

Course Book

Course Description	<p>This course presents the required knowledge in the field of structural analysis of trusses, beams and frames. The course will help the students to a better understanding the for concept of structural members behaviors under different loading types leading to a better understanding for the design requirements.</p> <p>This course requires a solid background in the Engineering Mechanic and Strength of Material and Calculus.</p>				
Course objectives	<ul style="list-style-type: none"> • Learn to compute deflections of beams using, conjugate beam and energy methods. • Learn to analyse indeterminate structures; • Application of analysis concepts to design. 				
Student's obligation	<p>The students are required to:</p> <ul style="list-style-type: none"> • Attend all the lectures and participate in the discussion and the class work; • Reading and practising on the problems given in previous lectures before attending a new one; • Performing the required tasks of preparation of Reports, Quizzes, Homework, projects • Participate in all tests and exams. 				
Required Learning Materials	<p>Lecture Notes.....Reference Books.....Data Show... Laptop.....</p>				
Evaluation	Task		Weight (Marks)	Due Week	Relevant Learning Outcome
	Assignments	Homework	10	4,8,12	1-5
		Class Activity	2	1 to 12	1-5
		Report/Poster	8	12	1-5
		Seminar	8	11	1-5
		Essay			
	Project	---			
	Quiz	8	4,8,12	1-5	
	Lab.				
	Midterm Exam	24	8	1-3	
	Final Exam	40	15	1-5	
Total					
Specific learning outcome:	<p>The students by the end of the course will be able to:</p> <ol style="list-style-type: none"> 1- Analyse determinate structures for deflection 2- Analyse indeterminate frames for moments/shears/axials. 3- Being able to research for information/knowledge about one of the Course topics or any related subjects approved by the lecturer. 				

Course References:	<ul style="list-style-type: none"> ▪ Key references: <ul style="list-style-type: none"> -“Structural Analysis” R.C. Hibbeler, 8th Edition, Pearson Education, Inc. New Jersey, USA. ▪ Useful references: <ul style="list-style-type: none"> - “ Structural Analysis: In theory and Practice”, Williams, Elsevier, 2009 - “Examples in Structural Analysis”, William M.C.McKenzie, 1st Edition, Taylor & Francis, Milton Park, Uk, 2006. ▪ Magazines and review (internet):
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Course topics (Theory)	Week	Learning Outcome
1- Deflections of Statically Determinate Structure (Frames) Energy method: Unit Load Method (Virtual Work Method)	1-2	1
2- Deflections of Statically Determinate Structure (Trusses) Energy method: Unit Load Method (Virtual Work Method)	3-4	2
3- Analysis of Statically Indeterminate Structures using Force Method (Consistent Deformations Method)	5-7	3
4- Analysis of Statically Indeterminate Structures using Displacement Method (Slope-Deflection Method)	8-9	4
5- Analysis of Statically Indeterminate Structures using Displacement Method (Moment Distribution Method)	10-12	5

Practical Topics	Week	Learning Outcome

Questions Example Design

1. Calculation Questions: In this type of exam the questions usually start with: Classify the structure, Analyse, Compute the deflection, ,
See an Example below:

Q3 : Analyze the adjacent beam using Slope Deflection method to determine the :

- Rotation at B;
- Moment at B;
- Moment at C.

$E = 21000 \text{ N/mm}^2$
Member section : 0.3 x 0.3 m

(15 Marks)

Typical Answer

Q3)

Member AB

$$M_{AB} = 0$$

$$M_{BA} = 3 \frac{EI}{8} (\theta_B) + 100 = \frac{3}{8} EI \theta_B + 100 \quad (1)$$

Member BC

$$M_{BC} = 2 \frac{EI}{6} (2\theta_B) - 35.55 = \frac{2}{3} EI \theta_B - 35.55 \quad (2)$$

$$M_{CB} = \frac{2EI}{6} \theta_B + 71.11 \quad (3)$$

Equilibrium Equation

$$M_{BA} + M_{BC} = 0 \quad (4)$$

$$\frac{3}{8} EI \theta_B + 100 + \frac{2}{3} EI \theta_B - 35.55 = 0$$

$$\theta_B = \frac{-61.875}{EI} = \frac{61.875 \times 10^9}{21000 \times 675000000}$$

$$= -0.00436 \text{ rad}$$

$$= 0.00436 \text{ rad } \curvearrowright$$

$E = 21000 \text{ N/mm}^2$
 $I = \frac{300 \times 300^3}{12} = 675000000 \text{ mm}^4$

$$M_{BA} = \frac{3}{8} EI \left(\frac{-61.875}{EI} \right) + 100 = 76.79 \text{ KN.m}$$

$$M_{CB} = \frac{2}{6} EI \left(\frac{-61.875}{EI} \right) + 71.11 = 50.48 \text{ KN.m}$$

Extra notes:

External Evaluator