



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

## SECOND SEMESTER 2022-2023

### Course Handout Part II

Date: 16-01-2023

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* : Raghu Piska

### **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 STAADPro to solve 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. Hibbler, R. C., Structural Analysis, Pearson Education; Ninth edition (27 October 2017).

### **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:

Lecture No.	Learning Objective	Topics to be covered		Chapter in the Text Book	SLO
1-3	able to Identify the static and kinematic indeterminacy of various structures	Introduction	Fundamentals of Structural Analysis, Static and Kinematic Indeterminacy	T1 Ch.2	(a)
4-6	able 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	able 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	able to use STAADPro to solve a structure and understand the underlying stiffness methods	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	able to Analyze trusses using Force based methods	Indeterminate Trusses	Redundancy and Analysis of indeterminate trusses	T1 Ch.14,	(a), (e)
27-30	able 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	
31-33	able 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	Able 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.

- (a) an ability to apply knowledge of mathematics, science and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) 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
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively



- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Evaluation Scheme:**

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Sem Test	90 min	25%	17/03 2.00 - 3.30PM	CB
Assignments (Theory, Programming and Software)		15%	TBD	OB
Project		20%		OB
Compre. Exam	180 min	40%	18/05 FN	OB

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

**Notices:** Notice concerning to the course will be displayed on 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**

