Lesson Plan- CE1017- Structural Analysis Academic year 2015-16 (Semester commencing in June 2015)

	Instructional objectives (IO)			
1	Preparation of influence line diagrams for statically determinate			
1	structures.			
2	Rolling loads on simply supported beams- uniformly distributed loads			
<u> </u>	and system of wheel loads			
	Analysis of indeterminate structures (beams, frames and trusses) for			
3	internal forces,			
	deflections etc.			
1	Classical methods - slope deflection method - use in analyzing			
4	indeterminate beams and plane frames with and without sway			
5	Moment distribution method - Iterative method often used in analyzing			
	indeterminate structures			

Student outcomes

Student outcome (SO)			
а	an ability to apply knowledge of mathematics, science, and engineering		
e	an ability to identify, formulate, and solve engineering problems		

Mapping of Instructional Objectives (IOs) with Student Outcomes (SOs) CE1017- Structural Analysis

	Student Outcomes		
Instructional objectives	а	e	
Preparation of influence line diagrams for statically determinate structures.	Х	Х	
Rolling loads on simply supported beams- uniformly distributed loads and system of wheel loads	Х	Х	
Analysis of indeterminate structures (beams, frames and trusses) for internal forces, deflections etc.	Х	Х	
Classical methods - slope deflection method - use in analyzing indeterminate beams and plane frames with and without sway	Х	Х	
Moment distribution method - Iterative method often used in analyzing indeterminate structures	Х	Х	

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Drawing ILD for reactions / truss members for parallel chord trusses like Pratt truss and Warren girder21a1, 2,5, 6, 88.Reversal of stresses in truss members11a1, 2,5, 6, 8UNIT-2 ROLLING LOADS9.Introduction to rolling loads – IRC loads – Class AA and Class A loads.12a, e1, 2,5, 6, 810.Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads12a, e1, 2,5, 6, 811.Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams22a, e1, 2,5, 6, 812.Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported /12a, e1, 2,5, 6, 8		supported beam	• •					7 7-7 -7 -
7.members for parallel chord trusses like Pratt truss and Warren girder21a1, 2, 5, 6, 88.Reversal of stresses in truss members11a1, 2, 5, 6, 8UNIT-2 ROLLING LOADS9.Introduction to rolling loads – IRC loads – Class AA and Class A loads.12a, e1, 2, 5, 6, 810.Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads12a, e1, 2, 5, 6, 811.Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams22a, e1, 2, 5, 6, 812.Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported /12a, e1, 2, 5, 6, 8	_	Drawing ILD for read	ctions / truss					
Pratt truss and Warren girder Image: Conservence of the servence	7.	members for parallel	chord trusses li	ke	2	1	a	1, 2,5, 6, 8
8. Reversal of stresses in truss members 1 1 1 a 1, 2, 5, 6, 8 UNIT-2 ROLLING LOADS 9. Introduction to rolling loads – IRC loads – Class AA and Class A loads. 1 2 a, e 1, 2, 5, 6, 8 10. Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads 1 2 a, e 1, 2, 5, 6, 8 11. Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams 2 2 a, e 1, 2, 5, 6, 8 12. Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported / 1 2 a, e 1, 2, 5, 6, 8	0	Pratt truss and Warren	n girder		1	1		1 25 6 0
ONTI-2 ROLLING LOADS9.Introduction to rolling loads – IRC loads – Class AA and Class A loads.12a, e1, 2, 5, 6, 810.Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads12a, e1, 2, 5, 6, 811.Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams22a, e1, 2, 5, 6, 812.Finding the maximum reaction and BM / SF at a section due to ull shorter and longer than span in simply supported /12a, e1, 2, 5, 6, 8	8.	Reversal of stresses in	truss member	S	1	1	a	1, 2,5, 6, 8
9.Introduction to rolling loads - IRC loads - Class AA and Class A loads.12a, e1, 2,5, 6, 810.Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads12a, e1, 2,5, 6, 811.Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams22a, e1, 2,5, 6, 812.Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported /12a, e1, 2,5, 6, 8		UN11-2 KULLING LUADS						
10. Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads 1 2 a, e 1, 2,5, 6, 8 11. Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams 2 2 a, e 1, 2,5, 6, 8 12. Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported / 1 2 a, e 1, 2,5, 6, 8	9.	Introduction to rolling	$\frac{1}{10}$ s 1	oads	1	2	a, e	1, 2, 5, 6, 8
10.Concept of Application of ILD to compute the Reactions / BM / SF due to rolling loads12a, e1, 2, 5, 6, 811.Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams22a, e1, 2, 5, 6, 812.Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported /12a, e1, 2, 5, 6, 8		- Class AA and Class	A loads.				,	
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Folling loadsFolling loads11.Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams22a, e1, 2,5, 6, 812.Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported /12a, e1, 2,5, 6, 8	10.	compute the Reaction	s / BM / SF du	e to	1	2	a, e	1, 2,5, 6, 8
11. Finding the maximum reaction and BM / SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams 2 2 a, e 1, 2,5, 6, 8 12. Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported / 1 2 a, e 1, 2,5, 6, 8		rolling loads						
11. SF at a section due to point loads for maximum 5 numbers in simply supported / overhanging beams 2 2 a, e 1, 2,5, 6, 8 12. Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported / 1 2 a, e 1, 2,5, 6, 8		Finding the maximum	reaction and	BM /				
12. Imaximum 5 numbers in simply supported / / overhanging beams 1 2 a, e 1, 2, 5, 6, 8	11.	SF at a section due to	point loads for	antad	2	2	a, e	1, 2,5, 6, 8
12. Finding the maximum reaction and BM / SF at a section due to udl shorter and longer than span in simply supported / 1 2 a, e 1, 2, 5, 6, 8		/ overhanging beens	in simply supp	orted				
12. $\begin{bmatrix} Finding the maximum feaction and BWT / SF at a section due to udl shorter and longer than span in simply supported / 1 2 a, e 1, 2,5, 6, 8$		Finding the maximum	roaction and					
12. SF at a section due to ddi shorter and 1 2 a, e $1, 2, 5, 6, 8$	12.	Finding the maximum	udl aborton and					
		longer than span in si	uui siioiter allo	1 1/	1	1 2	a, e	1, 2,5, 6, 8
overhanging beams		overhanging booms	mpry supported	1/				
Finding absolute maximum bending		Finding absolute may	imum handing					
13. $\begin{bmatrix} 1 \text{ multiple absolute maximum behaving} \\ \text{moment in simply supported beams due to} \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ 2 \\ 3 \end{bmatrix} \begin{bmatrix} 2 \\ 4 \\ 8 \\ 1 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ 3 \\ 4 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 4 \\ 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix} \begin{bmatrix} 2 $	13.	moment in simply our	morted beams	due to	2	2	a, e	1, 2,5, 6, 8

Lecture	Торіс	No. of	IOs	SO	Reference
N0.		nours			
	point loads (Max. 4)				
1.4	Finding absolute maximum bending	1	2		1 2 5 6 9
14.	moment in simply supported beams due to	1	2	a, e	1, 2, 5, 6, 8
	La shorter and longer than span				
15.	Equivalent udi from BM considerations	1	2	a, e	1, 2,5, 6, 8
16.	Curves of maximum B.M.D. and	1	2	a, e	1, 2, 5, 6, 8
	S.F.D concept				7 7 7 7 7 7
	Cycle Test –I	2	2	a, e	1, 2,5, 6, 8
	UNIT-2- STATICALLY INDETERMIN	ATE ST	RUCT	URES	
	Introduction to statically indeterminate				
	structures and their examples – beams,				
	frames, trusses				
17.	Qualitative Comparison between	2	3	a, e	1,2,5,6,7,8,9
	determinate and indeterminate structures				
	in terms of stresses, deflections,				
	settlements				
	Computation of static and kinematic				
18.	indeterminacy – degrees of freedom for	1	3	a, e	1.2.5.6.7.8.9
101	beams – beams with internal hinges and	-	C .	, .	1,2,0,0,7,0,7
	links				
	Computation of static and kinematic				
19.	indeterminacy – degrees of freedom for	1	3	a, e	1,2,5,6,7,8,9
	multistoried moment resistant frames with			,	
	and without sway				
20	Computation of static and kinematic	1	2		1256780
20.	indeterminacy – degrees of freedom for	1	3	a, e	1,2,5,6,7,8,9
	pin jointed trusses				
	indeterminedy degrees of freedom for				
21	simple three dimensional single storey	1	2	0.0	1256780
21.	moment registent fremes and simple nin	1	3	a, e	1,2,3,0,7,8,9
	iointed trusses like tripods				
	Analysis of propped cantilever by				
	Macaulay's method with and without				
22.	overhangs and drawing BMD and SED	2	3	a, e	1,2,5,6,7,8,9
	finding support reactions				
	Analysis of fixed beams, by Macaulay's				
	method and Area Moment method and				
23.	drawing BMD and SFD including for	3	3	a.e	1.2.5.6.7.8.9
20.	uniformly varying loads (triangular).	U	0	и, с	1,2,0,0,7,0,7
	finding support reactions				
	Analysis of continuous beams by				
	Clapeyron's Three Moment Equation				
.	method and drawing BMD and SFD.	A			1055500
24.	finding support reactions including	4	3	a, e	1,2,5,6,7,8,9
	considering settlement of supports. (
	maximum 2 unknown support moments)				

Lecture	Торіс	No. of	IOs	SO	Reference		
No.		hours					
	Analysis of continuous beams with fixed						
	supports						
	Introduction to Energy methods-						
25.	Statement of Castiglione's theorems – and	1	3	a, e	1,2,5,6,7,8,9		
	formulating unit load method						
	Analysis of indeterminate trusses with						
26	internal degree of indeterminacy one	2	3	a e	1.2.5.6.7.8.9		
20.	using unit load method (no. of members	-	5	u, c	1,2,3,0,7,0,5		
	in the truss not greater than 6)						
27.	Analysis of indeterminate trusses with	1	3	a.e	1.2.5.6.7.8.9		
	members with lack of fit	-		, •			
28.	Analysis of indeterminate trusses	1	3	a.e	1.2.5.6.7.8.9		
	subjected to temperature stresses	-			-,_,_,_,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	Cycle Test - II	2	3	a, e	1,2,3.4		
	UNIT-IV SLOPE DEFLECTION METH	IOD	[[[
	Comparison of Force and Displacement						
29.	methods	2	4	a.e	1,2,3,4,6,7		
	Introduction- derivation of slope			,			
	deflection equation – sign convention						
	Analysis of continuous beams including						
30.	with support settlements with degrees of	4	4	a, e	1,2,3,4,6,7		
	drawing BMD finding support reactions						
	Qualitative treatment of beams with						
31.	internal hinges	1		a, e	1,2,3,4,6,7		
	Analysis of plane moment resistant single						
	storey frames with degrees of freedom						
32.	less than or equal to two without side	4	4	a.e	1.2.3.4.6.7		
	sway and drawing BMD, finding support	+		и, с	_,_,_,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	reactions (BMD plotted on tension side)						
	Analysis of plane moment resistant single						
	storey frames with degrees of freedom		4	a, e	1,2,3,4,6,7		
33.	less than or equal to three with side sway	2					
	and drawing BMD, finding support						
	reactions						
UNIT-V MOMENT DISTRIBUTION METHOD							
34	Introduction- development moment	2	5	a, e	123467		
	distribution method – sign convention	2	5		1,2,3,7,0,7		
35.	Analysis of continuous beams drawing	1	5	ае	123467		
	BMD, finding support reactions	1	5	u, c,	1,2,3,1,0,7		
36.	Analysis of plane moment resistant single						
	storey frames drawing BMD, finding	2	5	a.e	1.2.3.4.6.7		
	support reactions (BMD plotted on	_	-		_,_,_,_,_,_,		
	tension side)						
37.	Analysis of plane moment resistant single	2	_		100467		
	storey frames with side sway and	3	5	a, e	1,2,3,4,6,7		
	urawing BMD, finding support reactions						

Lecture	Торіс	No. of	IOs	SO	Reference
No.		hours			
38.	Introduction to Kani's method – principles- factors- comparison with moment distribution method	2	5	a, e	2
39.	Introduction to Column analogy method – solving fixed beam problem	2	5	a, e	1,2
	Model Examination	3	1-5	a, e	1,2,3,4
	Total hours	75			

Note:

1. The faculty members handling the course may conduct surprise test according to their convenience. However a question paper in hard copy as well as key shall be made available for the surprise test. The process shall be same as that of cycle tests.

2. The portion for the cycle tests / model examinations will be announced a week prior to commencement of such exam / tests.

TEXT BOOKS

- 1. Menon, D., "Structural Analysis", Alpha Science International, Limited, 2008.
- 2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "*Theory of Structures*", Laxmi Publications, New Delhi, 12th Edition, 2004.

REFERENCE BOOKS

- 3. Bhavikatti .S.S., "*Structural Analysis Vol-1*", E-3, Vikas Publishing House Pvt Limited, 2009.
- 4. Vaidyanathan .R, "*Comprehensive Structural Analysis*", *Volume 1*, Laxmi Publications, New Delhi, 2005.
- 5. Pandit .G.S, "*Theory Of Structures*", Vol-I, McGraw-Hill Education (India) Pvt Limited, 1999.
- 6. Wang .C.K, "*Statically Indeterminate Structures*", McGraw Hill International Book Company, 1984.
- 7. Harry H.West., "Analysis of Structures", John Wiley & Sons. 1980.
- Charles Head Norris, John Benson Wilbur, Senol Utku, "Elementry Structural Analysis", 3rd Edn. McGraw Hill International Editions, Structures Series, 1987.
- 9. Timoshenko .S.P & Young .D.H, "*Theory of Structures*", 2 Edn. McGraw Hill Book Company, International Ed. 1965.

Prepared by

Prof. G. Augustine Maniraj Pandian 29-06-2015

Faculty members handling the course

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2.	Dr. P.R. Kannan Rajkumar
3.	Ms. S. Sindhu Nachiar
4.	Mr. S.A. Vengadesh Subramanian
5.	Ms. B. Geetha
6.	Mr.A. Joshua Daniel
7.	Ms.S. Karthiga
8.	Mr.S. Abdul Rahuman