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**SECOND SEMESTER 2021-2022**

# **Course Handout Part II**

**Date: 15-01-2022**

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : CE F241

## Course Title : Analysis of Structures

## Instructor-in-Charge : Dr. Shivang Shekhar (shivangshekhar@hyderabad.bits-pilani.ac.in)

**Scope and Objectives of the Course:**

This course covers - Static and kinematic Indeterminacy, Energy principles; Force Methods of analysis: strain energy method, consistent deformation method, Displacement Methods of analysis: Slope-deflection method, Moment distribution method; Introduction to Matrix Methods of structural analysis: Flexibility and Stiffness Methods, Influence Line Diagrams; Analysis of Moving/Rolling loads (for determinate structures), Introduction to approximate analysis of frames and trusses, Analysis of Three-hinged, two- hinged and fixed Arches, Analysis of indeterminate trusses. Exposure to relevant software.

**Course Outcomes:** The student should be able to

|  |  |
| --- | --- |
| **1** | Analyze beams and frames using Displacement based methods |
| **2** | Analyze beams and frames using Force based methods |
| **3** | Analyze frames using approximate methods |
| **4** | Use STAAD Pro to analyze a structure and understand the underlying stiffness methods(matrix methods) |
| **5** | Draw influence lines and calculate effect of moving loads |

Student Learning Outcomes\* (SLOs) assessed in this course – **(a), (e) and (k).**

**Textbook:**

1. Hibbeler, R. C., Structural Analysis, Pearson Education; Ninth edition

**Reference books:**

1. Leet, K. M., and Uang Chia-Ming, “Fundamentals of Structural Analysis,” Mc-Graw Hill Publication, New Delhi 1988.
2. Gupta, S.P., Pandit, G. S. and Gupta Rajesh. Theory of Structures (Vol. I & II), TMH, New Delhi, 1999.
3. H. Norris et al., Elementary Structural Analysis, Mcgraw-Hill 4 Sub edition, 1990.
4. D S Prakash Rao, Structural Analysis – A Unified Approach, Universities Press 1996
5. C. S. Reddy, Basic Structural Analysis, TMH, 2nd Ed., 1996.
6. D Menon, Structural Analysis, Narosa Publishers, India, 2008, Reprint 2016.
7. S S. Bhavikatti, Structural Analysis, Volume 2, Vikas Publishing House Pvt Limited, 2005.
8. Willilam, W. & Gere J.M. “Matrix Analysis of Framed Structures”, CBS Publishers & Distributers, 1986.

**Course Plan:**

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| --- | --- | --- | --- | --- | --- |
| Lecture No. | Learning Objective | Topics to be covered | | **Chapter in the Text Book** | **SLO** |
| 1-3 | To identify the static and kinematic indeterminacy of various structures | Introduction | Fundamentals of Structural Analysis, Static and Kinematic Indeterminacy, Revision of BMD and SFD | T1 Ch.2 | (a) |
| 4-6 | To analyze beams and frames using Force based methods | Force Methods | Consistent Deformation Method | R3 Ch.9 | (a), (e), (k) |
| 7-10 | Strain Energy Method | R6 Ch.15 |
| 11-13 | To analyze beams and frames using Displacement based methods | Displacement Methods | Slope-Deflection Method | T1 Ch.11 |
| 14-16 | Moment Distribution Method | T1 Ch.12 |
| 17-21 | To understand the underlying stiffness methods use STAAD Pro to analyze a structure | Matrix Methods | Stiffness Matrix method and STAAD Pro | T1 Ch.14, T1 Ch.15, T1 Ch.16, R7 Ch.11 |
| 22-23 | Introduction to Flexibility Matrix Method | R7 Ch.11 |
| 24-26 | To analyze trusses using Force based methods | Indeterminate Trusses | Redundancy and Analysis of indeterminate trusses | T1 Ch.14, |
| 27-30 | To draw influence lines and calculate effect of moving loads | Moving Loads on beams | Influence Line Diagrams and Analysis determinate beams under Moving Loads | T1 Ch.6, T1 Ch.9 | (a), (e) |
| 31-33 | To analyze frames using approximate methods | Approximate methods for analysis of Frames | Frames subjected to vertical loads | T1 Ch.7 | (a), (e), (k) |
| 34-37 | Frames subjected to Horizontal loads | T1 Ch.7 |
| 38-42 | To determine the internal forces and deformations of a given arch system | Arches | Two Hinged Arches  Fixed Arches | R4 Ch.12 | (a), (e) |

**\*Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

1. an ability to apply knowledge of mathematics, science and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multidisciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid Semester Exam | 90 min | 30 | 16/03 9.00am to10.30am | CB/OB |
| Assignments and Projects | - | 15 | Continuous evaluation during lecture and tutorial classes | OB |
| Surprise Quizzes\* | - | 10 | Continuous evaluation during lecture and tutorial classes | OB |
| Classroom Interaction and Viva |  | 10 | Continuous evaluation during lecture and tutorial classes | OB |
| Comprehensive Exam | 120 min | 35 | 19/05 FN | CB/OB |
| \* Surprise quizzes will be conducted during tutorial/lecture hours. A minimum of *n*+1 (typically 3) quizzes are planned. The best marks of *n* quizzes will be considered. | | | | |

**Chamber Consultation Hour:** To be announced in the class.

**Notices:** Notice concerning to the course will be displayed on Notice Board of CE Dept. & Google Classroom

**Make-up Policy:** Makeup will be given only to the genuine cases with prior permission.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**

**CE F241**