No. | Title | CO covered |
|---------|---|------------|
| 1 | Analysis of three span continuous beams. | (1), (2) |
| 2 | Analysis of propped cantilever beam. | (2) |
| 3 | Analysis of statically determinate plane truss. | (2), (3) |
| 4 | Analysis of statically indeterminate plane truss. | (3), (4) |
| 5 | Analysis of one bay – one storey plane frame. | (5) |

| | | | | | | |
|--|--|--|--|----------------------|-------------------------------|--|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Theory of Elasticity and Plasticity | L | T | | P | |
| 3. Course Code | 13160213 | 3 | 0 | | 0 | |
| 4. Type of Course | | <input checked="" type="checkbox"/> Core () | PE() | | OE() | |
| 5. Pre-requisite (if any) | Strength of Materials, Engg. Mechanics | 6. Frequency (use tick marks) | Even (<input checked="" type="checkbox"/>) | Odd () | Either Sem () Every Sem () | |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 46 | | Tutorials = 00 | | Practical =09 | | |
| <p>8. Brief Syllabus: Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures.</p> | | | | | | |
| <p>Learning objectives:</p> <p>1. This subject is taught to impart knowledge on theory of elasticity and plasticity.</p> | | | | | | |
| <p>Course Outcomes: On completion of this course, the students will be able to</p> <p>1. Analyse the stresses and strains for two dimensional and three dimensional elements. 2. Understand the equilibrium and compatibility conditions. 3. Solve the problems on Torsion for different shaped bars. 4. Understand the concept of plasticity.</p> | | | | | | |
| 9. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 8 | Stresses and strains | | | | |
| <p>Analysis of Stress and Strain - Elasticity approach – Definition and notation of stress – Components of stress and strain – Generalized Hooke's law -Two dimensional Problems in Cartesian Coordinates - Plane stress and plain strain problems with practical examples - Equations of equilibrium and compatibility conditions in Cartesian coordinates – Airy's stress function - Bending of simply supported beams.</p> | | | | | | |
| Unit - 2 | Number of lectures = 08 | Axi-symmetric problems | | | | |
| <p>Two dimensional Problems in Polar Coordinates - Equations of equilibrium and compatibility conditions in polar coordinates – Axi-symmetrical problems - Thick cylinder under uniform pressure - Circular arc beams subjected to pure bending</p> | | | | | | |
| Unit - 3 | Number of lectures = 08 | Prandle's membrane analogy | | | | |
| <p>Principal stresses and strains for three dimensional element – Equations of equilibrium and compatibility conditions for 3D problems in Cartesian co-ordinates - Transformation of stresses and strains.</p> | | | | | | |
| Unit - 4 | Number of | Introduction to plasticity | | | | |

Introduction to plasticity – Stress – Strain diagram – Plastic analysis – Yield criteria – St. Venant's theory – Von Mises criterion – Plastic work – Strain hardening.

10. Books Recommended

TEXT BOOKS

1. Timoshenko and Goodier, (1970), Theory of Elasticity, Third Edition, McGraw Hill Professional, ISBN-13: 9780070858053.

REFERENCE BOOKS

1. Srinath, (2002), Advanced Mechanics of Solids, Third Edition, Tata McGraw Hill Pvt. Ltd., ISBN-13: 9780070139886.
2. D. Peric, E. A. de Souza Neto & D. R. J. Owen, (2011), Computational Methods for Plasticity, Wiley, ISBN-13: 9781119964544.

| | | | | | | |
|---|---|--|--|-----------------------|-------------------------------|--|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Limit State Design of Steel Structures | L | T | | P | |
| 3. Course Code | 13160214 | 3 | 0 | | 2 | |
| 4. Type of Course | | <input checked="" type="checkbox"/> Core () | PE() | | OE() | |
| 5. Pre-requisite (if any) | Design of Steel Structure | 6. Frequency (use tick marks) | Even (<input checked="" type="checkbox"/>) | Odd () | Either Sem () Every Sem () | |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 44 | | Tutorials = 00 | | Practical = 08 | | |
| 8. Learning objectives: | | | | | | |
| 1. To know how to design and use the different types of steel structural elements. | | | | | | |
| Course Outcomes: | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Design compression members. | | | | | | |
| 2. Design light gauge steel structures. | | | | | | |
| 3. Analyse the beams and portal frames. | | | | | | |
| 4. Design joints and connections using riveted and welded connections. | | | | | | |
| 9. Unit wise detailed content | | | | | | |
| Unit – 1 | Number of lectures = 08 | Compression members | | | | |
| Design of compression members – Axially – Uniaxial and biaxial bending - Design of base slab. | | | | | | |
| Unit – 2 | Number of lectures = 12 | Plastic Analysis | | | | |
| Plastic Analysis of Structures – Introduction - Shape factors – Mechanisms - Plastic hinge - Analysis of beams and portal frames - Design of continuous beams. | | | | | | |
| Unit – 3 | Number of lectures = 08 | Light gauge sections | | | | |
| Design of Light Gauge Steel Structures - Types of cross sections - Local buckling and lateral buckling - Design of compression and tension members – Beams - Deflection of beams. | | | | | | |
| Unit – 4 | Number of lectures = 10 | Chimney | | | | |
| Design of Chimney, Design of foundation of chimney. | | | | | | |
| 10. Brief Description of self learning / E-learning component | | | | | | |
| 11. Books Recommended | | | | | | |

TEXT BOOKS

1. Dayarathnam. P., (1996), Design of Steel Structures, Second Edition, S. Chand and Publishers, ISBN-13: 0788121923200.

REFERENCE BOOKS

1. Duggal S. K., (2014), Limit State Design of Steel Structures, Second Edition, McGraw Hill, ISBN-13: 9789351343509.
2. Ramchandra, Virendra Gehlot, (2010), Limit State Design of Steel Structures: Based on IS: 800-2007 IN S. I. Units, Scientific Publishers, ISBN-13: 9788172336141.

| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
|---|-----------------------------------|-------------------------------|----------|----------------|---------------|--------------|
| 2. Course Name | Structural Engineering Laboratory | L | T | | P | |
| 3. Course Code | 13160215 | 0 | 0 | | 2 | |
| 4. Type of Course | | ✓ Core () | PE() | | OE() | |
| 5. Pre-requisite (if any) | None | 6. Frequency (use tick marks) | Even (✓) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 00 | | Tutorials = 00 | | Practical = 10 | | |
| Brief Syllabus: | | | | | | |
| Learning objectives: | | | | | | |
| <ol style="list-style-type: none"> 1. To teach students different types of testing of concrete structures. 2. To enable the students to know the behaviour of RCC structures. | | | | | | |
| Course Outcomes: | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| <ol style="list-style-type: none"> 1. Design concrete mix for particular grade of concrete 2. Test concrete beams for various loading conditions 3. Perform non-destructive testing. | | | | | | |
| 8. Books Recommended (3 Text Books + 2-3 Reference Books) | | | | | | |
| TEXT BOOKS | | | | | | |
| 1. Krishnaraju N., (2013), Advanced Reinforced Concrete Design, Second Edition, CBS Publisher, <i>ISBN-13: 9788123912257</i> . | | | | | | |
| REFERENCE BOOKS | | | | | | |
| 1. P. C. Varghese, (2009), Advanced Reinforced Concrete Design, Second Edition, Phi Learning Pvt. Ltd., ISBN-13: 9788120327870. | | | | | | |
| 2. M. L. Gambhir, (2009), Design of Reinforced Concrete Structures, First Edition, Phi Learning Pvt. Ltd., ISBN-13: 9788120331938. | | | | | | |
| 3. P. Dayaratnam, (2011), Design of Reinforced Concrete Structures, Fourth Edition, Oxford & IBH – Pubs Company, ISBN-13: 9788120414198. | | | | | | |
| 4. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, (2006), R. C. C. Designs, Laxmi Publication (P) Ltd., ISBN-13: 9788131809426. | | | | | | |

1. Lab component components

| Sr. No. | Title | CO covered |
|----------------|---|-------------------|
| 1 | To determine the compressive strength of fibre reinforced concrete by testing cubes specimen. | 1,2,3 |
| 2 | Casting and testing of simply supported RCC beams for flexural failure. | 2 |
| 3 | Casting and testing of simply supported RCC beams for shear failure. | 2 |
| 4 | To determine tensile strength on a steel reinforcement bar. | 2 |
| 5 | To determine shear strength of steel bar under double shear. | 2,4 |
| 6 | To conduct bending test of I-section steel beam. | 4 |
| 7 | To conduct bending test of steel channel section. | 3 |
| 8 | To study rebound hammer test on concrete blocks. | 2,4 |
| 9 | To study ultra sonic pulse velocity test | 2 |

| | | | | | | |
|--|---|--------------------------------------|-------------|----------------|-------------------|---------------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Seminar | L | T | P | | |
| 3. Course Code | 13160206 | 0 | 0 | 2 | | |
| 4. Type of Course | <input checked="" type="checkbox"/> Core () | | PE() | OE() | | |
| 5. Pre-requisite (if any) | Nil | 6. Frequency (use tick marks) | Even () | Odd (√) | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 0 | | Tutorials = 00 | | Practical = 28 | | |
| 8. Brief Syllabus: Depending upon their area of interest, students will choose any topic. | | | | | | |
| 9. Learning objectives: 1. To make literature survey for various recently emerging technologies. 2. To select any topic of interest and to review the related literature in detail. 3. To compare and analyze the various topologies for the selected topic of interest. 4. To conclude the advantages, drawbacks and future scopes of the technique. | | | | | | |
| 10. Course Outcomes: On completion of this course, the students will be able to 1. Get familiarity with the recently advanced techniques. 2. Get detailed information about the topic of interest. 3. Know how to do literature survey. 4. Develop the interest in different research areas of Structures. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit | Number of lectures =28 | Title of the unit: Seminar | | | | |
| To make literature survey for various recently emerging technologies.To select any topic of interest and to review the related literature in detail.To compare and analyze the various topologies for the selected topic of interest. To conclude the advantages, drawbacks and future scopes of the technique. | | | | | | |

12. Brief Description of self learning / E-learning component:

1. <https://www.sciencedirect.com/>
2. <https://www.elsevier.com/en-in>

3. Books Recommended

- iii. https://onlinecourses.nptel.ac.in/noc16_ge01/preview
- iv. <https://www.che.iitb.ac.in/online/resources/academic-resources/technical-guides-and-tools/report-writing/guidelines-presentation-seminar>

Semester III

| | | | | | | |
|---|-----------------------------|---|----------------|---------|---------------|--------------|
| 8. Name of the Department | | CIVIL ENGINEERING | | | | |
| 9. Course Name | Earthquake Resistant Design | L | T | | P | |
| 10. Course Code | 13160310 | 3 | 0 | | 0 | |
| 11. Type of Course (use tick mark) | | Core (√) | PE(-) | | OE() | |
| 12. Pre-requisite (if any) | Concrete Technology | 13. Frequency (use tick marks) | Even () | Odd (√) | Either Sem () | Every Sem () |
| 14. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 42 | | Tutorials = 00 | Practical = 10 | | | |
| 8. Brief Syllabus: | | | | | | |
| The aim of the course is to present to the students fundamental concepts of current seismic codes and technical seismology as well as the technical skills for the seismic design of structures and the evaluation of their seismic response. | | | | | | |
| 9. Learning objectives: | | | | | | |
| 1. To impart the knowledge about the earthquake and its occurrence. 2. To know about the mathematical modeling of structures subjected to earthquakes and their behavior | | | | | | |
| 10. Course Outcomes: | | | | | | |
| On completion of this course, the students will be able to 1. Evaluate the behaviour of structures under dynamic loadings. 2. Know methodology for earthquake resistant design. 3. Design the buildings using capacity design concept. 4. Design the multi storied building using computer. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: Basic of Seismology | | | | |
| Elements of Seismology - Definitions of magnitude – Intensity - Epicenter etc - General features of tectonics of seismic regions - Seismographs. | | | | | | |

| | | |
|---|-------------------------|--|
| Unit - 2 | Number of lectures = 08 | Title of the unit: Theory of vibrations |
| Theory of Vibrations - Free vibrations of single degree - Two degree and multiple degree freedom systems - Computations of dynamic response to time dependent forces - Vibrations isolation – Vibration absorbers - Brief introduction to instruments - Accelerograms | | |
| Unit - 3 | Number of lectures = 08 | Title of the unit: Earthquake resistant design |
| Principles of earthquake resistant design - Response spectrum theory - Application of response spectrum theory to seismic design of structures. | | |
| Unit - 4 | Number of lectures = 08 | Title of the unit: Capacity design method |
| Capacity - Design Principles - Design criteria for strength - Stiffness and ductility - Earthquake Analysis and Design - Characteristics of earthquake – Earthquake response of structures – Concept of earthquake resistance design – Code provisions for design of building – IS 1893 and IS 4326 – Energy absorption capacity. Behaviour and design of masonry buildings subjects to earthquake ground motion - Seismic retrofitting strategies for RC and masonry buildings. | | |
| 12. Brief Description of self learning / E-learning component http://retrofit.teipir.gr/?course=earthquakeresistant-design-of-structures&lang=en | | |
| 13. Books Recommended TEXT BOOKS 1. Anil K. Chopra, (2011), Dynamics of Structures - Theory and Applications to Earthquake Engineering, Second Edition, Ingram International Inc., ISBN-13: 9780132858038. REFERENCE BOOKS 1. Pankaj Agarwal and Manish Shrikhande, (2007), Earthquake Resistant Design of Structures, First Edition, Prentice-Hall India Pvt Ltd, ISBN-13: 9788120328921. 2. Gupta B. L., (2010), Principles of Earthquake Resistant Design of Structures & Tsunami, Standard Publishers & Distributors, ISBN-13: 9788180141485. | | |

| | | | | | | |
|--|--|---|-------------|---|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Matrix Methods of Structural Analysis | L | T | | P | |
| 3. Course Code | 13160311 Lab: 13160312 | 3 | 0 | | 2 | |
| 4. Type of Course (use tick mark) | | <input checked="" type="checkbox"/> Core () | PE() | | OE() | |
| 5. Pre-requisite (if any) | Structural Analysis | 6. Frequency (use tick marks) | Even () | <input checked="" type="checkbox"/> Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures =32 | | Tutorials = 00 | | Practical = 10 | | |
| Brief Syllabus: | | | | | | |
| 8. Learning objectives: | | | | | | |
| 1. The course is intended to teach the basic concepts of indeterminate structures, static indeterminacy and kinematic indeterminacy. | | | | | | |
| 2. Different matrix methods will be taught and their uses will be explained in the class | | | | | | |
| 9. Course Outcomes: | | | | | | |
| 1. Solve different structures by flexibility matrix method and stiffness matrix method. | | | | | | |
| 2. Visualize and analyze space trusses and space frames. | | | | | | |
| 3. Understand the effect of settlement of supports. | | | | | | |
| 10. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: Introduction to flexibility matrix and stiffness matrix | | | | |
| Concept of static indeterminacy and kinematic indeterminacy - concept of flexibility matrix and stiffness matrix - properties of matrices - coordinate system - solution of simple problems - derivation of stiffness matrix of beam element from strain energy. | | | | | | |
| Unit - 2 | Number of lectures = 08 | Title of the unit: Analysis of plane structures by flexibility matrix method | | | | |
| Analysis of continuous beam, plane truss and plane frame by flexibility matrix method - Internal forces due to thermal expansion and lack of fit – effect of settlement of supports. | | | | | | |
| Unit - 3 | Number of lectures = 08 | Title of the unit: Analysis of plane structures by stiffness matrix method | | | | |
| Analysis of continuous beam, plane truss and plane frame by stiffness matrix method - Internal forces due to thermal expansion and lack of fit – effect of settlement of supports | | | | | | |
| Unit - 4 | Number of lectures = 08 | Title of the unit: Space truss | | | | |
| Analysis of space truss by flexibility matrix method and stiffness matrix method | | | | | | |
| 11. Books Recommended | | | | | | |
| TEXT BOOKS | | | | | | |
| 1. Pundit G.S. & Gupta S.P., (2008), Structural Analysis (A matrix approach), Second Edition, Tata McGraw Hill Education, ISBN-13: 9780070667358. | | | | | | |

REFERENCE BOOKS

1. J. S. Przemieniecki, (1985), Theory of Matrix Structural Analysis, New Edition, Dover Publication, ISBN-13: 97804866494.
2. Richard B. Nelson, Lewis P. Felton, (1997), Matrix Structural Analysis, John Wiley & Sons, Imported Edition, ISBN-13: 9780471123248.

12. Lab component components

| Sr. No. | Title | CO covered |
|----------------|---|-------------------|
| 1 | Analysis of propped cantilever beam | 1 |
| 2 | Analysis of two span continuous beams | 1 |
| 3 | Analysis of statically determinate plane truss | 2 |
| 4 | Analysis of statically indeterminate plane truss | 2 |
| 5 | Analysis of kinematically indeterminate plane truss | 2 |
| 6 | Analysis of one bay – one storey plane frame | 1 |
| 7 | Analysis of multi bay – multi storied plane frame | 1 |
| 8 | Analysis of space truss | 3 |
| 9 | Analysis of grid | 2 |
| 10 | Analysis of space frame | 3 |

| | | | | | | |
|---|---|--------------------------------------|----------|----------------------|----------|-------------------------------|
| 1 Name of the Department | | CIVIL ENGINEERING | | | | |
| 2 Subject Name | Identification of Research Problem | L | T | | P | |
| 3 Subject Code | 13160305 | 0 | 0 | | 4 | |
| 4 Type of Subject (use tick mark) | | Core (√) | | OE() | | |
| 5 Pre-requisite (if any) | Nil | 1. Frequency (use tick marks) | | Even () | Odd (√) | Either Sem () Every Sem () |
| 6 Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 00 | | Tutorials =00 | | Practical =48 | | |
| <p>Detailed Syllabus: Students are required to search, collect and review various research articles published in chosen area of research and identifying research Problems. A student must analyze research related problems, based on geotechnical engineering research area.</p> | | | | | | |
| <p>8 Course Outcomes:</p> <ol style="list-style-type: none"> 1. Identify topics in thrust areas of Geotechnical engineering. 2. Take up critical review of literature on the chosen topic. 3. Carry out independent research work on the topic by experimental / analytical approaches. 4. Document and present the results of research problems | | | | | | |

Semester IV

| | | | | | | |
|---|--------------|--------------------------------------|----------|----------------|---------------|--------------|
| 1. Name of the Department: Civil Engineering | | | | | | |
| 2. Course Name | Dissertation | L 0 | T 0 | P 0 | | |
| 3. Course Code | 13160401 | | | | | |
| 4. Type of Course (use tick mark) | | Core (✓) | PE() | OE() | | |
| 5. Pre-requisite (if any) | Nil | 6. Frequency (use tick marks) | Even (✓) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 00 | | Tutorials = 00 | | Practical = 00 | | |
| 8. Brief Syllabus Depending upon their area of interest, students will choose any topic. | | | | | | |
| 9. Learning objectives: It will provide a strong fundamental scientific and technical knowledge related to topics of Civil Engineering. They will get the concept of theories and methodologies needed to plan, design, analyse, develop, organise and manage Civil Engineering topics / fields. They will get the expertise in the major areas of Civil Engineering, structural analysis, design and reliability, transportation system engineering, water resources and environmental engineering etc. with the knowledge of their projects and presentation. It will inculcate a deep understanding of engineering principles. It will also develop the capacity for independent studies and thinking. | | | | | | |
| 10. Course Outcomes (COs): Students will possess the ability to apply the basic mathematical and scientific concepts that underlie the modern field of Civil Engineering. They will be able to design, analyse and interpret experimental data. They will be capable of designing major Civil Engineering projects. They will possess the problem solving abilities and familiarity with the computational procedures essential to the field. They will have the skills and motivations for their professional growth. They will get the indepth of knowledge of their selected topic or subjects of their project. The presentation of their project will enhance communication skills and confidence about their knowledge in that subject topic. They will have the strong fundamental scientific and technical knowledge. | | | | | | |
| 11. Course content Depending upon their area of interest, students will choose any topic. | | | | | | |
| 12. Brief Description of self learning / E-learning component The students will be encouraged to learn using the SGT ELearning portal and choose the relevant lectures delivered by subject experts of SGT University. The link to the E-Learning portal: https://elearning.sgtuniversity.ac.in/course-category/general/ | | | | | | |
| 13. Books Recommended | | | | | | |

TEXT BOOKS

Depending upon their area of interest, students may choose any text book of relevant field or any article from Journal.

REFERENCE BOOKS

Depending upon their area of interest, students may choose any reference book of relevant field

Program Elective I

| | | | | | | |
|--|---------------------------------|---|-------------------------|----------------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Advanced Foundation Engineering | L | T | P | | |
| 3. Course Code | 13160239 | 3 | 0 | 0 | | |
| 4. Type of Course | | Core () | PE($\sqrt{\quad}$) | OE() | | |
| 5. Pre-requisite (if any) | Foundation Engineering | 6. Frequency (use tick marks) | Even ($\sqrt{\quad}$) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 42 | | Tutorials = 00 | | Practical = 00 | | |
| Brief Syllabus: | | | | | | |
| <p>The course "Advanced Foundation Engineering" will cover various aspects of foundation engineering including soil exploration, details of shallow and deep foundations, retaining walls. The soil-foundation interaction will also be discussed along with the numerical solution techniques of beams and plates resting on elastic foundation bed. The behavior and design methods of foundation on reinforced earth will be discussed. The advanced theories and design of various foundation components will be discussed in logical way. The earth pressure theories for designing the retaining walls will be discussed. The codal provisions of the design of various types of foundation will also be discussed. The number of chosen problems will be solved in this course. The advanced course material will be very useful to undergraduate and post-graduate students, teachers and practitioners.</p> | | | | | | |
| 8. Learning objectives: | | | | | | |
| <p>This subject is taught to impart the knowledge in the area of analysis and design of foundations and earth retaining structures.</p> | | | | | | |
| 9. Course Outcomes: | | | | | | |
| <p>On completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Understand the concepts of shallow foundations. 2. Design the retaining walls and sheet piles. 3. Know the types well foundations. 4. Design pile foundation | | | | | | |
| 10. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures =08 | Title of the unit: Shallow foundation | | | | |
| Shallow Foundations - Spread footings – Contact pressure – Structural design of individual footings – Pedestals - Combined footings (Rectangular and trapezoidal) – Eccentrically loaded footings – Mat foundations | | | | | | |
| Unit – 2 | Number of lectures = 08 | Title of the unit: Deep foundation | | | | |
| Retaining Structures - Stability of walls – Design of cantilever and counter fort walls – Design of gravity walls – Cofferdams – Braced coffer dams – Stability of bottom excavation – Anchorage – Walls and tie rods | | | | | | |
| Unit – 3 | Number of lectures =08 | Title of the unit: Retaining structures & Pile Foundation | | | | |
| Pile Foundations - Types of piles – Static and dynamic pile formula – Pile groups – Efficiency of pile | | | | | | |

| | | |
|---|-------------------------|---------------------------------|
| group, Settlement of piles – Batter piles – Analysis of pile groups – Structural design of piles and pile caps | | |
| Unit – 4 | Number of lectures = 08 | Title of unit: Well Foundations |
| Well Foundations - Types of wells or caissons – Components – Shapes of wells – Forces acting – Construction– Design of drilled caissons | | |
| <p>11. Brief Description of self learning / E-learning component:</p> <p>i. https://nptel.ac.in/courses/105108069</p> | | |
| <p>12. Books Recommended</p> <p>TEXT BOOKS</p> <p>1. GopalRanjan and A S R Rao (2000), Basic and Applied Soil Mechanics, Second Edition, New Age International, ISBN-13: 9788122412239.</p> <p>REFERENCE BOOKS</p> <p>1. J. E. Bowles, (2000), Foundation Analysis and Design, Fifth Edition, McGraw Hill Education India Pvt. Ltd., ISBN-13: 9781259061035.</p> <p>2. P. C. Verghese, (2009), Design of Reinforced Concrete Foundations, First Edition, PHI Learning Pvt. Ltd., ISBN-13: 9788120336155.</p> | | |

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|--|---------------------------------|---|---|-------------------------|--------|-------------------------------|--|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | | |
| 2. Course Name | Design of Industrial Structures | L | T | | P | | |
| 3. Course Code | 13160240 | 3 | 0 | | 0 | | |
| 4. Type of Course : | | Core () | | PE($\sqrt{\quad}$) | | OE() | |
| 5. Pre-requisite (if any) | Construction Technology | 6. Frequency (use tick marks) | | Even ($\sqrt{\quad}$) | Odd () | Either Sem () Every Sem () | |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | | |
| Lectures = 42 | | Tutorials = 00 | | Practical = 00 | | | |
| 8. Brief Syllabus | | | | | | | |
| The purpose of this course is to develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard. On completion of this course student gain good confidence in designing major industrial structures like bridge plate girders, industrial structures like gantry girders, water tanks, support structures, high rise chimneys and pre-engineered thin walled structures. | | | | | | | |
| 9. Learning objectives: | | | | | | | |
| 1. This subject is taught to impart a broad knowledge in the area of industrial structures. | | | | | | | |
| 10. Course Outcomes: | | | | | | | |
| On completion of this course, the students will be able to | | | | | | | |
| 1. Know the requirements of various industries. | | | | | | | |
| 2. Get an idea about the materials used and planning. | | | | | | | |
| 3. Know the construction techniques. | | | | | | | |
| 4. Understand the functional requirements | | | | | | | |
| 11. Unit wise detailed content | | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: Industrial requirements & Planning | | | | | |
| General - Specific requirements for industries like textile, sugar, cement, chemical, etc - Site layout and external facilities. Planning of Building Work – Standards - Structural materials including plastics – Polymers - Fibre glass - Pressed card boards, etc - Multi-storey buildings - Steel skeletal structures - Reinforced concrete frames – Workshops - Ware houses - Single storey buildings - Sheds in steel and reinforced concrete - North-lights - Single span spherical and other special constructions - Cooling towers and chimneys - Bunkers and silos' prefabrication - Construction. | | | | | | | |
| Unit – 2 | Number of lectures = 08 | Title of the unit: Construction techniques | | | | | |
| Construction Techniques - Expansion joints - Machine foundations - Other foundations - Water proofing - Roofs and roofing - Roof drainage - Floors and flooring joists - Curtain walling - Outer wall facing - Sound and shock proof mountings - Use of modern hoisting and other construction equipments. | | | | | | | |
| Unit – 3 | Number of lectures = 08 | Title of the unit: Circulation | | | | | |

| | | |
|--|------------------------|--|
| Circulation - Communication and Transport - Fixed points (central cores) – Staircases - Grid floor sections - Lifts refuse disposals - Utilization of waste materials – Cranes - Continuous conveyors - Mobile cranes – Transporters – Doors - Sliding gates | | |
| Unit – 4 | Number of lectures =08 | Title of the unit: Functional Requirements |
| Functional Requirements – Lighting: Natural lighting - Protection from the sun - sly lights - window cleaning installations -Services: Layout – wiring – fixtures - cable and pipe bridges - electrical installations - lighting substation - Effluent. Ventilation and fire protection: Ventilation - Air-conditioning - Fire escapes and chutes - Fire alarms - Hydrants. | | |
| <p>12. Brief Description of self learning / E-learning component: https://nptel.ac.in/courses/105106113/3</p> | | |
| <p>13. Books Recommended</p> <p>TEXT BOOKS</p> <p>1. El Reedy, (2010), Construction Management and Design of Industrial Concrete and Steel Structures, Taylor & Francis Group, ISBN-13: 9781439815991.</p> <p>REFERENCE BOOKS</p> <p>1. Nelson G. L., (1988), Light Agricultural and Industrial Structures: Analysis and Design Kluwer Academic Publisher, ISBN-13: 9780442267773.</p> <p>2. Dr. Raja RizwanHussain, (2011), Pre-Cast Concrete for Multi-Storey Structures, Createspace Publisher, ISBN: 9781467918220.</p> | | |

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|--|-------------------------------|--|-----------------------|------------------------|----------------|-------------|
| 1.Name of the Department | | CIVIL ENGINEERING | | | | |
| 2.Course Name | Soil Structure Interaction | L | T | P | | |
| 3.Course Code | 13160242 | 3 | 0 | 0 | | |
| 4.Type of Course (use tick mark) | | Core () | PE-($\sqrt{\quad}$) | OE() | | |
| 5.Pre-requisite (if any) | | 6.Frequency (use tick marks) | Even () | Odd ($\sqrt{\quad}$) | Either Sem () | Every Sem() |
| 7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | | Practical | | |
| 8.Brief Syllabus: | | | | | | |
| In this course, student will learn about open Mathematical model, Winkler model, Two parameter model, Modulus of sub grade reaction, Analysis of piles & Pile displacement. | | | | | | |
| 9.Learning objectives: | | | | | | |
| 1. This subject is taught to impart knowledge on soil structure interaction analysis, its influences in the design parameters. | | | | | | |
| 10.Course Outcomes | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Understand the concept of interaction, linear and non-linear behavior of soil. | | | | | | |
| 2. Design beams and slabs using Winkler foundation model. | | | | | | |
| 3. Do the elastic analysis of piles and pile groups. | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 8 | Mathematical model, Winkler model, Two parameter model | | | | |
| Soil models: single parameter model (Winkler), two parameter models – Filonenko - Borodich model, Pasternak model, Heteni model, visco elastic model, elastic continuum model, contact pressure distribution below the flexible and rigid footing and. raft parameter affecting conduct pressure. | | | | | | |
| Unit - 2 | Number of lectures = 11 | Modulus of subgrade, reaction | | | | |
| Contact pressure and subgrade modulus and beams on elastic foundation method - analysis of contact pressure distribution – modulus of subgrade reaction – classical solution for beam of infinite length subjected to concentrated load and moment, beams of finite length (formulation of basic equation for slabs resting on elastic foundation), Application of design of combined footing. | | | | | | |
| Unit - 3 | Number of lectures = 10 | Beams and slabs | | | | |

Plates in elastic medium – soil structure interaction for shallow foundation – interface behaviour - Thin and thick plates – analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions, Baker’s method for rafts.

| | | |
|----------|-------------------------|-------------------|
| Unit - 4 | Number of lectures = 05 | Analysis of piles |
|----------|-------------------------|-------------------|

Soil pile interaction : Introduction – elastic analysis of single pile, theoretical solutions for settlement and load distribution analysis of pile group interaction analysis – Load distribution with groups with rigid cap – elastic continuum and elasto-plastic analysis of piles and pile groups (Ultimate lateral resistance of piles by various approaches).

13. Books Recommended

TEXT BOOKS

1. Hemsley, (1997), Elastic Analysis of Raft Foundations, Telford & Thomas Ltd. Publishers, ISBN-13: 9780727725943.

REFERENCE BOOKS

1. Smith I. M., (1994), Proceedings of the Third European Conference, Manchester, 7-9 September, CRC Press, ISBN-13: 9789054105107.
2. Volkan Kaltakci, (2009), Practical Methods for the Analysis of Piled Raft Foundations: Computer Aided Analysis, Design Charts, Simplified Methods, Lambert Academic Publishing, ISBN-13: 9783838314051

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|---|--|-------------------------------------|-----------|--------|---------------|-------------|
| 1.Name of the Department | | CIVIL ENGINEERING | | | | |
| 2.Course Name | Maintenance & Rehabilitation of Structures | L | T | P | | |
| 3.Course Code | 13160241 | 3 | 0 | 0 | | |
| 4.Type of Course (use tick mark) | | Core () | PE-(√) | OE() | | |
| 5.Pre-requisite (if any) | | 6.Frequency (use tick marks) | Even (√) | Odd () | Either Sem () | Every Sem() |
| 7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | Practical | | | |
| 8.Brief Syllabus: | | | | | | |
| In this course, student will learn Maintenance & Rehabilitation of Structures by learning different properties of concrete, repairing materials and different repairing techniques. | | | | | | |
| 9.Learning objectives: | | | | | | |
| 1. This subject imparts a broad knowledge in the area of repair and rehabilitation of structures | | | | | | |
| 10.Course Outcomes | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Understand the properties of fresh and hardened concrete. | | | | | | |
| 2. Know the strategies of maintenance and repairing. | | | | | | |
| 3. Get an idea of repairing techniques. | | | | | | |
| 4. Understand the properties of repairing materials | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 8 | Properties of concrete | | | | |
| Serviceability and Durability of Structures - Quality Assurance for concrete construction - Fresh concrete properties – Strength – Permeability - Cracking - Effects due to climate – Temperature – | | | | | | |

chemicals - Wear and erosion - Design and construction errors - Corrosion mechanism - Effects of cover thickness and cracking - Methods of corrosion protection – Inhibitors - Resistant steels – Coatings - Cathodic protection

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|----------|-------------------------|---------------------|
| Unit - 2 | Number of lectures = 11 | Repairing materials |
|----------|-------------------------|---------------------|

Diagnosis and Assessment of Distress - Visual inspection – Non destructive tests –Ultrasonic pulse velocity method – Rebound hammer technique – ASTM classifications – Pullout tests – Core test

| | | |
|----------|-------------------------|----------------------|
| Unit - 3 | Number of lectures = 10 | Repairing techniques |
|----------|-------------------------|----------------------|

Materials for Repairing - Special concretes and mortar - Concrete chemicals - Special elements for accelerated strength gain - Expansive cement - Polymer concrete – Ferro cement, Fibre reinforced concrete - Fibre reinforced plastics.

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| Unit - 4 | Number of lectures = 05 | Repairs to structures |
|----------|-------------------------|-----------------------|

Techniques for Repair - Rust eliminators and polymers coatings for rebars during repair - Foamed concrete - Mortar and dry pack - Vacuum concrete - GModulee and shotcrete - Epoxy injection - Mortar repair for cracks - Shoring and underpinning.

13. Books Recommended

1. Shetty M. S., (2008), Concrete Technology, Seventh Edition, S. Chand & Company Ltd. **ISBN-13: 9788121900034.**

REFERENCE BOOKS

1. Ravindra K. Dhir, M. Roderick Jones & Li Zheng, (2005), Repair and Renovation of Concrete Structures, American Society of Civil Engineers, **ISBN-13: 9780727734051.**
2. A. R. Santha Kumar, (2006), Concrete Technology, First Edition, Oxford University Press, ISBN-13: 9780195671537.

Program Elective II

| | | | | | | |
|---|---|--|----------|---------------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Design of Tall Buildings | L | T | P | | |
| 3. Course Code | 13160329 | 3 | 0 | 0 | | |
| 4. Type of Course | | Core () | PE(√) | | OE() | |
| 5. Pre-requisite (if any) | Design of Steel Structures, Structural analysis | 6. Frequency (use tick marks) | Even (√) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 42 | | Tutorials = 00 | | Practical =00 | | |
| 8. Brief Syllabus: Classification of buildings, Three dimensional analysis, Shear wall system ,In-filled frame system, Plane frame system. | | | | | | |
| 9.Learning objectives: 1. This course is intended to teach the concept of tall structures. 2. Various methods to analyse the tall structure will be explained in the classes. | | | | | | |
| 10.Course Outcomes: On completion of this course, the students will be able to 1. Know the types of tall buildings. 2. Analyze the plane frame systems by different methods. 3. Design the shear wall systems and in filled frame systems. | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: Classification of buildings | | | | |
| Introduction - Classification of buildings according to NBC – Types of loads – wind load – Seismic load – Quasi static approach | | | | | | |
| Unit – 2 | Number of lectures = 08 | Title of the unit:Plane frame systems | | | | |
| Plane Frame System - Calculation of wind load – Approximate method – Portal - Cantilever and factor methods – Kani’s method – Substitute frame method for dead load and live loads | | | | | | |
| Unit – 3 | Number of lectures = 08 | Title of the unit: Shear wall system | | | | |
| Shear Wall System - Rosman’s analysis – Design aspect – RC frame and shear wall interaction – Equivalent frame method | | | | | | |
| Unit - 4 | Number of lectures = 08 | Title of the unit: In-filled frame system | | | | |
| In-filled Frame Systems - Importance – Methods of analysis – Equivalent truss and frame method – Force-displacement method – Effect of perforation in the in-filled frame. | | | | | | |
| 12.Books Recommended | | | | | | |
| TEXT BOOKS 1. Bryan Stafford Smith and Alex Coull, (2011), Tall Building Structures: Analysis and Design, Wiley India, ISBN-13: 9788126529896. | | | | | | |
| REFERENCE BOOKS 1. SarwarAlamRaz, (2002), Structural Design in Steel, Second Edition, New Age International, | | | | | | |

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|---|----------------------------|--|----------|----------------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Energy Efficient Buildings | L | T | | P | |
| 3. Course Code | 13160330 | 3 | 0 | | 0 | |
| 4. Type of Course | | Core () | PE(√) | | OE() | |
| 5. Pre-requisite (if any) | Nil | 6. Frequency (use tick marks) | Even (√) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 42 | | Tutorials = 00 | | Practical = 07 | | |
| 8. Brief Syllabus: Green Buildings, Energy and Environment ,Renewable Energy, Site and Climate ,Building Form and Fabric ,Energy Awareness, Infiltration, Ventilation, Lighting, Cooling and Water Conservation . | | | | | | |
| 9. Learning objectives: | | | | | | |
| i. This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century. | | | | | | |
| ii. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings | | | | | | |
| iii. To give a full understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation. | | | | | | |
| iv. To highlight the importance of Environmental Management as well as Environmental impact Assessment methods in Energy efficient buildings. | | | | | | |
| 10.Course Outcomes: On completion of this course, the students will be able to | | | | | | |
| 1. Understand to make buildings energy efficient. | | | | | | |
| 2. Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaic, and Ground source heat pumps, and their adaption to green building concepts. | | | | | | |
| 3. Understand the concepts of Site and Climate, Building Form, Building Fabric, Infiltration and ventilation, Lighting, Heating, Cooling, Energy Management and water conservation. | | | | | | |
| 4. Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge management strategies too. | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: Green Buildings, Energy and Environment & Energy awareness | | | | |
| Green Buildings within the Indian Context - Types of Energy - Energy Efficiency and Pollution - Better Buildings - Reducing energy consumption - Low energy design. Energy awareness - monitoring energy consumption - Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED) Sustainable architecture and urban design - principles of | | | | | | |

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| environmental architecture - Benefits of green buildings - Energy Conservation Building code – NBC. | | |
| Unit - 2 | Number of lectures = 08 | Title of the unit: Renewable Energy, Site and Climate |
| Renewable Energy sources that can be used in Green Buildings - Solar energy - Passive Solar Heating - Passive Solar collection - Wind and other renewable - A passive solar strategy - Photovoltaics - Climate and Energy - Macro and Microclimate - Indian Examples. | | |
| Unit - 3 | Number of lectures = 08 | Title of the unit: Building Form and Fabric |
| Building Form - Surface area and Fabric Heat Loss - utilizing natural energy - Internal Planning - Grouping of buildings - Building Fabrics - Windows and doors - Floors - Walls - Masonry - Ecological walling systems - Thermal Properties of Construction Material. | | |
| Unit - 4 | Number of lectures = 08 | Title of the unit:Infiltration, Ventilation, Lighting, Cooling and Water Conservation |
| Infiltration and ventilation - Natural ventilation in commercial buildings - passive cooling - modelling air flow and ventilation - Concepts of daylight factors and day lighting - daylight assessment - artificial lighting - New light sources - Cooling buildings - passive cooling - mechanical cooling - Water conservation- taps, toilets and urinals, novel systems - collection and utilization of rain water. | | |
| 12. Brief Description of self learning / E-learning component https://www.concretesociety.co.za/images/stories/conferences/Brochure%20-%20Buildings%20&%20Bridges.pdf | | |
| 13. Books Recommended 1. William T. Meyer, (2007), Energy Economics and Building Design, McGraw - Hill, ISBN: 9780070417519. REFERENCE BOOKS 1. Sim Van Der Ryn and Stuart Cowan, “Ecological Design”, Annotated Edition, Island Press ISBN-13: 9781597261418. 2. Richard D. Rush, (1991), The Building System Integration Handbook., Butterworth – Heinemann Ltd, ISBN-13: 9780750691987. | | |

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|--|--------------------------------------|--------------------------------------|-------------------------|----------------------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Environmental Engineering Structures | L | T | | P | |
| 3. Course Code | 13160331 | 3 | 0 | | 2 | |
| 4. Type of Course | | Core () | | PE($\sqrt{\quad}$) | OE() | |
| 5. Pre-requisite (if any) | Design of Concrete Structures | 6. Frequency (use tick marks) | Even ($\sqrt{\quad}$) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 30 | | Tutorials = 00 | | Practical = 00 | | |
| 8. Brief Syllabus: Pipe Design, Water Tank Design, Economic Analysis, Swimming Pools, Mixing Tank | | | | | | |
| 9. Learning objectives: 1. This subject is taught to impart the knowledge in the area of analysis and design of pipes and sewage structures. | | | | | | |
| 10. Course Outcomes: On completion of this course, the students will be able to On completion of this course, the students will be able to 1. Understand the concepts of pipe network and design. 2. Design the water tanks and concrete roofing systems. 3. Design the special purpose structures. 4. Understand the concepts of filter walls and clarifiers. | | | | | | |
| 11. Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures =08 | Title of the unit: Pipe design | | | | |
| Design of Pipes - Structural design of concrete - Pre-stressed concrete steel and cast iron piping mains - Sewerage tanks design - Anchorage for pipe – Massive outfalls – Structural design and laying – Hydrodynamic considerations. | | | | | | |
| Unit – 2 | Number of lectures = 08 | Title of the unit: Water tank design | | | | |
| Analysis and design of water tanks - Design of concrete roofing systems using cylindrical, spherical and conical shapes using membrane theory and design of various types of folded plates for roofing using concrete - IS Codes for the design of water retaining structures. | | | | | | |
| Unit – 3 | Number of lectures =0 8 | Title of the unit: Economic analysis | | | | |
| .Design of circular, rectangular, spherical and Intze type of tanks using concrete - Design of pre-stressed concrete cylindrical tanks – Economic analysis. | | | | | | |
| Unit – 4 | Number of lectures = 08 | Title of the unit: Swimming pools | | | | |
| .Design of Special Purpose Structures - Underground reservoirs and swimming pools - Intake towers - Structural design including foundation of water retaining structures such as settling | | | | | | |

tanks, clarifloculators, aeration tanks etc. – Effect of earth pressure and uplift considerations – Selection of materials of construction.

13. Books Recommended

TEXT BOOKS

1. P. Dayaratnam, (2011), Design of Reinforced Concrete Structures, Fourth Edition, Oxford & IBH – Pubs Company, ISBN-13: 9788120414198.

REFERENCE BOOKS

1. M. L. Gambhir, (2009), Design of Reinforced Concrete Structures, First Edition, Phi Learning Pvt. Ltd., ISBN-13: 9788120331938.
2. Krishna Raju, (2004), Pre-stressed Concrete (Problems and Solutions), Second Edition, CBS Publishers & Distributors, ISBN-13: 9788123902174.

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|---|-------------------------|-------------------------------------|-------------------------|---------|----------------|-------------|
| 1.Name of the Department | | CIVIL ENGINEERING | | | | |
| 2.Course Name | Stability of Structures | L | T | P | | |
| 3.Course Code | 13160332 | 3 | 0 | 0 | | |
| 4.Type of Course (use tick mark) | | Core () | PE-($\sqrt{\quad}$) | OE() | | |
| 5.Pre-requisite (if any) | | 6.Frequency (use tick marks) | Even ($\sqrt{\quad}$) | Odd () | Either Sem () | Every Sem() |
| 7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | Practical | | | |
| 8.Brief Syllabus: | | | | | | |
| In this course, student will learn about Static equilibrium and different equation for columns, analysis of columns. Analysis of frame and different methods for frame stability. | | | | | | |
| 9.Learning objectives: | | | | | | |
| 1. This subject is taught to impart the knowledge in the area of stability of structures | | | | | | |
| 10.Course Outcomes | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Understand the behaviour of eccentric column. | | | | | | |
| 2. Analysis the beam columns | | | | | | |
| 3. Analysis the frames stability. | | | | | | |
| 4. Understand the concept of buckling of shells. | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 8 | Introduction | | | | |
| Introduction - Static equilibrium – Governing equation for columns – Analysis for various boundary conditions - Analysis of Eccentrically loaded column. | | | | | | |
| Unit - 2 | Number of lectures = 11 | Column analysis | | | | |
| Beam Columns – Theory of Beam column – Stability analysis of beam column with different types of loads – Failure of beam columns. | | | | | | |
| Unit - 3 | Number of lectures = 10 | Frame analysis | | | | |
| Analysis and stability of frames | | | | | | |
| Unit - 4 | Number of lectures = 05 | Frames stability | | | | |

13.Books Recommended

TEXT BOOKS

1. Aswini Kumar, (1985), Stability Theory of Structures, McGraw Hill Book Co. Limited, ISBN-13: 9780074515167.

REFERENCE BOOKS

1. Timoshenko S. P. & Gere J. M., (2010), Theory of Elastic Stability, Second Edition, McGraw Hill Education, ISBN-13: 9780070702417.
2. Chai H. Yoo, (2011), Stability of Structures Principles and Applications, Elsevier Publisher, ISBN-13: 9780123851222.

Program Elective

III

| | | | | | | |
|--|--------------------------|-------------------------------------|----------|-----------|----------------|--------------|
| 1.Name of the Department | | CIVIL ENGINEERING | | | | |
| 2.Course Name | Prefabricated Structures | L | T | P | | |
| 3.Course Code | 13160334 | 3 | 0 | 0 | | |
| 4.Type of Course (use tick mark) | | Core () | PE-(√) | OE() | | |
| 5.Pre-requisite (if any) | | 6.Frequency (use tick marks) | Even (√) | Odd () | Either Sem () | Every Sem() |
| 7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | | Practical | | |
| 8.Brief Syllabus: | | | | | | |
| In this course, student will learn about types of foundation, Prefabrication systems and structural schemes, Handling and erection stresses, Dimensioning and detailing of joints, Design of pre fabricated Modules | | | | | | |
| 9.Learning objectives: | | | | | | |
| 1. This subject is taught to impart the knowledge in the area of prefabricated structures. | | | | | | |
| 10.Course Outcomes | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Know the types of prefabrication systems. | | | | | | |
| 2. Understand the behaviour of shell structures. | | | | | | |
| 3. Design pre fabricated Modules. | | | | | | |
| 4. Do the detailing of pre fabricated Modules. | | | | | | |
| 11.Unit wise detailed content | | | | | | |
| Unit-1 | Number of lectures = 8 | Introduction | | | | |
| Types of foundation - Modular co-ordination – Components - Prefabrication systems and structural schemes - Design considerations - Economy of prefabrication - Prefabrication of load-carrying members - DisModuleing of structures - Structural behaviour of pre cast structure | | | | | | |
| Unit - 2 | Number of lectures = 11 | Handling and erection stresses | | | | |
| Handling and erection stresses - Application of pre stressing of roof members - Floor systems - Two | | | | | | |

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|---|-------------------------|--------------------------------------|
| way load bearing slabs - Wall panels | | |
| Unit - 3 | Number of lectures = 10 | Dimensioning and detailing of joints |
| Dimensioning and detailing of joints for different structural connections - Construction and expansion joints. | | |
| Unit - 4 | Number of lectures = 05 | Erection of structures |
| Production - Transportation and Erection - Organising of production - Storing and erection equipment - Shuttering and mould design - Dimensional tolerances, Erection of R.C. structures, Total prefabricated buildings | | |
| 13. Books Recommended | | |
| TEXT BOOKS | | |
| 1. Hass, A. M., Precast Concrete Design and Applications, Taylor & Francis Publishers, ISBN-13: 9780853341970. | | |
| REFERENCE BOOKS | | |
| 1. A. S. G. Bruggeling & G. F. Huyghe, (1991), Prefabrications with Concrete, CRC Press, ISBN-13: 9789061911838., Second Edition, Applied Science Publishers Ltd., ISBN-13: 9780415268462. | | |

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|---|-------------------------|--------------------------------------|-------------------------|-----------|----------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Structural Optimization | L | T | P | | |
| 3. Course Code | 13160335 | 3 | 0 | 0 | | |
| 4. Type of Course (use tick mark) | | Core () | PE-($\sqrt{\quad}$) | OE() | | |
| 5. Pre-requisite (if any) | | 6. Frequency (use tick marks) | Even ($\sqrt{\quad}$) | Odd () | Either Sem () | Every Sem() |
| 7. Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | | Practical | | |
| 8. Brief Syllabus: | | | | | | |
| In this course, student will learn about Formulation of Structural Optimization problem, Linear Programming techniques, Stochastic Optimization Methods , Genetic Algorithm based Optimization Methods. | | | | | | |
| 9. Learning objectives: | | | | | | |
| 1. This course is intended to teach the importance of Optimization problems in the Structural Engineering. | | | | | | |
| 10. Course Outcomes | | | | | | |
| On completion of this course, the students will be able to | | | | | | |
| 1. Understand the concepts of Optimization problems in the Structural Engineering. | | | | | | |
| 2. Know the different methods for the Optimization problems. | | | | | | |
| 3. Understand the concepts of Linear and Non-Linear Programming techniques. | | | | | | |
| 4. Understand the concepts of Stochastic Optimization Methods. | | | | | | |
| 5. Understand the concepts of Genetic Algorithm based Optimization Methods. | | | | | | |

| 11. Unit wise detailed content | | |
|---|-------------------------|---|
| Unit-1 | Number of lectures = 8 | Formulation of Structural Optimization problems |
| Formulation of Structural Optimization problems: Design variables - Objective function - constraints. Fully stressed design. | | |
| Unit - 2 | Number of lectures = 11 | Linear Programming techniques |
| Review of Linear Algebra: Vector spaces, basis and dimension, canonical forms. | | |
| Unit - 3 | Number of lectures = 10 | Non-Linear Programming techniques |
| Linear Programming: Revised Simplex method, Application to structural Optimization | | |
| Unit - 4 | Number of lectures = 05 | Stochastic Optimization Methods |
| Nonlinear Programming: Deterministic Methods_ Unconstrained and constrained Optimization - Kuhn-Tucker conditions, Direct search and gradient methods - One dimensional search methods - DFP and BFGS algorithms, constrained Optimization - Direct and Indirect methods - SLP, SQP and SUMT, Application of NLP methods to optimal structural design problems. Optimality criteria based methods, Reanalysis techniques - Approximation concepts - Design sensitivity Optimization of sections, steel and concrete structures - framed structures, bridge structures | | |
| 13. Books Recommended | | |
| TEXT BOOKS | | |
| 1. S.S.Rao, (2009), Engineering Optimization: Theory and Practice, Fourth Edition, John Wiley – Mehul Exclusive, ISBN-13: 9788126540440. | | |
| REFERENCE BOOKS | | |
| 1. Smith D. R., Variational Methods in Optimization, New Edition, Dover Publications, ISBN-13: 9780486404554. | | |
| 2. Ravindran A., Reklaitis G. V. & Ragsdell K. M., (2006), Engineering Optimization – Methods and Applications, Second Edition, John Wiley & Sons, ISBN-13: 9780471558149. | | |

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|--|----------------------|-------------------------------------|-------------------------|-----------|---------------|-------------|
| 1.Name of the Department | | CIVIL ENGINEERING | | | | |
| 2.Course Name | Composite Structures | L | T | P | | |
| 3.Course Code | 13160336 | 3 | 0 | 0 | | |
| 4.Type of Course (use tick mark) | | Core () | PE-($\sqrt{\quad}$) | OE() | | |
| 5.Pre-requisite (if any) | | 6.Frequency (use tick marks) | Even ($\sqrt{\quad}$) | Odd () | Either Sem () | Every Sem() |
| 7.Total Number of Lectures, Tutorials, Practical (assuming 14 weeks of one semester) | | | | | | |
| Lectures = 41 | | Tutorials = | | Practical | | |
| 8.Brief Syllabus: | | | | | | |
| <p>In this course, student will learn about open channel hydraulics: Pipe Flow and Free Surface Flow, Continuity Equation, Energy in Free Surface Flow, Basic Momentum Equation, Velocity Distribution, Occurrence, Critical Depth in Trapezoidal & Circular Channels, Hydraulic Exponent for Critical Flow, Critical Flow Depth Computations, Derivation of Uniform Flow Equations, Resistance in Open Channel Hydraulics, History of Uniform Flow Velocity and Resistance Factor, Integration of Differential Equation, Improved Euler Method.</p> | | | | | | |
| 9.Learning objectives: | | | | | | |
| <ol style="list-style-type: none"> 1. To know the types of composites 2. To understand the need for stress strain relation | | | | | | |

3. To understand the fabrication methods
4. To understand the laminated plates
5. To study and understand the different methods & analysis of composite materials.

10.Course Outcomes

On completion of this course, the students will be able to

1. Analyze composite structures
2. Do microscopic and macroscopic analysis
3. Analyze sandwich and laminated plates
4. Understand the failure criteria for composites.
5. Know the fabrication techniques

11.Unit wise detailed content

| | | |
|--|-------------------------|-----------------------------------|
| Unit-1 | Number of lectures = 8 | Stress Strain Relationship |
| Introduction - advantages and application of composite materials, reinforcements and matrices - Generalised Hooke's Law - Elastic constants for anisotropic, orthotropic and isotropic materials. | | |
| Unit - 2 | Number of lectures = 11 | Finite Element Analysis of Plates |
| Introduction - concept of mesh - Displacement function - Stress-Strain Matrix – Stiffness matrix of plate element – Solution of problem | | |
| Unit - 3 | Number of lectures = 10 | Methods of Analysis |
| Micro mechanics - Mechanics of materials approach, elasticity approach to determine material properties - Macro Mechanics - Stress-strain relations with respect to natural axis, arbitrary axis - Determination of material properties - Experimental characterization of lamina. | | |
| Unit - 4 | Number of lectures = 05 | Laminated Plates |
| Governing differential equation for a general laminate, angle ply and cross ply laminates - Failure criteria for composites. | | |

13.Books Recommended

TEXT BOOKS

1. Madhujit Mukhopadhyay, (2010), Mechanics of Composite Materials and Structures, First Edition, Orient Blackswan Pvt. Ltd., ISBN-13: 9788173714771.

REFERENCE BOOKS

1. Jones, R.M., (1998), Mechanics of Composite Materials, Second Edition, Taylor and Francis Publisher, Isbn-13: 9781560327127.
2. Atul K. Kaw, (2005), Mechanics of Composite Materials, Second Edition, CRC Press, ISBN-13: 9780849313431.

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|---|--------------------------------|--------------------------------------|----------|----------------|---------------|--------------|
| 1. Name of the Department | | CIVIL ENGINEERING | | | | |
| 2. Course Name | Design of Bridges | L | T | | P | |
| 3. Course Code | 13160333 | 3 | 0 | | 0 | |
| 4. Type of Course | | Core () | PE(√) | | OE() | |
| 5. Pre-requisite (if any) | Reinforced Concrete Structures | 6. Frequency (use tick marks) | Even (√) | Odd () | Either Sem () | Every Sem () |
| 7. Total Number of Lectures, Tutorials, Practical | | | | | | |
| Lectures = 42 | | Tutorials = 00 | | Practical = 00 | | |
| 8. Brief Syllabus: | | | | | | |
| Design of reinforced concrete bridges is normally done on the basis of a structural analysis. The purpose of the analysis is to find a distribution of sectional forces which fulfils equilibrium and is suitable for design. | | | | | | |
| 9. Learning objectives: | | | | | | |
| This subject is taught to impart the knowledge in the analysis and design of concrete bridges. | | | | | | |
| 10. Course Outcomes: On completion of this course, the students will be able to | | | | | | |
| 1. Understand the load distribution and IRC standards | | | | | | |
| 2. Design the slab bridges | | | | | | |

| | | |
|---|-------------------------|---|
| 3. Design the Arch bridges | | |
| 4. Design the bridge bearings, hinges and expansion joints | | |
| 11. Unit wise detailed content | | |
| Unit-1 | Number of lectures = 08 | Title of the unit: IRC loading and other methods |
| Load Distribution Theory - I.R.C. loading standards – Bridge slabs – Effective width method as per I.R.C. – Pigeaud’s method – Bridge girders – Courbon’s method – Assumptions and analysis of a typical bridge floor – Hendry-Jaeger method – Morice – Little version of Guyon and Massonet method (principles only) . | | |
| Unit – 2 | Number of lectures = 08 | Title of the unit: Slab bridges |
| Slab Bridges - Straight and skew slab bridges – T beam bridges – Balanced cantilever bridges – Design of articulation – Continuous girder bridges. | | |
| Unit – 3 | Number of lectures = 08 | Title of the unit: Arch bridges |
| Arch Bridges - Single span closed and open spandrel symmetrical type (structural arrangements and functions only) – Design of bow string girder bridges. | | |
| Unit – 4 | Number of lectures = 08 | Title of the unit: Miscellaneous bridges & Substructures |
| Other Bridges - Box culvert (Single vent only) – Single span rigid frame bridges (Barrel of solid slab type only) – Pre-stressed composite T beam bridges (structural arrangements only) Design of slab base and gusset base and grillage foundation along with its connection with column. Substructures - Design principles of Piers and abutments – Bridge bearings - Hinges and expansion joints. | | |
| 12. Brief Description of self learning / E-learning component | | |
| https://onlinecourses.nptel.ac.in/noc17_ce24/preview | | |
| 13. Books Recommended | | |
| TEXT BOOKS | | |
| 1. Johnson Victor, (2007), Essentials of Bridge Engineering, Sixth Edition, Oxford & IBH Publishing Co. Ltd., ISBN-13: 9788120417175. | | |
| REFERENCE BOOKS | | |
| 1. Wilbur Jay Watson, (2910), General Specifications for Concrete Bridges, Nabu Press, ISBN-13: 9781177206587. | | |
| 2. Portland Cement Association, (2010), Continuous Concrete Bridges, Cambridge Scholars Publishing, ISBN-13: 978115337241. | | |

