KINGS COLLEGE OF ENGINEERING
Recognised under 2(f) & 12(B) of UGC
Approved by AICTE, New Delhi.
Affiliated to Anna University, Chennai.
ACCREDITED WITH GRADE B++ NAAC

DEPARTMENT OF CIVIL ENGINEERING

1.1.1 CURRICULUM PLANNING AND IMPLEMENATION

K. Abhirami
14/8/24

IQAC COORDINATOR

Dr. K. Abhirami
IQAC Coordinator
Kings College of Engineering
(Autonomous)
Punalkulam - 613 303

J. [signature]
14/8/24

PRINCIPAL

Principal
Kings College of Engineering
(Autonomous)
Punalkulam - 613 303

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – III Year UG (Regulations 2021)

JULY 2023 & AUGUST 2023

DATE	DAY	Events	Cum. W/D
27.07.23	Thursday	**Commencement of Classes for III Year UG**	**1**
28.07.23	Friday		**2**
29.07.23	Saturday	**Muharram - Holiday**	**-**
31.07.23	Monday		**3**
01.08.23	Tuesday		**4**
02.08.23	Wednesday	**Staff Council Meeting**	**5**
03.08.23	Thursday	Class Committee Meeting I for III Year UG	**6**
04.08.23	Friday		**7**
05.08.23	Saturday	**Working day**	**8**
07.08.23	Monday	Submission of CCM-I Minutes & Action taken report to Principal by HODs	**9**
08.08.23	Tuesday		**10**
09.08.23	Wednesday		**11**
10.08.23	Thursday	Submission of DRM Minutes by HODs to IQAC Coordinator	**12**
11.08.23	Friday		**13**
12.08.23	Saturday	**Working day**	**14**
14.08.23	Monday	Submission of Status of distribution of learning materials to students	**15**
15.08.23	Tuesday	**Independence Day - Flag Hoisting Ceremony**	**-**
16.08.23	Wednesday	Submission of DRC Meeting Minutes by DRC Convener to Principal	**16**
17.08.23	Thursday	IQAC Meeting	**17**
18.08.23	Friday		**18**
19.08.23	Saturday	**Holiday**	**-**
21.08.23	Monday	Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal	**19**
22.08.23	Tuesday		**20**
23.08.23	Wednesday		**21**
24.08.23	Thursday		**22**
25.08.23	Friday	**Last Date for Payment of Fees**	**23**
26.08.23	Saturday	**Working day**	**24**
28.08.23	Monday	**Staff Appraisal Feed Back Collection – III Year UG**	**25**
29.08.23	Tuesday		**26**
30.08.23	Wednesday		**27**
31.08.23	Thursday		**28**

NO. OF WORKING DAYS : 03+25

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – III Year UG (Regulations 2021)

SEPTEMBER 2023

DATE	DAY	Events	Cum. W/D
01.09.23	Friday		**29**
02.09.23	Saturday	**Holiday**	**-**
04.09.23	Monday	Class Committee Meeting II for III Year UG	**30**
05.09.23	Tuesday	**- Teachers' Day** - Submission of Assignment I Status & Syllabus Completion Report to Principal by HODs - III Year UG	**31**
06.09.23	Wednesday	**Krishna Jayanthi - Holiday**	**-**
07.09.23	Thursday	**- Staff Council Meeting** **- Revision classes Commences (Phase I) for III Year UG** - Submission of CAT I Question Papers to CCE Office – III Year UG	**32**
08.09.23	Friday	Submission of CCM-II Minutes & Action taken report to Principal by HODs	**33**
09.09.23	Saturday	**- Working day** **- Revision classes Ends (Phase I) for III Year UG**	**34**
11.09.23	Monday	- Submission of DRM Minutes by HODs to IQAC Coordinator **- Continuous Assessment Test I Commences for III Year UG**	**35**
12.09.23	Tuesday		**36**
13.09.23	Wednesday		**37**
14.09.23	Thursday		**38**
15.09.23	Friday	**- Engineer's Day** - Submission of DRC Meeting Minutes by DRC Convener to Principal	**39**
16.09.23	Saturday	**- Working day** **- Continuous Assessment Test I Ends for III Year UG**	**40**
18.09.23	Monday		**41**
19.09.23	Tuesday		**42**
20.09.23	Wednesday	- Submission of Continuous Assessment Test I Result Analysis by HODs - Submission of CAT I Answer Scripts to CCE office - III Year UG **- Counseling I for III Year UG**	**43**
21.09.23	Thursday	- IQAC Meeting - Review Meeting With Principal	**44**
22.09.23	Friday	Report Submission of Counseling I by Coordinator – III Year UG	**45**
24.09.23	Saturday	**Holiday**	**-**
25.09.23	Monday	Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal	**46**
26.09.23	Tuesday		**47**
27.09.23	Wednesday	**National Level Technical Symposium – CSE, ECE & EEE Department**	**48**
28.09.23	Thursday	**Milad-un-Nabi - Holiday**	**-**
29.09.23	Friday	**National Level Technical Symposium – CIVIL & Mechanical Department**	**49**
30.09.23	Saturday	**- Working day** **- Parents Teachers Meeting**	**50**

NO. OF WORKING DAYS : 22

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – III Year UG (Regulations 2021)

OCTOBER 2023

DATE	DAY	Events	Cum. W/D
02.10.23	Monday	**Gandhi Jayanthi - Holiday**	**-**
03.10.23	Tuesday		**51**
04.10.23	Wednesday	**Staff Council Meeting**	**52**
05.10.23	Thursday	Class Committee Meeting III for III Year UG	**53**
06.10.23	Friday		**54**
07.10.23	Saturday	**Working day**	**55**
09.10.23	Monday	Submission of CCM-III Minutes & Action taken report to Principal by HODs	**56**
10.10.23	Tuesday	Submission of DRM Minutes by HODs to IQAC Coordinator	**57**
11.10.23	Wednesday		**58**
12.10.23	Thursday		**59**
13.10.23	Friday		**60**
14.10.23	Saturday	**Holiday**	**-**
16.10.23	Monday	Submission of DRC Meeting Minutes by DRC Convener to Principal	**61**
17.10.23	Tuesday		**62**
18.10.23	Wednesday		**63**
19.10.23	Thursday	IQAC Meeting	**64**
20.10.23	Friday		**65**
21.10.23	Saturday	**- Working day** - Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal	**66**
23.10.23	Monday	**Ayutha Pooja - Holiday**	**-**
24.10.23	Tuesday	**Vijaya Dasami - Holiday**	**-**
25.10.23	Wednesday	Submission of Assignment II Status & Syllabus Completion Report to Principal by HODs - III Year UG	**67**
26.10.23	Thursday	- Submission of CAT II Question Papers to CCE Office - III Year UG **- Revision classes Commences (Phase II) for III Year UG**	**68**
27.10.23	Friday		**69**
28.10.23	Saturday	**- Working day** **- Revision classes Ends (Phase II) for III Year UG** **- Counseling II for III Year UG**	**70**
30.10.23	Monday	**Continuous Assessment Test II Commences for III Year UG**	**71**
31.10.23	Tuesday	Report Submission of Counseling II by Coordinator – III Year UG	**72**

NO. OF WORKING DAYS : 22

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – III Year UG (Regulations 2021)

NOVEMBER 2023

DATE	DAY	Events	Cum. W/D
01.11.23	Wednesday	**Staff Council Meeting**	**73**
02.11.23	Thursday		**74**
03.11.23	Friday		**75**
04.11.23	Saturday	**- Working day** **- Continuous Assessment Test II Ends for III Year UG**	**76**
06.11.23	Monday	**Model Practical Examinations**	**77**
07.11.23	Tuesday	**- Model Practical Examinations** - Submission of Model Exam Question Papers to CCE Office - III Year UG	**78**
08.11.23	Wednesday	**- Model Practical Examinations** - Submission of Continuous Assessment Test II Result Analysis by HODs - Submission of CAT II Answer Scripts to CCE office - III Year UG	**79**
09.11.23	Thursday	**- Model Exam: Theory 1 for III Year UG** - Review Meeting With Principal	**80**
10.11.23	Friday	- Submission of DRM Minutes by HODs to IQAC Coordinator **- Model Exam: Theory 2 for III Year UG**	**81**
11.11.23	Saturday	**Holiday**	**-**
13.11.23	Monday	**Model Exam: Theory 3 for III Year UG**	**82**
14.11.23	Tuesday	**Model Exam: Theory 4 for III Year UG**	**83**
15.11.23	Wednesday	- Submission of DRC Meeting Minutes by DRC Convener to Principal **- Model Exam: Theory 5 for III Year UG**	**84**
16.11.23	Thursday	**Model Exam: Theory 6 for III Year UG** , IQAC Meeting	**85**
17.11.23	Friday	**Last Working day**	**86**
18.11.23	Saturday	**- Working day** - Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal **- Submission of Subject Allocation Report for next semester**	
20.11.23	Monday	**Commencement of Practical Examinations**	
21.11.23	Tuesday	- Submission of Model Exam Result Analysis by HODs - III Year UG - Submission of Model Exam Answer Scripts to CCE office	
22.11.23	Wednesday	Review Meeting With Principal	
23.11.23	Thursday	**Internal File Audit Commences**	
24.11.23	Friday		
25.11.23	Saturday	**Holiday**	
27.11.23	Monday		
28.11.23	Tuesday		
29.11.23	Wednesday	**Commencement of End Semester Examinations**	
30.11.23	Thursday	**- Internal File Audit Ends** - Submission of Department activities completion report & **PAC completion report** - Last Date for submission of LM, QB for next semester	

NO. OF WORKING DAYS : 14 + 10

J. [signature] 25/7/2023.

PRINCIPAL

Copy to:

Secretary, VP, HODs, AO, DW-Hostels, Transport, Canteen, HS-GH

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – IV Year UG (Regulations 2017)

JULY 2023 & AUGUST 2023

DATE	DAY	Events	Cum. W/D
27.07.23	Thursday	**Commencement of Classes for IV Year UG**	**1**
28.07.23	Friday		**2**
29.07.23	Saturday	**Muharram - Holiday**	**-**
31.07.23	Monday		**3**
01.08.23	Tuesday		**4**
02.08.23	Wednesday	**Staff Council Meeting**	**5**
03.08.23	Thursday	Class Committee Meeting I for IV Year UG	**6**
04.08.23	Friday		**7**
05.08.23	Saturday	**Working day**	**8**
07.08.23	Monday	Submission of CCM-I Minutes & Action taken report to Principal by HODs	**9**
08.08.23	Tuesday		**10**
09.08.23	Wednesday		**11**
10.08.23	Thursday	Submission of DRM Minutes by HODs to IQAC Coordinator	**12**
11.08.23	Friday		**13**
12.08.23	Saturday	**Working day**	**14**
14.08.23	Monday	Submission of Status of distribution of learning materials to students	**15**
15.08.23	Tuesday	**Independence Day - Flag Hoisting Ceremony**	**-**
16.08.23	Wednesday	Submission of DRC Meeting Minutes by DRC Convener to Principal	**16**
17.08.23	Thursday	IQAC Meeting	**17**
18.08.23	Friday	**- Staff Appraisal Feed Back Collection – IV Year UG** - Submission of CAT I Question Papers to CCE Office – IV Year UG	**18**
19.08.23	Saturday	**Holiday**	**-**
21.08.23	Monday	Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal	**19**
22.08.23	Tuesday	Submission of Assignment I Status & Syllabus Completion Report to Principal by HODs - IV Year UG	**20**
23.08.23	Wednesday	**Continuous Assessment Test I Commences for IV Year UG**	**21**
24.08.23	Thursday		**22**
25.08.23	Friday	**Last Date for Payment of Fees**	**23**
26.08.23	Saturday	**Working day**	**24**
28.08.23	Monday		**25**
29.08.23	Tuesday	**Continuous Assessment Test I Ends for IV Year UG**	**26**
30.08.23	Wednesday		**27**
31.08.23	Thursday		**28**

NO. OF WORKING DAYS : 03+25

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – IV Year UG (Regulations 2017)

SEPTEMBER 2023

DATE	DAY	Events	Cum. W/D
01.09.23	Friday	- Submission of Continuous Assessment Test I Result Analysis by HODs - Submission of CAT I Answer Scripts to CCE office - IV Year UG	**29**
02.09.23	Saturday	**Holiday**	**-**
04.09.23	Monday	Review Meeting With Principal	**30**
05.09.23	Tuesday	**Teachers' Day**	**31**
06.09.23	Wednesday	**Krishna Jayanthi - Holiday**	**-**
07.09.23	Thursday	**Staff Council Meeting**	**32**
08.09.23	Friday	Class Committee Meeting II for IV Year UG	**33**
09.09.23	Saturday	**Working day - Counseling I for IV Year UG**	**34**
11.09.23	Monday	Submission of DRM Minutes by HODs to IQAC Coordinator	**35**
12.09.23	Tuesday	Submission of CCM-II Minutes & Action taken report to Principal by HODs	**36**
13.09.23	Wednesday	Report Submission of Counseling I by Coordinator – IV Year UG	**37**
14.09.23	Thursday	Submission of CAT II Question Papers to CCE Office – IV Year UG	**38**
15.09.23	Friday	**- Engineer's Day** - Submission of DRC Meeting Minutes by DRC Convener to Principal	**39**
16.09.23	Saturday	**- Working day** - Submission of Assignment II(PCE Activities) Status & Syllabus Completion Report to Principal by HODs - IV Year UG	**40**
18.09.23	Monday	**Continuous Assessment Test II Commences for IV Year UG**	**41**
19.09.23	Tuesday		**42**
20.09.23	Wednesday		**43**
21.09.23	Thursday	IQAC Meeting	**44**
22.09.23	Friday		**45**
24.09.23	Saturday	**Holiday**	**-**
25.09.23	Monday	- Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal **- Continuous Assessment Test II Ends for IV Year UG**	**46**
26.09.23	Tuesday		**47**
27.09.23	Wednesday	**National Level Technical Symposium – CSE, ECE & EEE Department**	**48**
28.09.23	Thursday	**Milad-un-Nabi - Holiday**	**-**
29.09.23	Friday	**National Level Technical Symposium – CIVIL & Mechanical Department** - Submission of Continuous Assessment Test II Result Analysis by HODs - Submission of CAT II Answer Scripts to CCE office - IV Year UG	**49**
30.09.23	Saturday	**- Working day** **- Parents Teachers Meeting**	**50**

NO. OF WORKING DAYS : 22

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – IV Year UG (Regulations 2017)

OCTOBER 2023

DATE	DAY	Events	Cum. W/D
02.10.23	Monday	**Gandhi Jayanthi - Holiday**	**-**
03.10.23	Tuesday	Review Meeting With Principal	**51**
04.10.23	Wednesday	**Staff Council Meeting**	**52**
05.10.23	Thursday		**53**
06.10.23	Friday		**54**
07.10.23	Saturday	**Working day**	**55**
09.10.23	Monday		**56**
10.10.23	Tuesday	Submission of DRM Minutes by HODs to IQAC Coordinator	**57**
11.10.23	Wednesday	Class Committee Meeting III for IV Year UG	**58**
12.10.23	Thursday		**59**
13.10.23	Friday	Submission of CCM-III Minutes & Action taken report to Principal by HODs	**60**
14.10.23	Saturday	**Holiday**	**-**
16.10.23	Monday	Submission of DRC Meeting Minutes by DRC Convener to Principal	**61**
17.10.23	Tuesday		**62**
18.10.23	Wednesday	**Zeroth Project Review for IV Year UG**	**63**
19.10.23	Thursday	IQAC Meeting	**64**
20.10.23	Friday	Submission of Zeroth Project Review Report by HODs	**65**
21.10.23	Saturday	**- Working day , Counseling II for IV Year UG** - Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal - Submission of Syllabus Completion Report to Principal by HODs – IV Year UG	**66**
23.10.23	Monday	**Ayutha Pooja - Holiday**	**-**
24.10.23	Tuesday	**Vijaya Dasami - Holiday**	**-**
25.10.23	Wednesday	**Revision classes Commences (Phase I) for IV Year UG**	**67**
26.10.23	Thursday	Report Submission of Counseling II by Coordinator – IV Year UG	**68**
27.10.23	Friday	Submission of Model Exam Question Papers to CCE Office - IV Year UG	**69**
28.10.23	Saturday	**- Working day** **- Revision classes Ends (Phase I) for IV Year UG**	**70**
30.10.23	Monday	**Model Exam: Theory 1 for IV Year UG**	**71**
31.10.23	Tuesday	**Model Exam: Theory 2 for IV Year UG**	**72**

NO. OF WORKING DAYS : 22

KINGS COLLEGE OF ENGINEERING

Academic Calendar Academic Year 2023-2024 (Odd Semester) – IV Year UG (Regulations 2017)

NOVEMBER 2023

DATE	DAY	Events	Cum. W/D
01.11.23	Wednesday	**- Staff Council Meeting** **- Model Exam: Theory 3 for IV Year UG**	**73**
02.11.23	Thursday	**Model Exam: Theory 4 for IV Year UG**	**74**
03.11.23	Friday	**Model Exam: Theory 5 for IV Year UG**	**75**
04.11.23	Saturday	**Working day, Model Exam: Theory 6 for IV Year UG**	**76**
06.11.23	Monday	**Model Practical Examinations**	**77**
07.11.23	Tuesday	**Model Practical Examinations**	**78**
08.11.23	Wednesday	**- Model Practical Examinations** - Submission of Model Exam Result Analysis by HODs - IV Year UG - Submission of Model Exam Answer Scripts to CCE office	**79**
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13.11.23	Monday		**82**
14.11.23	Tuesday		**83**
15.11.23	Wednesday	Submission of DRC Meeting Minutes by DRC Convener to Principal	**84**
16.11.23	Thursday	IQAC Meeting	**85**
17.11.23	Friday	**- Last Working day** **- Revision classes Ends (Phase II) for IV Year UG**	**86**
18.11.23	Saturday	**- Working day** - Submission of IQAC Meeting Minutes by IQAC Coordinator to Principal **- Submission of Subject Allocation Report for next semester**	
20.11.23	Monday	**Commencement of Practical Examinations**	
21.11.23	Tuesday		
22.11.23	Wednesday		
23.11.23	Thursday	**Internal File Audit Commences**	
24.11.23	Friday		
25.11.23	Saturday	**Holiday**	
27.11.23	Monday		
28.11.23	Tuesday		
29.11.23	Wednesday	**Commencement of End Semester Examinations**	
30.11.23	Thursday	**- Internal File Audit Ends** - Submission of Department activities completion report & **PAC completion report** **-** Last Date for submission of LM, QB for next semester	

NO. OF WORKING DAYS : 14 + 10

J. [signature] 25/7/2023

PRINCIPAL

Copy to:

Secretary, VP, HODs, AO, DW-Hostels, Transport, Canteen, HS-GH.

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B++ NAAC

ACADEMIC YEAR 2023 – 24 ODD SEMESTER

GUIDELINES FOR TIMETABLE PREPARATION

- College Timing - 9.15 am – 4.20 pm / (8 Periods / Week) / (45 min / Period)
- Lecture Hours
  - Maximum 5 to 6 periods allocated for tough Subjects (Credit 4 or Tutorial) and 4 to 5 periods allocated for remaining subjects (Credit 3).
  - Toughest subject is selected by concern HOD based on the results obtained in the previous year.
  - Tutorial / Elective / Theory Cum Practical Subjects must be mentioned in timetable itself.
- Lab Hours
  - Allocate 4 hrs for Credit 2 subjects
  - Allocate 3 hrs for Credit 1.5 subjects (Regulation 2021)
  - Allocate 2 hrs for Credit 1 subjects
- As per the instructions given by Tamilnadu Government and Anna University, Thursday will be utilized for Naan Mudalvan Course.
- Allocate 2 hours/ week for physical grooming (Yoga and Sports activities)
- Excess Hours can be utilized by their concern HoD instructions,
  - Allocate 1 period for NPTEL/Swayam for all year
  - II Year – any Certification courses (online / offline) – 1 or 2 periods / Week
  - III Year
    - GATE Coaching & Competitive Exam coaching – 1 or 2 periods / Week
    - Any Certification courses (online / offline) – 1 or 2 periods / Week
  - IV Year
    - Industry Ready Training – 2 or 3 Periods/week
    - Saturday will be utilized for Project work
  - Give more attention towards value addition initiative practices
- Training & Placement Hour
  - Allocate 2 periods / week to all department students.
  - for all year
    - Soft Skill – 1 period / Week
    - Aptitude – 1 period / Week
- Tentative Last Working Day (Specified by Anna University) will be included in Timetable format.

19/7/23
OVERALL TIMETABLE COORDINATOR

19/7/2023.
PRINCIPAL

KINGS COLLEGE OF ENGINEERING
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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023 – 2024 (ODD SEMESTER)

SUBJECT ALLOCATION - CIRCULAR

DATE: 23.06.2023

The Subject Allocation meeting for the Academic Year 2023 – 2024 (Odd Semester) is scheduled to be conducted on **26.06.2023** by **10.00 AM** at **Dept.Library**. All the faculty members are asked to attend the meeting without fail. The subjects list is attached with this circular for reference.

R. Saravanan 23/06/2023
HOD/CIVIL

KINGS COLLEGE OF ENGINEERING
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Department of Civil Engineering

ACADEMIC YEAR 2023- 2024 (ODD SEMESTER)

SUBJECT ALLOCATION WILLINGNESS FORM

23.06.2023

S No	STAFF NAME	SUB	YEAR/SEM	SUB.CODE	SUB.NAME	Staff Sign
1	Dr.R.Saravanan	T 1	IV / VII	OEN751	Green Building Design	R.Saravanan 23/06/23
		T 2	III / V	CE 3025	Airport and Harbour.	
		T 3				
		L 1	IV / VII	CE 8711	Creative and Innovative project.	
		L 2				
2	Mr. R.Sundharam	T 1	IV / VII	CE 8703	Structural Design and Drawing.	R. [signature] 23/6/23
		T 2	II / III	CE 3302	Construction Materials and Technology.	
		T 3	III / V		Airport and Harbour Engg.	
		L 1	III / V	CE 3512	Survey Camp	
		L 2	III / V	CE 3511	Highway Engg Lab	
3	Mr.K.Arun	T 1	III / V	CE 3502	Structural Analysis I	K.Arun 23/6/23
		T 2	IV / VII	CE 8701	ECVE	
		T 3	II / III	ME 3351	EM	
		L 1	IV / VII	CE 8711	Creative & Innovative Project	
		L 2	III / V	CE 3512	Survey Camp	
4	Mr.R.Ramchandar	T 1	II / III	CE 3303	Water and Waste Water Engineering	R.Ramchandar 23/6/23
		T 2	III / V		Airport and Harbours	
		T 3	IV / VII	CE 8702	Railways, Airports Docks and Harbour Engineering	
		L 1	IV / VII	CE 8712	Industrial Training	
		L 2	III / V	CE 3512	Survey Camp	
5	Mr.D.Nandakumar	T 1	II / III	ME3351	Engineering Mechanics.	D.Nandakumar 23/6/23
		T 2	IV / VII	CE 8702	Railways, Airports, Docks and Harbour Engineering	
		T 3	III / V		Rehabilitation / Heritage Restoration	
		L 1	III / V	CE 3511	Highway Engineering Laboratory.	
		L 2	II / III	CE 3311	Water and waste water Analysis Laboratory	

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Department of Civil Engineering
ACADEMIC YEAR 2023- 2024 (ODD SEMESTER)
SUBJECT ALLOCATION WILLINGNESS FORM

23.06.2023

S No	STAFF NAME	SUB	YEAR/SEM	SUB.CODE	SUB.NAME	Staff Sign
6	Ms.A.Suganya	T 1	II / III	CE3302	Construction Materials and Technology.	A.Suganya
		T 2	III / V	CE3503	Foundation Engineering.	
		T 3	III / V	CE3502	Structural Analysis-I	
		L 1	III / V	CE3511	Highway lab.	
		L 2	II / IV	CE3512.	Survey camp	
7	Mr.A.Sagaya Albert	T 1	II / III	CE3301	Fluid Mechanics	Sagaya Albert 26/06/23
		T 2	III / V	CE3501	Design of Reinforced concrete structural elements	
		T 3	II / III	CE3302	Construction Materials and Technology.	
		L 1	II / III	CE3361	Surveying and levelling Laboratory	
		L 2	III / V	CE3512	Survey camp.	
8	Ms.P.Kavimuhil	T 1	IV / VII	CE8701	Estimation, costing and Valuation	[signature] 26/6/'23
		T 2	II / III	CE3303	Water supply and wastewater Engineering	
		T 3	II / III	CE3311	water supply and wastewater lab	
		L 1	III / V	CE3511	Highway lab	
		L 2	III / V	CE3025	Airport and Harbour.	

[signature] 26/06/2023
SUBJECT ALLOCATION INCHARGE

[signature] 26/06/2023
HOD/CIVIL

KINGS COLLEGE OF ENGINEERING
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B++ NAAC

DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023 – 2024 (ODD SEMESTER)
COMPETENCY MATRIX FOR SUBJECT ALLOCATION

26.06.2023

S.No	Staff Name	III SEM							V SEM							VII SEM				
		ME3351 - EM	CE3301 - FM	CE3302 - CMT	CE3303 - WWE	CE3351 - SUR	*CE3311 - WWE LAB*	*CE3361 - SUR LAB*	CE3501 - DRCCE	CE3502 - SA I	CE3503 - FE	CE3005 - RHR	CE3025 - AAH	CE3050 - FFE	*CE3512 - HE LAB*	CE8701 - ECVE	CE8702 - RADHE	CE8703 - SDD	OEN751 - GBD	*CE8711 - CIP*
1	Dr.R.Saravanan												*						***	***
2	Mr. R.Sundharam			**									*		**			***		
3	Mr.K.Arun	**								***						**				***
4	Mr.S.Kamaraj																			
5	Mr.R.Ramchandar					*							*				**			
6	Mr.D.Nandakumar	**					*								*		**			
7	Ms.A.Suganya			**						*	*				**					
8	Ms.P.Kavimugil		**		*		*		**							**				
9	Mr.A.Sagaya Albert		**		*			*	**							**				

* **Willing**   ** **Capable of Handling**   *** **Expertise**

26/06/2023
PREPARED BY
(Mr.ARUN.K, AP/ CIVIL)

26/06/2023
APPROVED BY
(Dr.R.SARAVANAN, HOD/ CIVIL)

KINGS COLLEGE OF ENGINEERING
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Department of Civil Engineering
ACADEMIC YEAR 2023 – 2024 (ODD SEMESTER) - SUBJECT ALLOCATION

Sl. No.	STAFF NAME	NAME OF THE SUBJECTS	YEAR/SEM	OTHER RESPONSIBILITIES
1	Dr.R.Saravanan	**T1:** OEN751 - Green Building design	IV / VII	* **HOD/Civil**
		L1: CE8711- Creative and Innovative Project	IV / VII	
2	Mr. R.Sundharam	**T1:** CE8703 - Structural Design and Drawing	IV / VII	* **IV Yr CC** *Dy.Coordinator of Examinations *Alumni Coordinator *Dept.Library Incharge *Discipline Incharge *FAA member *IIC member *Class Committe Chairperson *ToT-Naan Mudhalvan
		T2: CE3005 - Rehabilitation/Heritage Restoration	III / V	
3	Mr.K.Arun	**T1:** CE3502 - Structural Analysis I	III / V	* **III Yr CC** *PAC Member *IQAC Member *LO Coordinator *Subject Allocation Incharge *Dept. EDUMATE Coordinator *Class Committe Chairperson *Dept.Submissions * ToT-Naan Mudhalvan
		L1: CE8711- Creative and Innovative Project	IV / VII	
4	Mr.R.Ramchandar	**T1:** CE3025 - Airports and Harbours	III / V	*Timetable Coordinator *IHT Coordinator *MOU Coordinator *Dept. Budget Incharge *Dept. Estate office member *Class Committe Chairperson
		T2: CE3351 - Surveying and Levelling	II / III	
		L1: CE3361 - Surveying and levelling Laboratory	II / III	
5	Mr.D.Nandakumar	**T1:** ME3351 - Engineering Mechanics	II / III	* **II Yr CC** *DRC Member *Placement Coordinator *ISTE Coordinator * ToT-Naan Mudhalvan
		T2: CE8702 - Railways, Airports, Docks and Harbour Engineering	IV / VII	
6	Ms.A.Suganya	**T1:** CE3503 - Foundation Engineering	III / V	*Class committee Coordinator *Counselling Coordinator *BE Club Incharge
		T2: CE3302 - Construction Materials and Technology	II / III	
		L1: CE3511 - Highway Engineering Laboratory	III / V	
7	Mr.A.Sagaya Albert	**T1:** CE3501 - Design of Reinforced Concrete Structural Elements	III / V	* GATE coordinator *PTA Coordinator *Kings Times Coordinator
		T2: CE3301 - Fluid Mechanics	II / III	
		L1: CE3361 - Surveying and levelling Laboratory	II / III	
8	Ms.P.Kavimuhil	**T1:** CE8701 - Estimation, Costing and Valuation Engineering	IV / VII	*SCC Coordinator *Co-Curricular actvivities Coordinator
		T2: CE3303 - Water and Waste Water Engineering	II / III	
		L1: CE3311 - Water and Waste Water Analysis Laboratory	II / III	

Total No. of Theory Subjects : 15
Total No. of Laboratories : 04

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Department of Civil Engineering
ACADEMIC YEAR 2023 – 2024 (ODD SEMESTER)

Sl. No.	SEM	SUB. CODE	NAME OF THE SUBJECT	STAFF NAME
T1	VII	CE8701	Estimation, Costing and Valuation Engineering	Ms.P.Kavimuhil
T2	VII	CE8702	Railways, Airports, Docks and Harbour Engineering	Mr.D.Nandakumar
T3	VII	CE8703	Structural Design and Drawing	Mr. R.Sundharam
T4	VII	OEN751	Green Building design	Dr.R.Saravanan
T5	V	CE3501	Design of Reinforced Concrete Structural Elements	Mr.A.Sagaya Albert
T6	V	CE3502	Structural Analysis I	Mr.K.Arun
T7	V	CE3503	Foundation Engineering	Ms.A.Suganya
T8	V	CE3005	Rehabilitation/Heritage Restoration	Mr. R.Sundharam
T9	V	CE3025	Airports and Harbours	Mr.R.Ramchandar
T10	V	CE3050	Finance for Engineers	Dr.K.Sudhakar
L2	V	CE3511	Highway Engineering Laboratory	Ms.A.Suganya
T11	III	ME3351	Engineering Mechanics	Mr.D.Nandakumar
T12	III	CE3301	Fluid Mechanics	Mr.A.Sagaya Albert
T13	III	CE3302	Construction Materials and Technology	Ms.A.Suganya
T14	III	CE3303	Water and Waste Water Engineering	Ms.P.Kavimuhil
T15	III	CE3351	Surveying and Levelling	Mr.R.Ramchandar
L3	III	CE3361	Surveying and levelling Laboratory	Mr.R.Ramchandar/ Mr.A.Sagaya Albert
L4	III	CE3311	Water and Waste Water Analysis Laboratory	Ms.P.Kavimuhil

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR : 2023-24 / ODD SEM

CE3502- STRUCTURAL ANALYSIS I

YEAR/SEM : III / V

COURSE FILE

STAFF INCHARGE

K.ARUN / AP CIVIL

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR (2023 – 2024) ODD SEMESTER
COURSE FILE - CONTENT PAGE

YEAR/SEC/SEM: III / V

BATCH: 2021- 2025

SUBJECT CODE: CE3502

SUBJECT NAME: STRUCTURAL ANALYSIS I

REGULATION: 2021

STAFF IN-CHARGE: K. ARUN, AP/CIVIL

- **Syllabus**
- **Course Plan**
- **Question Bank**
- **Student Name list**
- **Individual Timetable**
- **Unitwise Notes**
- **Internal Assessment Question Paper, Answer key**
- **Sample Assessment Papers**
- **Internal Assessment Mark Statement**
- **Support to Slow learner**
  - > Slow Learners list
  - > Remedial class plan & Attendance
  - > Supporting Documents
- **Support to Advanced learner**
  - > Advanced Learners list
  - > Promotional Activity details
  - > Supporting Documents
- **Format A (For Assignments)**
- **Sample Assignments**
- **Format B (For Content Beyond Syllabus)**
- **University Question Papers**
- **Review Sheet**
- **Test Report (Covering Corrective, Preventive action)**

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ACCREDITED WITH GRADE B++ NAAC

DEPARTMENT OF CIVIL ENGINEERING

SUBJECT: STRUCTURAL ANALYSIS I

YEAR/SEM: III/V

QUESTION BANK (CE3502)
(Version : 1)

PREPARED BY

Mr.K.ARUN, AP / CIVIL

CE3502 **STRUCTURAL ANALYSIS I** **L T P C**
3 0 0 3

UNIT I ANALYSIS OF TRUSSES **9**

Determinate and indeterminate trusses - analysis of determinate trusses - method of joints - method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature method of tension coefficient - Application to space trusses.

UNIT II SLOPE DEFLECTION METHOD **9**

Slope deflection equations - Equilibrium conditions - Analysis of continuous beams and rigid frames - Rigid frames with inclined members - Support settlements - Symmetric frames with symmetric and skew - symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD **9**

Stiffness - Distribution and carryover factors- Analysis of continuous Beams - Plane rigid frames with and without sway- Support settlement - symmetric frames with symmetric and Skew - symmetric loadings.

UNIT IV FLEXIBLITY METHOD **9**

Primary structures - Compatibility conditions - Formation flexibility matrices - Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT V STIFFNESS METHOD **9**

Restrained structure -Formation of stiffness matrices - equilibrium condition- Analysis of Continuous Beams - Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

K. Arun 05/07/2023
STAFF INCHARGE
Mr.K.ARUN

R. Saravanan 05/07/2023
HOD/CIVIL
Dr.R.SARAVANAN

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DEPARTMENT OF CIVIL ENGINEERING
COURSE PLAN

Sub. Code	: CE3502	**Branch / Year / Sem**	: B.E CIVIL /III/V
Sub.Name	: Structural Analysis I	**Batch**	: 2021-2025
Staff Name	: Mr.K.Arun	**Academic Year**	: 2023-24 (ODD)

COURSE OBJECTIVE

- To introduce the students to the basic theory and concepts of classical methods of structural analysis.

TEXT BOOKS:

T1. Bhavikatti.S.S, Structural Analysis, Vol.1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi-4, 2014.

T2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.

REFERENCES BOOKS:

R1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi,2015.

R2. Bansal. R.K. "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi,2010

R3. Pandit G.S.and Gupta S.P.,Structural Analysis–AMatrix Approach, Tata McGraw Hill Publishing Company Ltd.,2006

WEB RESOURCES

W1. https://archive.nptel.ac.in/courses/105/105/105105166/ **(Topic No.02)**

W2. https://www.brainkart.com/article/Solved-Problems--Slope-Deflection-Method--Structural-Analysis_4578/ **(Topic No.08)**

W3.https://learnaboutstructures.com/Slope-Deflection-Method-for-Sway-Frames **(TopicNo.09)**

W4. https://www.degreetutors.com/moment-distribution-method/ **(Topic.No:14)**

W5.https://eng.libretexts.org/Bookshelves/Civil_Engineering/Structural_Analysis_(Udoeyo)/01%3A_Chapters/1.12%3A_Moment_Distribution_Method_of_Analysis_of_Structures **(Topic.No:15)**

W6. https://www.brainkart.com/article/Solved-Problems--Structural-Analysis--Flexibility-Method_4581/ **(Topic.No:22)**

W7. http://www.facweb.iitkgp.ac.in/~baidurya/CE21004/online_lecture_notes/m4l30.pdf **(Topic.No:25)**

Topic No	Topic	Books for Reference	Page No.	Teaching Methodology	No. of Hours Required	Cumulative No. of periods
UNIT I		**ANALYSIS OF TRUSSES**				**(9+1)**
1	Determinate and indeterminate trusses	R1	992-993	BB/PPT	1	1
2	Analysis of determinate trusses, Method of joints	R1 R2 W1	998-1033 471-484	NPTEL	2	3
3	Method of sections	R1 R2	1034-1053 492-501	L.VIDEO	2	5
4	Deflections of pin-jointed plane frames	R2	485-489	BB/PPT	2	7
5	Lack of fit , Change in temperature method of tension coefficient	R2	489-492	BB/PPT	2	9
6	Application to space trusses.	R2	501-507	BB/PPT	1	10

LEARNING OUTCOME

At the end of this unit, students will be able to

- Identify the determinate and indeterminate trusses
- Analyse a determinate truss using method of joints
- Analyse a determinate truss using method of sections

Topic No	Topic	Books for Reference	Page No.	Teaching Methodology	No. of Hours Required	Cumulative No. of periods
UNIT II		**SLOPE DEFLECTION METHOD**				**(9+1)**
7	Slope deflection equations, Equilibrium conditions	T2	165-168	BB/PPT	2	12
8	Analysis of continuous beams	T2 W2	168-173	L.VIDEO	2	14
9	Analysis of rigid frames	T2 W3	174-177	BB/PPT	2	16
10	Rigid frames with inclined members	T2	177-192	BB/PPT	2	18
11	Support settlements	T1(Vol.2)	13-16	BB/PPT	1	19
12	Symmetric frames with symmetric and skew-symmetric loadings.	T1(Vol.2)	20-39	BB/PPT	1	20

LEARNING OUTCOME

At the end of this unit, students will be able to

- Gain knowledge about the analysis of continuous beams by using slope deflection methods
- Understand the analysis of rigid frames
- Understand about support settlements

Topic No	Topic	Books for Reference	Page No.	Teaching Methodology	No. of Hours Required	Cumulative No. of periods
UNIT III		**MOMENT DISTRIBUTION METHOD**				**(9+1)**
13	Stiffness, Distribution and carry over factors	T1(Vol.2)	45-49	BB/PPT	1	21
14	Analysis of continuous Beams	T1(Vol.2) W4	49-60	BB/PPT	2	23
15	Analysis of Plane rigid frames with sway	T2 W5	223-248	L.VIDEO	2	25
16	Plane rigid frames without sway	T2	209-223	BB/PPT	2	27
17	Support settlement, symmetric frames with symmetric loadings	T1(Vol.2)	61-64	BB/PPT	2	29
18	Skew symmetric loadings	T1(Vol.2)	83-86	BB/PPT	1	30

LEARNING OUTCOME

At the end of this unit, students will be able to

- Analyse the continuous beams by using moment distribution method.
- Acquire knowledge about plane rigid frames with sway.
- Gain knowledge about plane rigid frames without sway.

Topic No	Topic	Books for Reference	Page No.	Teaching Methodology	No. of Hours Required	Cumulative No. of periods
UNIT IV		**FLEXIBLITY METHOD**				**(9+1)**
19	Primary structures, Compatibility conditions,	T1(Vol.2)	324-326	BB/PPT	2	32
20	Formation flexibility matrices	T1(Vol.2) R3	327-328 138-139	BB/PPT	2	34
21	Analysis of indeterminate pin-jointed plane frames	T1(Vol.2) R3	342-350 318-323	L.VIDEO	2	36
22	Analysis of indeterminate continuous beams	T1(Vol.2) W6	330-342	BB/PPT	2	38
23	Analysis of indeterminate rigid jointed plane frames by direct flexibility approach.	R3	373-378	BB/PPT	2	40

LEARNING OUTCOME

At the end of this unit, students will be able to

- Acquire knowledge about flexibility method
- Classify the determinate and indeterminate frames and beams
- Examine the forces in the continuous beams

Topic No	Topic	Books for Reference	Page No.	Teaching Methodology	No. of Hours Required	Cumulative No. of periods
UNIT V			STIFFNESS METHOD			(9+1)
24	Restrained structure	T1(Vol.2)	350-351	FV	1	41
25	Formation of stiffness matrices, equilibrium condition	R3 W7	142-143	BB/PPT	2	43
26	Analysis of Continuous Beams	T1(Vol.2)	351-361	L.VIDEO	3	46
27	Analysis of Pin-jointed plane frames	R3	345-362	BB/PPT	2	48
28	Analysis of rigid frames by direct stiffness method.	R3	383-390	BB/PPT	2	50

LEARNING OUTCOME

At the end of this unit, students will be able to

- Define the concept of element and global stiffness matrices
- Understand the transformation of stiffness matrices
- Gain knowledge about analysis of beams and frames by stiffness method

COURSE OUTCOME

At the end of the course, the students will be able to

- Analyze the pin-jointed plane and space frames.
- Analyse the continuous beams and rigid frames by slope defection method.
- Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
- Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
- Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

CONTENT BEYOND THE SYLLABUS

- Analysis of beams using strain energy method.

INTERNAL ASSESSMENT DETAILS

ASST. NO.	CAT I	CAT II	MODEL
Topic Nos.	1-15	16-28	1-28
Date			

ASSIGNMENT DETAILS

ASSIGNMENT	I	II
Topic Nos. for reference	1 - 15	16-28
Deadline		

Class Strength : 21		
ASSIGNMENT: I (40 Marks) (Before CAT – I) Topics for Reference (1-15)		
	Question / Activity / Activities	Evaluation
Level-1 (7 Students)		
L1- (Q1-Q4)	Quiz 1. Determinate trusses 2. Rigid frames 3. Continuous beams 4. Frames without sway	Total 20 questions. (20*2= 40 Marks)
L1- (Q4-Q7)	Seminar 5. Lack of fit 6. Sway conditions 7. Analysis of Trusses	PPT: 15 Marks Presentation: 20 Marks Q&A: 05 Marks
Level-2 (7 Students)		
L2- (Q8-Q11)	Application of concepts 1. Slope deflection method 2. Moment distribution method 3. Tension coefficient method 4. Deflection of frames	Reasoning level questions 20 With necessary explanation. (20*2=40 Marks)
L2- (Q12-Q14)	Crossword 5. Slope deflection equations 6. Support settlements 7. Distribution factors	Report: 25 Marks Q&A: 15 Marks
Level-3 (7 Students)		
L3- (Q15-Q18)	Poster Presentation 1. Types of trusses 2. Types of beams 3. Types of loads 4. Types of supports	Poster Design: 20 Marks Explanation: 15 Marks Q&A: 5 Marks
L3- (Q19-Q21)	GATE Questionnaire 5. Method of joints 6. Method of sections 7. Analysis of continuous beams	Total 20 questions. (20*2= 40 Marks)

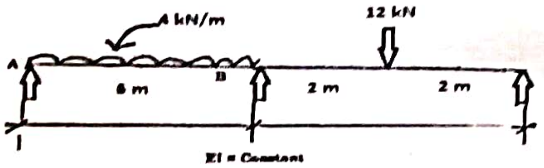
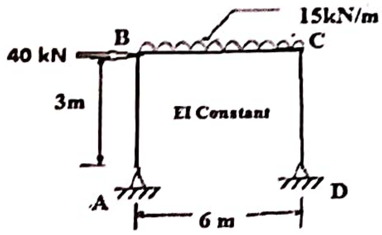
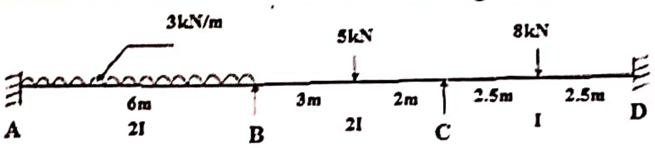
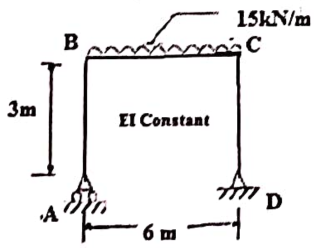
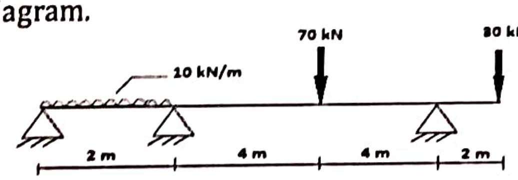
Class Strength : 21		
ASSIGNMENT: II (40 Marks) (Before CAT – II) **Topics for Reference (16-28)**		
	Question / Activity / Activities	**Evaluation**
Level-1 (7 Students)		
L1- **(Q1-Q4)**	**Seminar** 1. Formation of flexibility matrices 2. Formation of stiffness matrices 3. Primary structures 4. Restrained structures	PPT: 15 Marks Presentation: 20 Marks Q&A: 05 Marks
L1- **(Q4-Q7)**	**Quiz** 5. Rigid jointed plane frames 6. Indeterminate frames 7. Matrix method	Total 20 questions. (20*2= 40 Marks)
Level-2 (7 Students)		
L2- **(Q8-Q11)**	**Crossword** 1. Symmetric frames 2. Skew symmetric loadings 3. Lack of fit 4. Pin jointed plane frames	Report: 25 Marks Q&A: 15 Marks
L2- **(Q12-Q14)**	**Application of concepts** 5. Carryover factor 6. Sway conditions 7. Symmetric loadings	Reasoning level questions 20 With necessary explanation. (20*2=40 Marks)
Level-3 (7 Students)		
L3- **(Q15-Q18)**	**GATE Questionnaire** 1. Stiffness method 2. Flexibility method 3. Analysis of trusses 4. Frames with sway and without sway conditions	Total 20 questions. (20*2= 40 Marks)
L3- **(Q19-Q21)**	**Poster Presentation** 5. Compatibility conditions 6. Equilibrium conditions 7. Distribution and carryover factors	Poster Design: 20 Marks Explanation: 15 Marks Q&A: 5 Marks

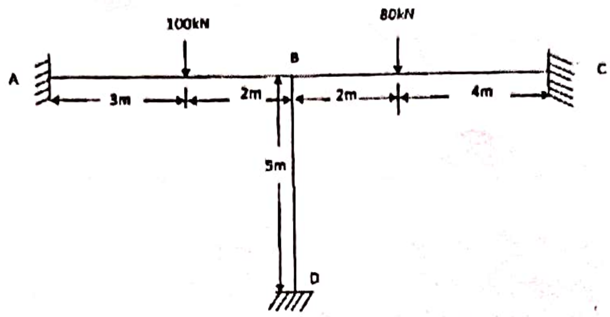
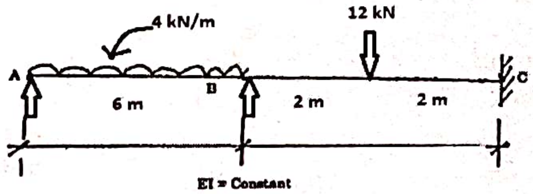
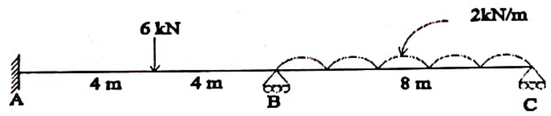
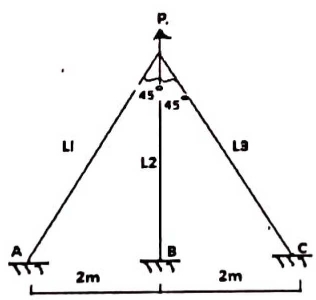
COURSE ASSESSMENT PLAN

CO	CO Description	Weightage	CAT 1	CAT 2	MODEL	ASSIGN -1	ASSIGN -2	AU
CO1	Analyze the pin-jointed plane and space frames.	20%	√		√	√		
CO2	Analyse the continuous beams and rigid frames by slope defection method.	20%	√		√	√		
CO3	Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.	20%	√	√	√	√	√	
CO4	Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.	20%		√	√		√	
CO5	Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.	20%		√	√		√	

COURSE OUTCOME ALIGNMENT MATRIX – MODEL EXAM SAMPLE QUESTION SET

Q.No	Question	Marks	CO	BTL
1	Differentiate perfect and imperfect frame.	2	CO 1	L2
2	State the principle of virtual displacement.	2	CO 1	L1
3	Distinguish between symmetry and anti-symmetry of structures.	2	CO 2	L2
4	Identify the limitations of slope deflection method.	2	CO 2	L2
5	What is meant by distribution factor?	2	CO 3	L1
6	What are the situations where in sway will occur in portal frames?	2	CO 3	L1
7	Define a primary structure.	2	CO 4	L1
8	Define Flexibility Coefficient	2	CO 4	L1
9	Compare the flexibility and stiffness matrix method.	2	CO 4 CO 5	L2
10	List out the properties of rotation matrix.	2	CO5	L2

Q.No	Question	Marks	CO	BTL
11(a)	Analyse the beam loaded as shown in figure by strain energy method and draw the BMD.EI is constant.  	13	CO 1	L4
11(b)	Analyse the structure shown in figure by strain energy method and sketch the bending moment diagram.  	13	CO 1	L4
12(a)	A continuous beam ABCD consists of three span and is loaded as shown in figure. Solve the beam by using slope deflection method and draw BMD. E is constant throughout.  	13	CO 2	L3
12(b)	Solve the portal frame loaded in figure by the slope deflection method and draw the bending moment diagram.  	13	CO 2	L3
13(a)	Determine the support moment for the beam shown in figure by moment distribution method and sketch the bending moment diagram.  	13	CO 3	L3

13(b)	Evaluate the beam by moment distribution method shown in figure and sketch the bending moment diagram.  	13	CO 3	L3
14(a)	Find the bending moment values for the beam shown in figure by flexibility approach .AE is constant for all members.  	13	CO 4	L1
14(b)	**(i)** A two span continuous beam ABC is fixed at A and hinged at supports B and C. Span of AB = span of BC = 13 m. Set up flexibility influence co-efficient matrix assuming vertical reaction at B and C as redundant. **(ii)** A cantilever of length 20 meters is subjected to a single concentrated load of 45 kN at the middle of the span. Find the deflection at the free end using flexibility matrix method. EI is uniform throughout.	13	CO 4	L1
15(a)	Interpret the moments for the beam shown in figure by stiffness matrix method and draw the BMD.  	13	CO 5	L2
15(b)	Interpret the frame given in figure by stiffness matrix method AE is equal to unity.  	13	CO 5	L2

16(a)	A continuous beam ABC 24m long is fixed at A, simply supported at B and C. The intermediate support B is at 12m from A and sinks by 30mm. The span AB carries a uniformly distributed load of 3kN/m and the span BC is subjected to a point load of 24 kN at 8m from C. Formulate the beam by moment distribution method and draw the bending moment diagram. Take the flexural rigidity EI as 40,000kN-m^2 and is constant throughout.	13	CO 3	L4
16(b)	A continuous beam ABC is fixed at A and simply supported at B and C. The span AB is 5m and carries a concentrated load of 80kN at its mid-span and the span BC is 8m and carries a uniformly distributed load of 12kN/m. Take the flexural rigidity for portion AB as EI and that for portion BC as 2EI. Adapt slope deflection method & draw the bending moment diagrams.	13	CO 2	L4

ASSESSMENT PAPER QUALITY MATRIX

PART	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
A	2,5,6,7,8	1,3,4,9,10	–	–	–	–
B	14 A,B	15 A,B	12 A,B 13 A,B	11 A,B	–	–
C	–	–	–	16 A,B	–	–
TOTAL	**23**	**23**	**26**	**28**	–	–
Distribution	**46%**		**54%**		–	

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UNIT I
ANALYSIS OF TRUSSES
PART A

1.	**Give an outline on determinate and indeterminate structures.**	**UNDERSTAND BT-L2**	**CO1**
Determinate structure: A structure is considered statically determinate if all of its support reactions and member forces can be calculated using only the equations of static equilibrium. **Indeterminate structure:** A structure is termed as statically indeterminate, if it cannot be analyzed from principles of statics alone, i.e. $\sum H = 0, \sum V = 0, \sum M = 0$.			
2.	**Define tension coefficient.**	**REMEMBER BT-L1**	**CO1**
The force per unit length of a member is known as tension coefficient. It is given by, **T = F/ L** where, T is tension coefficient, F is the force and L is length of the member.			
3.	**What is redundant frame and deficient frame?**	**REMEMBER BT-L1**	**CO1**
If the number of members are more than (2j – 3), then the frame is known as redundant frame. **n> 2j-3** Also, if the number of members are less than (2j – 3), then the frame is known as deficientframe. **n< 2j-3**			
4.	**Write the advantages of method of section for calculating member forces in a truss.**	**REMEMBER BT-L1**	**CO1**
The primary benefit of the method of sections is that, for a determinate truss, the force in any individual member can be found quickly without having to solve through the entire truss one joint at a time.			
5.	**List the classification of frames.**	**REMEMBER BT-L1**	**CO1**
Frames are classified as follows: • Perfect frame • Deficient frame • Redundant frame • Statically determinate frame • Statically indeterminate frame			
6.	**What is meant by perfect frame?**	**REMEMBER BT-L1**	**CO1**
A frame composed of members, which is just sufficient to keep it in equilibrium, when an external load is applied, is termed as perfect frame. Here **n = 2j – 3.**			
7.	**How imperfect frame can be explained?**	**UNDERSTAND BT-L2**	**CO1**
A frame, in which number of members and number of joints are not as given by **n = 2j – 3**, is known as imperfect frame. This means that number of members in an imperfect frame will be either more or less than **(2j – 3).**			

8.	**What are the assumptions made in finding out the forces in a frame?**	**REMEMBER BT-L1**	**CO1**

The assumptions made in finding out the forces in a frame are:

- The frame is perfect
- The frame carries load at the joints
- All the members are pin-jointed

9.	**What are the methods available for the analysis of a frame?**	**REMEMBER BT-L1**	**CO1**

The following are the methods available for the analysis of a frame:

- Methods of joints
- Methods of sections
- Graphical method

10.	**How is method of joints applied to trusses carrying inclined loads?**	**UNDERSTAND BT-L2**	**CO1**

If a truss carries inclined loads hinged at one end supported on roller at the other end, the support reaction at the roller support end will be normal, whereas the support reaction at the hinged end will consist of horizontal reaction and vertical reaction.

11.	**How is the force in a member determined by method of joints?**	**REMEMBER BT-L1**	**CO1**

While determining the force in a member by methods of joints, the joint should be selected in such a way that at any time there are only two members in which the forces are unknown.

12.	**State the advantages of method of sections over the method of joints in the analysis of plane trusses.**	**UNDERSTAND BT-L2**	**CO1**

The advantages of method of sections over the method of joints are:

- Time is saved.
- Forces in any particular /few members of the truss can be determined.
- Moment equilibrium equation can be effectively used to find the member force.

13.	**Distinguish between plane truss and space truss.**	**UNDERSTAND BT-L2**	**CO1**

Plane Truss	**Space Truss**
• A plane truss or planar truss is basically a two-dimensional network of uniform cross-sectional members. • They generally comprise straight members such as bars and links. The members are joined to one another by pin joints. • In the plane trusses, the loads applied and reactions induced are only at the joints, and lie in the plane of the truss.	• A space truss is a three-dimensional structure that consists of members arranged to form tetrahedrons. • These kinds of structures remain under the application of three-dimensional force systems. • The simplest space truss structure can be formed by joining six members with four joints to form a tetrahedron.

14.	**What is meant by lack of fit in a truss?**	**UNDERSTAND BT-L2**	**CO1**

One or more members in a pin jointed statically indeterminate frame may be a little shorter or longer than what is required. Such members will have to be forced in place during the assembling. These are called members having Lack of fit. Internal forces can develop in a redundant frame (without external loads) due to lack of fit.

15.	Distinguish between pin jointed and rigidly jointed structure.	UNDERSTAND BT-L2	CO1

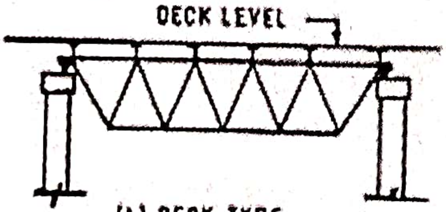
Pin jointed structure	Rigidly jointed structure
• The joints permit change of angle between connected members. • The joints are incapable of transferring any moment to the connected members and vice-versa. • The pins transmit forces between connected members by developing shear.	• The members connected at a rigid joint will maintain the angle between them even under deformation due to loads. • Members can transmit both forces and moments between themselves through the joint. • Provision of rigid joints normally increases the redundancy of the structures.

16.	Differentiate the statically determinate structures and statically indeterminate structures.	UNDERSTAND BT-L2	CO1

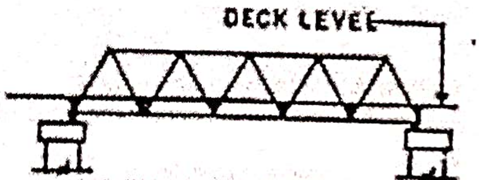
Statically determinate structures	Statically indeterminate structures
• Conditions of equilibrium are sufficient to analyze the structure • Bending moment and shear force is independent of material and cross sectional area. • No stresses are caused due to temperature change and lack of fit.	• Conditions of equilibrium are insufficient to analyze the structure • Bending moment and shear force is dependent of material and independent of cross sectional area. • Stresses are caused due to temperature change and lack of fit.

17.	Distinguish between 'deck type' and 'through type' trusses.	UNDERSTAND BT-L2	CO1

Deck type truss	Through type truss
• A deck truss is a type of bridge in which the road deck lies above the structural parts. • The supporting beams of the truss structure are arranged in triangular patterns to distribute loads and ensure the bridge stays stable.	• In Through type bridge, the carriageway rests at the bottom level of the main load carrying members. • The trusses to either side are generally higher and are connected by cross-bracing at their tops. These are designed for heavier loads and longer spans.



(b) DECK TYPE



(a) THROUGH TYPE

18.	What are the steps necessary for obtaining graphical solution of a frame?	REMEMBER BT-L1	CO1

The following steps are necessary for obtaining graphical solution of a frame:

- Making a space diagram
- Constructing a vector diagram
- Preparing a force table.

19.	What is the effect of temperature on the members of a statically determinate plane truss?	REMEMBER BT-L1	CO1

In determinate structures temperature changes do not create any internal stresses. The changes in lengths of members may result in displacement of joints. But these would not result in internal stresses or changes in external reactions.

20.	**How to calculate degree of freedom and its types?**	**UNDERSTAND BT-L2**	**CO1**

Degree of freedom is defined as the least no of independent displacements required to define the deformed shape of a structure. There are two types of DOF:

- Nodal type DOF and
- Joint type DOF.

21.	**Define trussed beam.**	**REMEMBER BT-L1**	**CO1**

A beam strengthened by providing ties and struts is known as Trussed Beams. A beam reinforced by a truss rod or formed of straight or cambered pieces joined by trussing.

22.	**List the assumptions made in the analysis of perfect frame.**	**REMEMBER BT-L1**	**CO1**

The assumptions made in the analysis of perfect frame are:

- The loads applied at the joints of the truss
- The members of the truss carry axial forces only
- The self weight of the members are neglected

23.	**How is a frame analyzed?**	**UNDERSTAND BT-L2**	**CO1**

Analysis of a frame consists of:

- Determination of the reactions at the supports and
- Determination of the forces in the members.

24.	**What are the conditions of equilibrium?**	**REMEMBER BT-L1**	**CO1**

The conditions of equilibrium consists of three equations namely:

- $\Sigma H = 0$: the sum of the horizontal components of the forces equals zero;
- $\Sigma V = 0$: the sum of the vertical components of forces equals zero;
- $\Sigma M = 0$: the sum of the moments equals zero

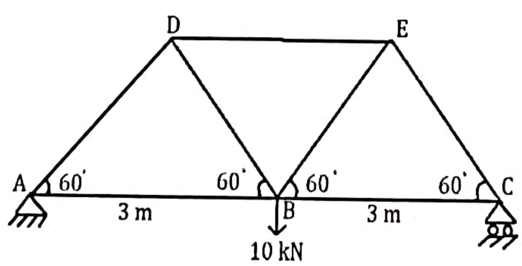
25.	**What are the advantages of space trusses?**	**REMEMBER BT-L1**	**CO1**

The advantages of space frame are:

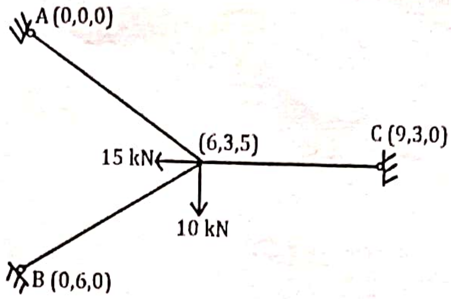
- These three-dimensional structures are sturdy. They aid load sharing with maximum precision.
- The steel elements are portable and lightweight. Therefore, their assembly is modular, secure and efficient.
- It is capable of bearing heavy loadings with minimum deflections.
- The cost of transportation is less as compared to conventional steel structures.

PART B

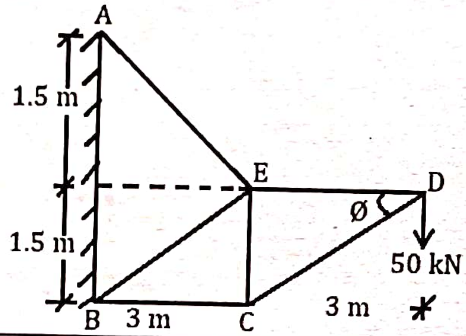
1.	Analyze the pin jointed plane determinate truss shown in the figure by the method ofjoints. (13)	**ANALYZE BT-L4**	**CO1**



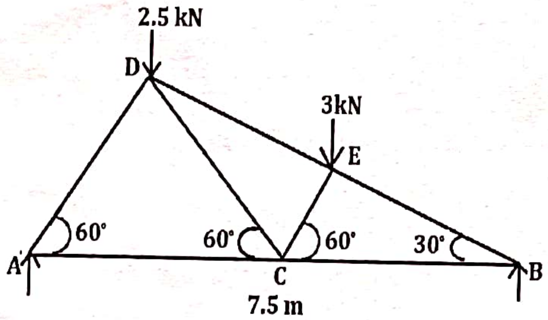
2.	Determine the forces in the members of the space truss shown in the figure. By tensioncoefficient method. **(13)**	**APPLY** **BT-L3**	**CO1**



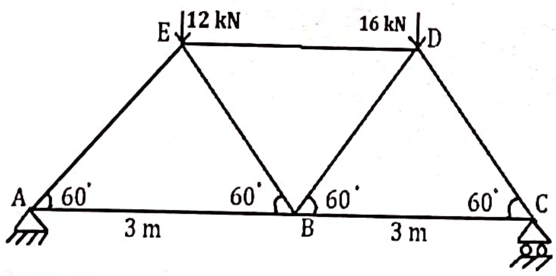
3.	Determine the focus in all the members of the truss given in the figure. Use method of joints. **(13)**	**APPLY** **BT-L3**	**CO1**



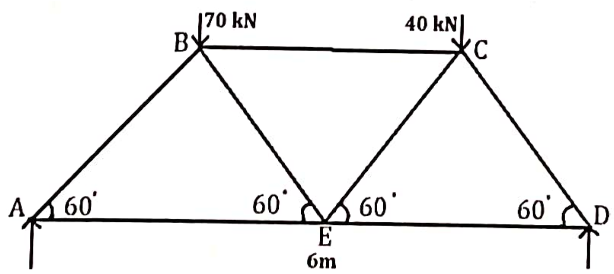
4.	Determine the forces in the member using method of sections for the truss shown in figure. **(13)**	**APPLY** **BT-L3**	**CO1**

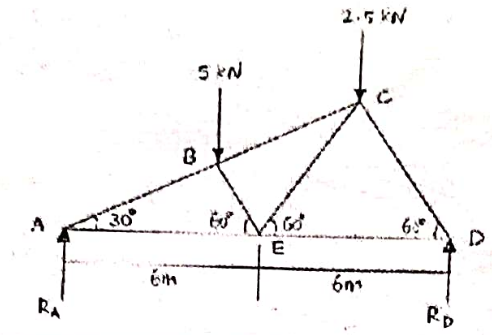
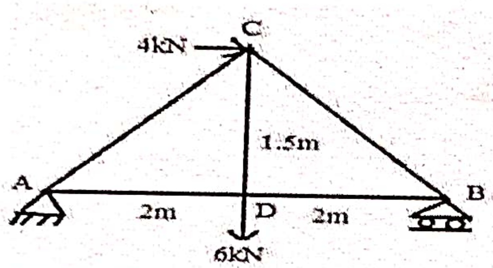
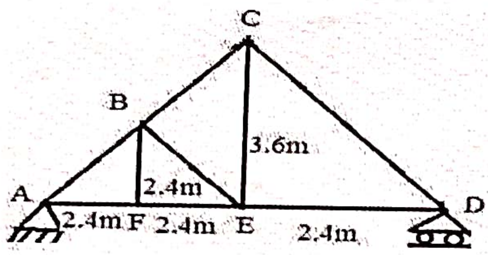
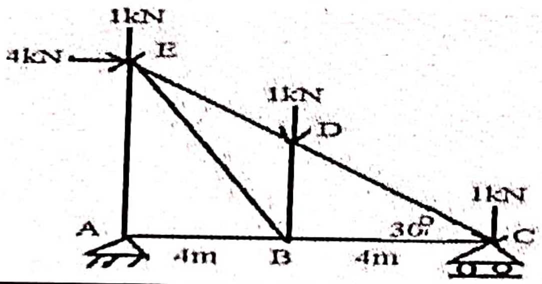
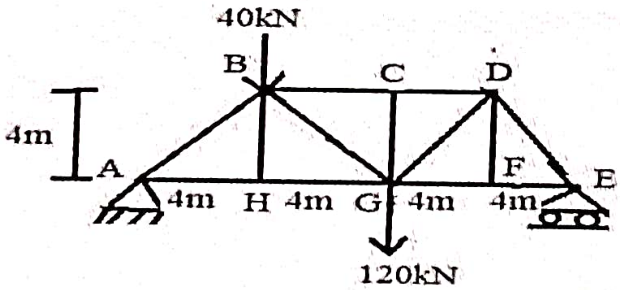


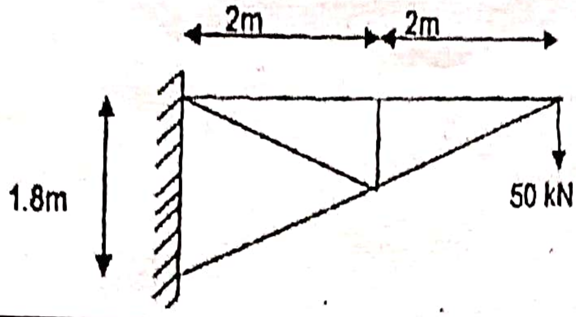
5.	Determine the forces in all the members of the frame shown in figure below. Use method of joints. **(13)**	**APPLY** **BT-L3**	**CO1**



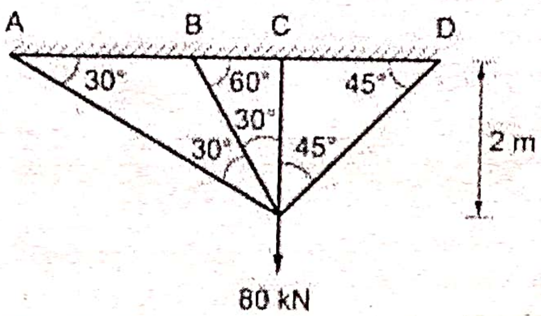
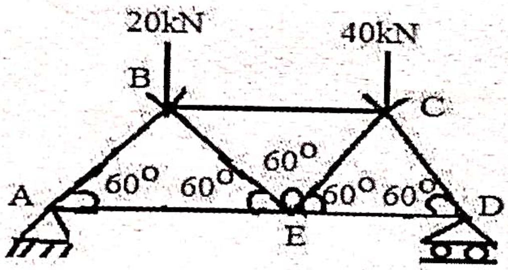
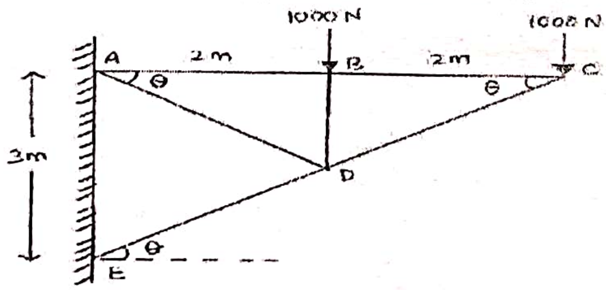
6.	Using method of sections determine the forces in all the members of the frame shown in the figure. **(13)**	**APPLY** **BT-L3**	**CO1**



7.	Find the forces in the member of the truss shown in figure by the method of joints. (13)  	APPLY BT-L3	CO1
8.	Find the forces in the members of the truss shown in the figure. (13)  	APPLY BT-L3	CO1
9.	Find the forces in the member of the truss shown in fig. by method of sections. (13)  	APPLY BT-L3	CO1
10.	For the truss shown in figure find the forces in members CD, CB, BD and AE by method of joints. (13)  	APPLY BT-L3	CO1
11.	Determine the forces in all members of a truss as shown in the figure using tension coefficient method. (13)  	APPLY BT-L3	CO1

12.	Determine the stresses in the members by tension coefficient method. (13) 	APPLY BT-L3	CO1
13.	Explain in detail about the (i) Plane frame (ii) Pin jointed Frame (iii) Rigid jointed Frame. (13)	UNDERSTAND BT-L2	CO1
14.	Derive the stiffness matrix of a typical pin-jointed two-dimensional frame element. (13)	UNDERSTAND BT-L2	CO1
15.	How do you determine the forces in the members of a truss using method of joints? Explain in detail. (13)	UNDERSTAND BT-L2	CO1

PART C

1.	Analyze the pin-connected plane frame shown in the figure. The cross-sectional area of each member is 3000 mm². Take E equal to 210kN/mm². (15) 	APPLY BT-L3	CO1
2.	Find the forces in all the members of the girder shown in Fig. by the method of joints, indicating whether the force is compressive or tensile. (15) 	APPLY BT-L3	CO1
3.	Analyze the cantilevered truss by method of sections. (15) 	ANALYZE BT-L4	CO1

UNIT II

SLOPE DEFLECTION METHOD

PART A

1.	**Write the general slope deflection equation.**	REMEMBER BT-L1	CO2

$$M_{AB} = M'_{AB} + \frac{2EI}{l}\left[2\theta_A + \theta_B + \frac{3\Delta}{l}\right]$$

$$M_{BA} = M'_{BA} + \frac{2EI}{l}\left[2\theta_B + \theta_A + \frac{3\Delta}{l}\right]$$

where,

M'_{AB}, M'_{BA} = Fixed end moment at A and B respectively due to the given loading

θ_A , θ_B = Slopes at A and B respectively

Δ = Sinking of support A with respect to B

2.	**State the assumptions made in the slope deflection method.**	REMEMBER BT-L1	CO2

Following are the assumptions made in slope deflection method,

- All the joints of the frame are rigid, i.e, the angle between the members at the joints do not change, when the frame is loaded.
- Whenever the beams or frames are deflected, the rigid joints are considered to rotate as a whole, i.e, the angle between the tangents to the various branches of the elastic curve meeting at a joint, remain the same as those in the original structure.
- Distortions, due to axial and shear stresses, being very small, are neglected.

3.	**Write about the effect of support displacement in a structure.**	UNDERSTAND BT-L2	CO2

The statically determinate structure changes their shape due to support settlement and this would in turn include reactions and stresses in the system. Since there is not external force system acting on the structures, these forces form a balanced force system by themselves and the structure would be in equilibrium.

4.	**How many slope deflection equations are available for two span continuous beam?**	REMEMBER BT-L1	CO2

Two numbers of slope-deflection equations are available for each span, describing the moment at each end of the span and hence four slope deflection equations are available for two span continuous beam.

5.	**What is sway frame?**	REMEMBER BT-L1	CO2

Sway is the lateral movement of joints in a portal frame due to the un-symmetry in geometry of the frame, un-symmetry in loading, moments of inertia, end conditions, settlement of one end of frame and horizontal loading on the column of the frame.

6.	**Mention any four causes for sway in portal frames.**	REMEMBER BT-L1	CO2

Sway in portal frames may occur due to:

- Un-symmetry in geometry of the frame
- Un-symmetry in loading
- Settlement of one end of a frame
- Horizontal loading on the column of the frame.

7.	**Write the advantages of slope deflection method.**	**REMEMBER BT-L1**	**CO2**

The advantages of slope deflection method are:

- The slope-deflection method can be used to analyze statically determinate and indeterminate beams and frames. In this method it is assumed that all deformations are due to bending only. In other words deformations due to axial forces are neglected.
- The slope-deflection equations are not that lengthy in comparison.
- The slope-deflection equations are derived for the simplest case i.e. for the case of continuous beams with unyielding supports.

8.	**Identify the limitations of slope deflection method.**	**REMEMBER BT-L1**	**CO2**

The limitations of slope deflection method are:

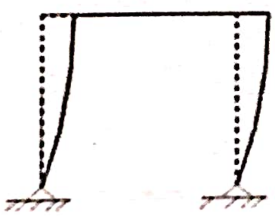
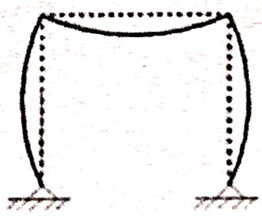
- It is not easy to account for varying member sections.
- It becomes very cumbersome when the unknown displacements are large in number.

9.	**List the uses of slope deflection method.**	**REMEMBER BT-L1**	**CO2**

Using slope deflection method rigid jointed structure can be analyzed. This method is applied to analyze the following type of structures:

- Continuous beam
- Frames without side sway
- Frames with side sway

10.	**Distinguish between sway type and non-sway type frames.**	**UNDERSTAND BT-L2**	**CO2**

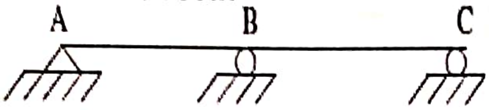
Sway frame	Non-sway frame
• The frame in which longitudinal deflection takes place when the horizontal load is applied is known as a sway frame. • It is a type of an unbraced frame.	• The frame in which longitudinal deflection is restrained by supports when the horizontal loads is applied is known as a non-sway frame. • It is a type of a braced frame.
Sway mode 	Non-sway mode 

11.	**Distinguish between symmetry and anti-symmetry of structures.**	**UNDERSTAND BT-L2**	**CO2**

Symmetry	Anti-symmetry
• Symmetry refers to the balanced and proportional arrangement of elements in a structure. • It ensures that the load distribution is even and minimizes stress concentrations. • Symmetry is important as it improves the structural stability, aesthetic appeal, and overall performance of the building.	• For an anti-symmetric system the structure (including support conditions) remains symmetric. • However the loading is anti-symmetric and has uneven stress concentrations. • For an anti-symmetric loading bending moment and displacement will be zero.

12.	**What is meant by fixed end moment?**	**REMEMBER BT-L1**	**CO2**
Due to loading, end moments develop without any rotations at ends. These moments are similar to the end moments in a fixed beam and hence are called fixed end moments. The fixed end moments are reaction moments developed in a beam member under certain load conditions with both ends fixed. A beam with both ends fixed is statically indeterminate to the 3rd degree, and any structural analysis method applicable on statically indeterminate beams can be used to calculate the fixed end moments.			
13.	**Define stiffness.**	**REMEMBER BT-L1**	**CO2**
Stiffness of a prismatic member is the moment required to rotate the end while acting on it through a unit rotation, without translation. It is denoted as k. For simply supported beam, **k = 3 EI / L** For fixed beam, **k = 4 EI / L** where, E = Young's modulus of the beam material. I = Moment of inertia of the beam & L = Beam's span length.			
14.	**How do you account for sway in slope deflection method for portal frames?**	**REMEMBER BT-L1**	**CO2**
Because of sway, there will be rotations in the vertical members of a frame. This induces moments in the vertical members. To account for this, besides the equilibrium, one more equation namely shear equation connecting the joint-moments is used.			
15.	**A rigid frame is having totally 10 joints including support joints. Out of slope-deflection and moment distribution methods, which method would you prefer for analysis? Why?**	**UNDERSTAND BT-L2**	**CO2**
Moment distribution method is preferable. Because, if we use slope-deflection method, there would be 10 (or more) unknown displacements and an equal number of equilibrium equations. In addition, there would be 2 unknown support moments per span and the same number of slope-deflection equations. Solving them is difficult.			
16.	**What are the quantities in terms of which the unknown moments are expressed in slope-deflection method?**	**REMEMBER BT-L1**	**CO2**
In slope-deflection method, unknown moments are expressed in terms of • Slopes (θ) & • Deflections (Δ) To find θ and Δ, joint equilibrium conditions and shear equations are established. The forces (moments) are found using force-displacement relations.			
17.	**Who introduced slope-deflection method of analysis and why this method is called a 'displacement method'?**	**REMEMBER BT-L1**	**CO2**
Slope-deflection method was introduced by **Prof. George A.Maney** in 1915. In slope-deflection method, displacements (like slopes and deflections) are treated as unknowns and hence the method is called as 'displacement method'.			
18.	**What is the basis on which the sway equation is formed for a structure?**	**REMEMBER BT-L1**	**CO2**
Sway is dealt with in slope-deflection method by considering the horizontal equilibrium of the whole frame taking into account the shears at the base level of columns and external horizontal forces. The shear condition is $\frac{M_{AB} + M_{BA} - P_h}{L} + \frac{M_{CD} + M_{DC}}{L} + P = 0$			

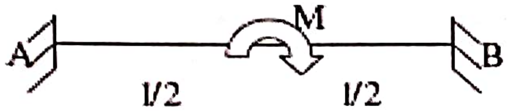
19. **The beam shown in Fig. is to be Analyzed by slope-deflection method. What are the unknowns and, to determine them, what are the conditions used?** — **UNDERSTAND BT-L2** — **CO2**



Unknowns: qA, qB, qC

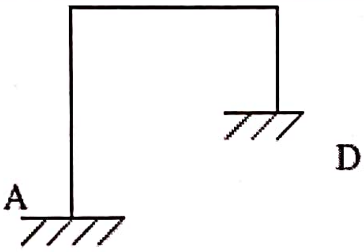
Equilibrium equations used: (i) $M_{AB} = 0$ (ii) $M_{BA} + M_{BC} = 0$ (iii) $M_{CB} = 0$

20. **Write the fixed end moments for a beam carrying a central clockwise moment.** — **REMEMBER BT-L1** — **CO2**



Fixed end moments : $M'_{AB} = M'_{BA} = M/4$

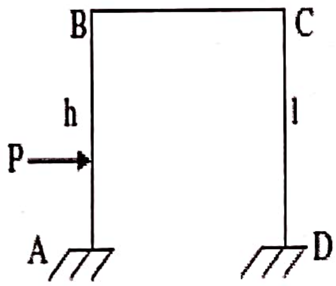
21. **Write down the equation for sway correction for the portal frame shown in Fig.** — **REMEMBER BT-L1** — **CO2**



The shear equation (sway correction) is

$$\frac{M_{AB} + M_{BA}}{l} + \frac{M_{CD} + M_{DC}}{l} = 0$$

22. **Write down the equilibrium equations for the frame shown in Fig.** — **REMEMBER BT-L1** — **CO2**



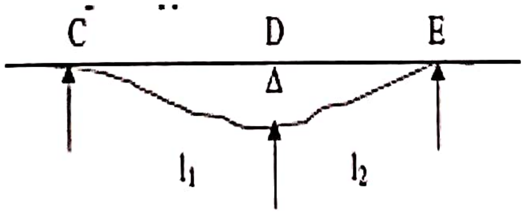
Unknowns : θ_B , θ_C

Equilibrium equations : At B, $M_{BA} + M_{BC} = 0$

At C, $M_{CB} + M_{CD} = 0$

Shear equation : $\frac{M_{AB} + M_{BA} - Ph}{l} + \frac{M_{CD} + M_{DC}}{l} + P = 0$

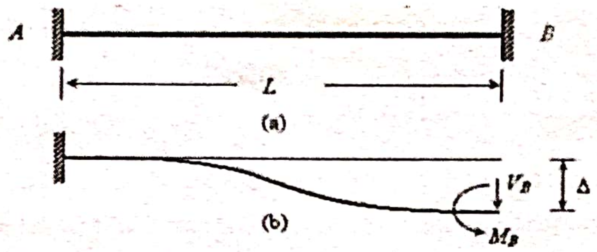
23. **In a continuous beam, one of the support sinks. What will happen to the span and support moments associated with the sinking of support?** — **UNDERSTAND BT-L2** — **CO2**



Let support D sinks by Δ. This will not affect span moments. Fixed end moments (support moments) will get developed as under $M'CD = M'DC = -\frac{6EI\Delta}{l_1}$ & $M'DE = M'ED = \frac{6EI\Delta}{l_2}$

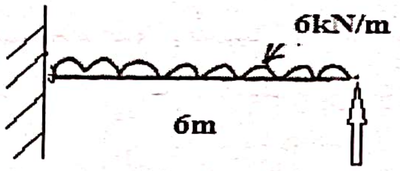
24.	**Write the support reactions induced in a fixed beam when one of its supports sinks.**	**REMEMBER BT-L1**	**CO2**

Let the end reactions due to settlement at B be V_B and M_B as shown in figure,



Support reactions : $M_B = 6EI\Delta/L^2$ and $V_B = 12EI\Delta/L^3$

25.	**A propped cantilever of span 6m is subjected to a uniformly distributed load of 6kN/m over the span. Using slope deflection method, Identify the slope at B. Take the flexural rigidity EI as 9000 kN-m^2.**	**UNDERSTAND BT-L2**	**CO2**



$$M_{BA} = M'_{BA} + \frac{2EI}{l}\left[2\theta_B + \theta_A + \frac{3\Delta}{l}\right]$$

Equilibrium condition $M_{BA} = 0$

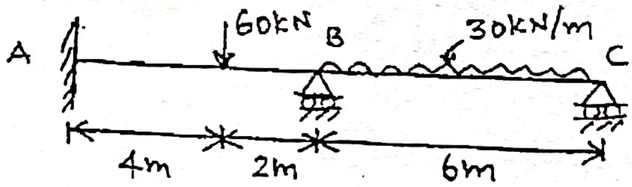
$M'_{BA} = (wl^2/12) = (6 \times 6^2)/12 = 18$ kNm

$0 = 18 + ((2 \times 9000)/6) \times \theta B$

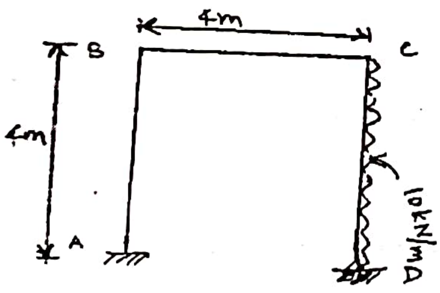
$\therefore \theta B = -3 \times 10^{-3}$

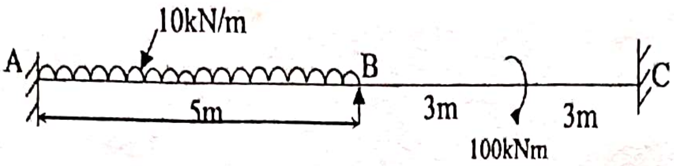
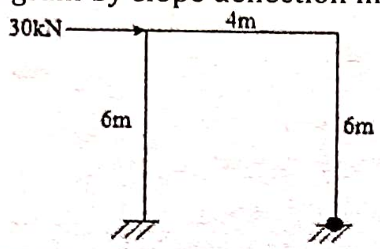
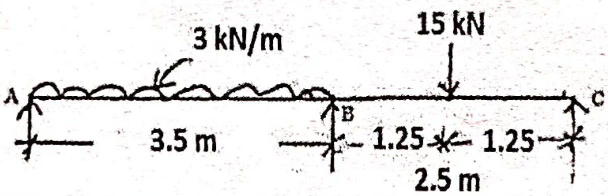
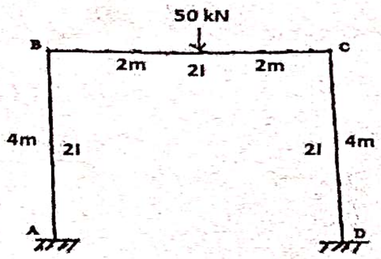
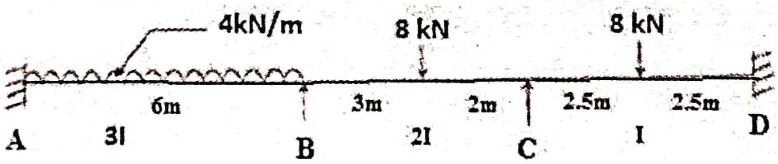
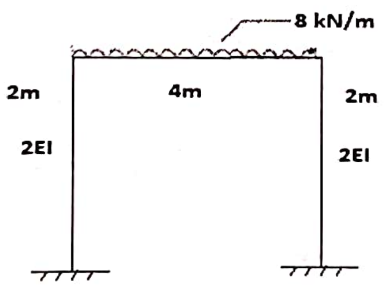
PART B

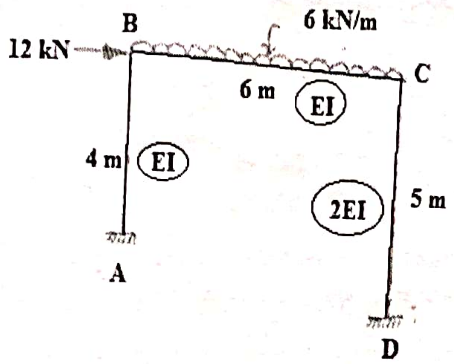
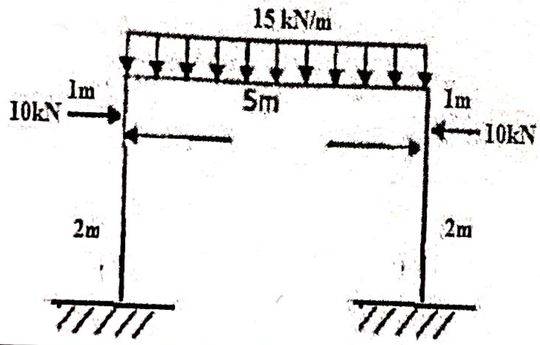
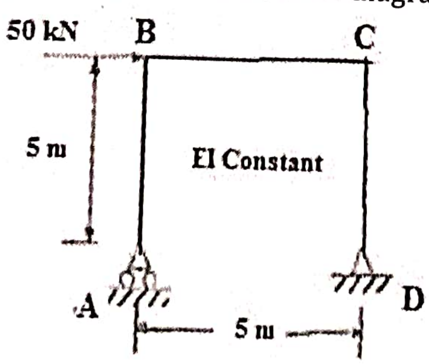
1.	Analyze the two-spaced continuous beam shown in the figure by the slope deflection method and draw the bending moment and shear force diagram. Take the value of the constant Young's modulus. **(13)**	**ANALYZE BT-L4**	**CO2**



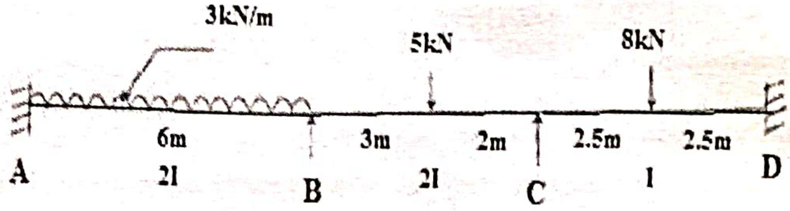
2.	Analyze a rigid frame by the slope deflection method as shown in figure and draw the graph of the bending moment. E = 2 x 10^5 MPa and I = 8 x 10^4 mm^4. **(13)**	**ANALYZE BT-L4**	**CO2**



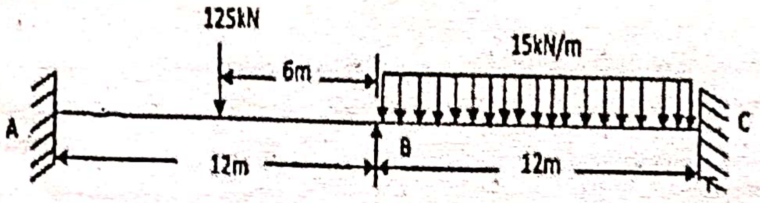
3.	Analyze the continuous beam shown in Fig. and plot the bending moment and shear force diagram by slope deflection method. **(13)** 	ANALYZE BT-L4	CO2
4.	Analyze the frame shown in figure and plot the bending moment and shearforce diagram by slope deflection method. **(13)** 	ANALYZE BT-L4	CO2
5.	Analyze the continuous beam ABC shown in figure by slope deflection method. EI = constant. **(13)** 	ANALYZE BT-L4	CO2
6.	Analyze the portal frame ABCD shown in figure by slope deflection method. Take EI = constant. **(13)** 	ANALYZE BT-L4	CO2
7.	A continuous beam ABCD consists of three span and is loaded as shown in figure. Analyze the beam by using slope deflection method. E is constant throughout. **(13)** 	ANALYZE BT-L4	CO2
8.	Solve the frame shown in fig by slope deflection method. **(13)** 	APPLY BT-L3	CO2

<table>
<tr><td>9.</td><td>Analyze the portal frame shown in figure by slope deflection method and draw the bending moment diagram. (13)

</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
<tr><td>10.</td><td>A continuous beam ABC is simply supported at A, fixed at C and continuous over support B. The span AB is 6m and carries a concentrated load of 60 kN at its mid-span and the span BC is 8m and carries a uniformly distributed load of 10kN/m. Take the flexural rigidity for portion AB as 2EI and that for portion BC as EI. Analyze the beam by slope deflection method anddraw the shearing force and bending moment diagram. (13)</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
<tr><td>11.</td><td>A continuous beam ABC is fixed at A and simply supported at B and C. The span AB is 5m and carries a concentrated load of 80kN at its mid-span and the span BC is 8m and carries a uniformly distributed load of 12kN/m. Take the flexural rigidity for portion AB as EI and that for portion BC as 2EI. Adapt slope deflection method and draw the shearing force and bending moment diagrams. (13)</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
<tr><td>12.</td><td>Analyze the portal frame shown in figure by slope deflection method and draw the bending moment diagram. (13)

</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
<tr><td>13.</td><td>Analyze the structures shown in figure by slope deflection method. Sketch the bending moment and shear force diagrams. (13)

</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
</table>

14.	A continuous beam ABCD consists of three span and is loaded as shown in figure. Solve the beam by using slope deflection method. E is constant throughout. (13)	APPLY BT-L3	CO2

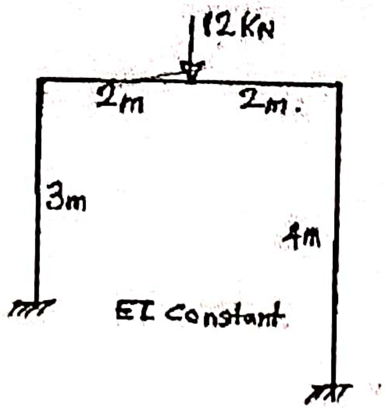


15.	ABC is a continuous beam with constant EI throughout its length as shown in figure. The end supports A and C are fixed and the beam is continuous over middle support B. Span BC is uniformly loaded with 15 kN/m length while a concentrated vertical downward load of 125 kN acts at the midspan of AB. Find the moments by slope deflection method. (13)	ANALYZE BT-L4	CO2



PART C

1	Analyze a three span continuous beam ABCD each span of 6 m length fixed at the left end and simply supported at the right end, by slope deflection method. The supports B and C sinks by 10 mm and 5 mm respectively and the support A rotates through an anticlockwise angle of 0.1 radian. There are no loads on the beam. Take E = 200 GPa; I = 4 $\times 10^7$ mm^4. Sketch the bending moment diagram and shear force diagram. (15)	ANALYZE BT-L4	CO2
2	A continuous beam ABC consists of spans AB and BC of 5m length in each. Both ends of the beam are fixed. The span AB carries a point load of 15 kN at its middle point. The span BC carries a point load of 25 kN at is middle point. Find the moments and reactions at the supports. Assume the beam is of uniform section. Use slope deflection method. (15)	ANALYZE BT-L4	CO2
3	Analyze the portal frame shown in figure by slope deflection method. (15)	ANALYZE BT-L4	CO2



UNIT III

MOMENT DISTRIBUTION METHOD

PART A

1.	**Define moment distribution method.**	**REMEMBER BT-L1**	**CO3**
Moment distribution method is widely used for the analysis of indeterminate structures. In this method, all the members of the structure are assumed to be fixed in position and fixed end moments due to external loads are obtained. It is also known as Hardy cross method.			
2.	**Write about distribution factor.**	**UNDERSTAND BT-L2**	**CO3**
Distribution factor for the member at a joint is the ratio of the relative stiffness of a member to the total stiffness of all the members meeting at the joint. **Distribution factor = K / ∑K**			
3.	**Define carry over factor.**	**REMEMBER BT-L1**	**CO3**
Carry over factor is defined as the ratio of the induced moment to the applied moment. It is the one in which half of the balanced moment is carried to far fixed end (ie.CO=0.5). The carry over factor is zero if the end is hinged/pin connected.			
4.	**What is meant by side sway?**	**REMEMBER BT-L1**	**CO3**
The lateral movement of the frames is known as side sway. If the loading system (or) the geometry of the system is not symmetric, the frame will have side sway. Side sway may be prevented in a frame by providing shear or partition walls and fixing the top of frame with adjoining rigid structures.			
5.	**Write about the conditions for sway corrections.**	**UNDERSTAND BT-L2**	**CO3**
Sway correction for a frame becomes necessary when the frame itself is unsymmetrical. The following are the conditions when sway corrections are required: • Sway Correction for Unsymmetrical Frame • Sway Correction for Unsymmetrical Loading • Sway Correction for Both Unsymmetrical Frame and Loading • Sway Correction for Unsymmetrical Loading on Symmetrical Frame			
6.	**What is unbalanced moment?**	**REMEMBER BT-L1**	**CO3**
Moment distribution method of analysis assumes that the joints in a structure are initially clamped or locked and then released successively. Once a joint is released, a rotation takes place, since the sum of the fixed end moments of the members meeting at that joint is not zero. The value of the sum of the end moments obtained is the unbalanced moment at that joint.			
7.	**What is carryover moment?**	**REMEMBER BT-L1**	**CO3**
The distributed moments in the ends of members meeting at a joint cause moments in the other ends, which are assumed to be fixed. These induced moments at the other ends are called carry-over moments.			
8.	**What is distributed moment?**	**REMEMBER BT-L1**	**CO3**
Upon the release of the imaginary clamp at a joint, the unbalanced moment at that joint causes it to rotate. The rotation twists the end of the members meeting at the joint, resulting in the development of resisting moments. These resisting moments are called distributed moments.			

9.	**Write about point of contra flexure.**	**UNDERSTAND BT-L2**	**CO3**
A point of contra flexure occurs where the bending moment in a beam changes its sign (i.e. from +ve to -ve or -ve to +ve). In a bending moment diagram, it is the point at which the bending moment curve intersects with the zero line.			
10.	**What are the assumptions made in the moment distribution method?**	**REMEMBER BT-L1**	**CO3**
The assumptions made in moment distribution method are as follows: • All the members of the structure are assumed to be fixed in position • Joints are prevented from any possible rotation. • The moments developed at the member ends are taken as fixed end moments.			
11.	**List the steps involved in moment distribution method.**	**REMEMBER BT-L1**	**CO3**
The steps involved in moment distribution method are listed below: • Calculation of fixed end moments. • Calculation of unbalanced moment. • Computing balancing moments. • Distribution of balancing moment. • Carryover of distributed moment. • Total moment at the end of cycle.			
12.	**What are the limitations of moment distribution method?**	**REMEMBER BT-L1**	**CO3**
The limitations of moment distribution method are: • In this method continuity of slope is assumed. • This method is not applicable where there is a sudden break in the continuity of slope such as an internal hinge or internal links are present.			
13.	**How stiffness of beams can be calculated?**	**UNDERSTAND BT-L2**	**CO3**
Beam stiffness can be calculated using two factors as follows: • The first factor is the elastic modulus. This is a material property that relates to the material's tendency to deform, or stretch out, when stress is applied. • The other factor in beam stiffness is the area moment of inertia of the beam's cross section. This relates with the vertical distribution of material close to or away from the center of the beam.			
14.	**Write the fixed end moments of a beams having sinking supports.**	**REMEMBER BT-L1**	**CO3**
For any intermediate span AB, if there is sinking of support or lateral downward displacement of left end A with respect to right end B, i.e. δ, the fixed end moments at A and B are as follows: $FM_{AB} = FM_{BA} = +6EI\delta/L^2$ **(clockwise)** This fixed end moment is added to those due to external loads in analysis procedure.			
15.	**Give an outline about compatibility conditions.**	**UNDERSTAND BT-L2**	**CO3**
• The compatibility conditions are developed for the manual analysis of simple structures, and are based on the concept of redundant structural members. • Compatibility is used when solving indeterminate members because the equations of equilibrium do not allow us to solve for all of the unknowns within a system. • Compatibility equations are those additional equations which can be made considering equilibrium of the structure, to solve statically indeterminate structures.			

16.	**Define static indeterminacy.**	**REMEMBER BT-L1**	**CO3**

The static indeterminacy is defined as the number of equations required over and above the equations of static equilibrium for the analysis of a structure is known as the degree of static indeterminacy or degree of redundancy.

17.	**What are the conditions in which a frame is subjected to sway?**	**REMEMBER BT-L1**	**CO3**

The conditions in which a frame is subjected to sway are listed below:

- Different end conditions of the columns
- Non-uniform section of the members
- Unsymmetrical settlement of supports
- Eccentric or unsymmetric loading

18.	**What are the advantages of continuous beam over simply supported beam?**	**UNDERSTAND BT-L2**	**CO3**

The advantages of continuous beam over simply supported beam are:

- The maximum bending moment in case of continuous beam is much less than in case of simply supported beam of same span carrying same loads.
- In case of continuous beam, the average bending moment is lesser and hence lighter materials of construction can be used to resist the bending moment.

19.	**What are symmetric quantities in structural behaviour?**	**REMEMBER BT-L1**	**CO3**

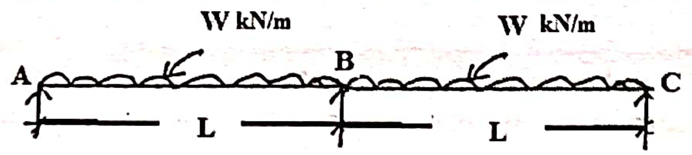
When a symmetrical structure is loaded with symmetrical loading, the bending moment and deflected shape will be symmetrical about the same axis. These bending moment and deflection are termed as symmetrical quantities.

20.	**In a member AB, if a moment of –10 KNm is applied at A, what is the moment carried over to B?**	**UNDERSTAND BT-L2**	**CO3**

Carry over moment = Half of the applied moment/Carry over moment to B

= -10/2 = -5 kNm

21.	**A Continuous beam ABC of length 2L (with constant EI) is simply supported at the ends A and C and continuous over the support B at mid-length. Using moment distribution method, Find the moment at the support B, if it is subjected to a uniformly distributed load 'w' throughout the length.**	**UNDERSTAND BT-L2**	**CO3**

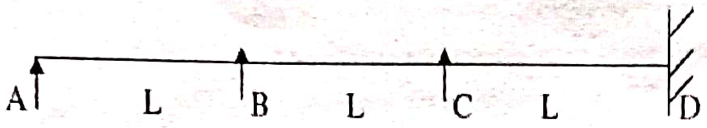


Distribution factor = ½

Joint	A	B		C
Member	AB	BA	BC	CB
Distribution factor		½	½	
Fixed end Moment	$-WL^2/12$ $+WL^2/12$	$+WL^2/12$ $+WL^2/24$	$-WL^2/12$ $-WL^2/24$	$+WL^2/12$ $-WL^2/12$
Initial moment	0	$+WL^2/8$	$-WL^2/8$	0
Balancing		0	0	
Final moment		$+WL^2/8$	$-WL^2/8$	

Moment at the support B = $WL^2/8$

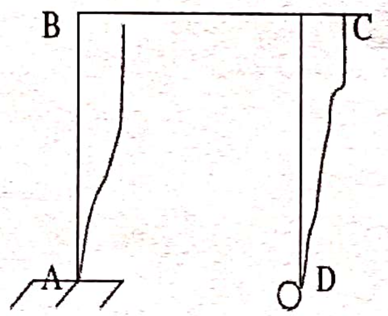
22. **Calculate the distribution factor for the given beam.** — **UNDERSTAND BT-L2** — **CO3**



Joint	Member	Relative stiffness	Sum of Relative stiffness	Distribution factor
A	AB	4EI / L	4EI / L	(4EI / L) / (4EI / L) = 1
B	BA	3EI /L	3EI /L + 4EI / L = 7EI / L	(3EI / L) / (7EI / L)= 3/7
	BC	4EI / L		(4EI / L) / (7EI / L) = 4/7
C	CB	4EI / L	4EI / L + 4EI / L =8EI / L	(4EI / L) / (8EI / L) =4/8
	CD	4EI / L		(4EI / L) / (8EI / L)= 4/8
D	DC	4EI / L	4EI / L	(4EI / L)/ (4EI / L) = 1

23. **Show the ratio of sway moments at column heads when one end is fixed and the otherend hinged. Assume that the length and M.I of both legs are equal.** — **UNDERSTAND BT-L2** — **CO3**

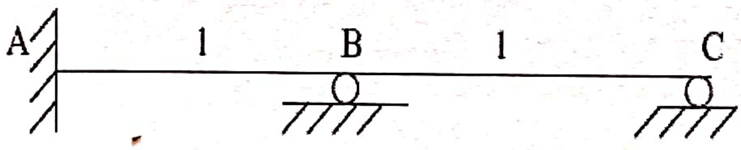
Assuming the frame to sway to the right:



Ratio of sway moments =

$$\frac{M_{BA}}{M_{CD}} = \frac{-\left(\frac{6EI\delta}{l^2}\right)}{-\left(\frac{3EI\delta}{l^2}\right)} = 2$$

24. **A beam is fixed at A and simply supported at B and C. AB = BC = *l*. Flexural rigidities of AB and BC are 2EI and EI respectively. Find the distribution factors at joint B if no moment is to be transferred to support C.** — **UNDERSTAND BT-L2** — **CO3**



Joint B: Relative stiffness: $\frac{I_1}{l} = \frac{2I}{l}$ for BA. $K_{BA} = 2$

$\frac{3}{4} \times \frac{I_1}{l} = \frac{3I}{4l}$ for BC $K_{BC} = ¾ = 0.75$

Distribution factors:

DF for BA: $\frac{K_{BA}}{K_{BA} + K_{BC}} = \frac{2}{2 + 0.75} = 8/11 = 0.727$

DF for BC: $\frac{K_{BC}}{K_{BC} + K_{BA}} = \frac{0.75}{2 + 0.75} = 3/11 = 0.273$

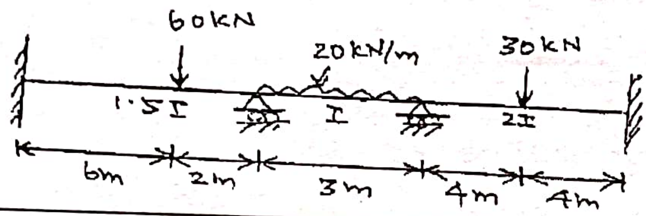
25.	**What are the advantages of Naylor's simplification?**	REMEMBER BT-L1	CO3

The advantages of Naylor's simplification are:

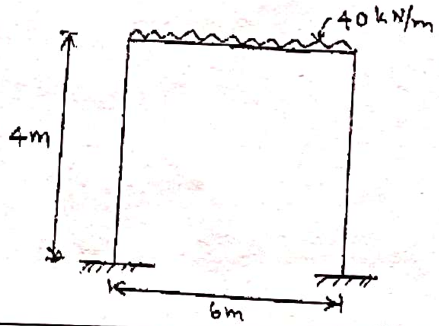
- It is suited to frame, especially multistory frames.
- It can handle symmetric frames with any loading since it can analyze completely symmetric and antisymmetric loading components.
- In this method sway analysis is completely avoided.

PART B

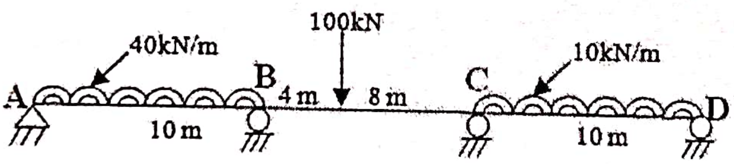
1.	Analyze the three-spaced continuous beam supported as shown in the figure by the moment distribution method and draw the bending moment diagram. (13)	ANALYZE BT-L4	CO3



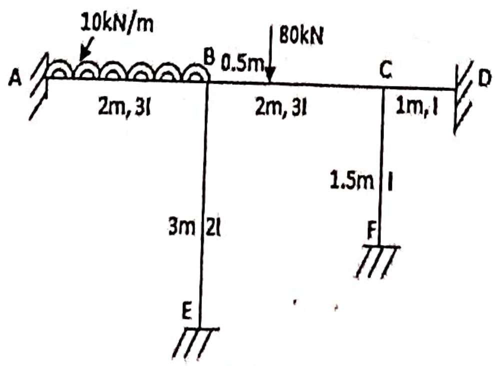
2.	Analyze a portal frame structure by the moment distribution system as shown in the Figure and draw a bending moment diagram. (13)	ANALYZE BT-L4	CO3

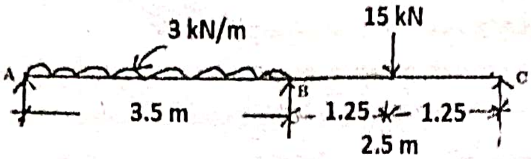
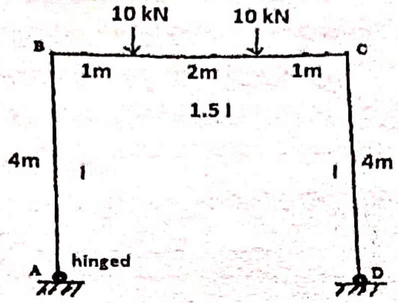
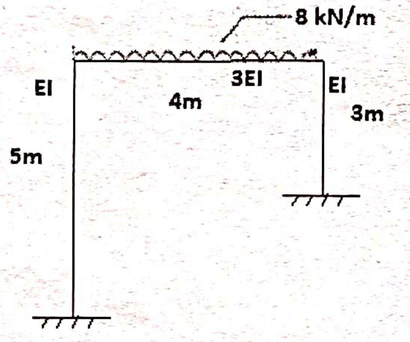
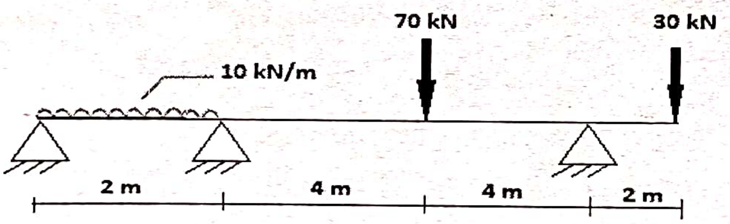
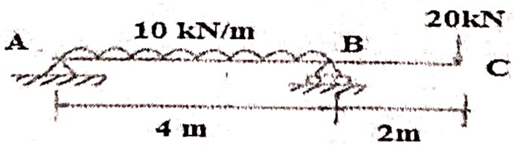
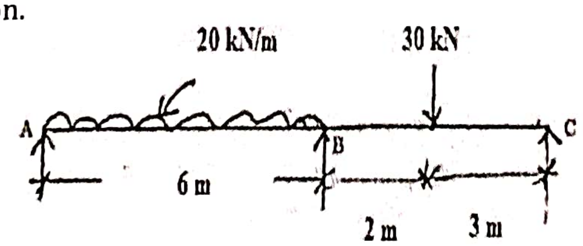


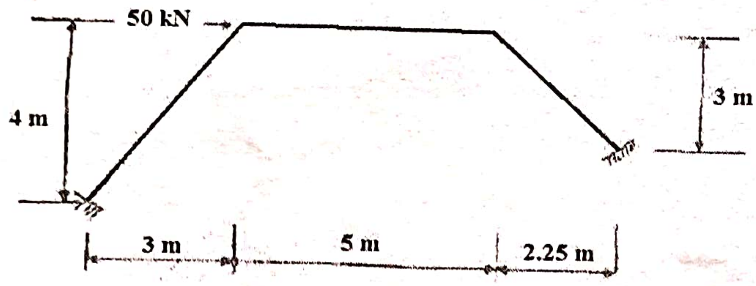
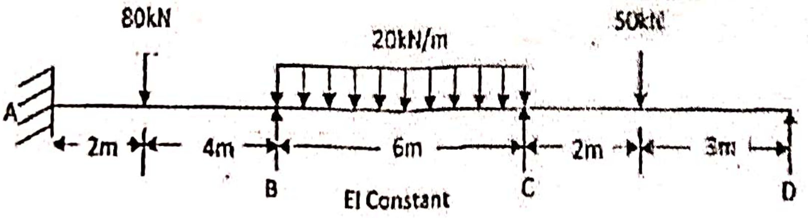
3.	Analyze the continuous beam shown in figure and plot the bending moment and shear force diagram by moment distribution method. (13)	ANALYZE BT-L4	CO3



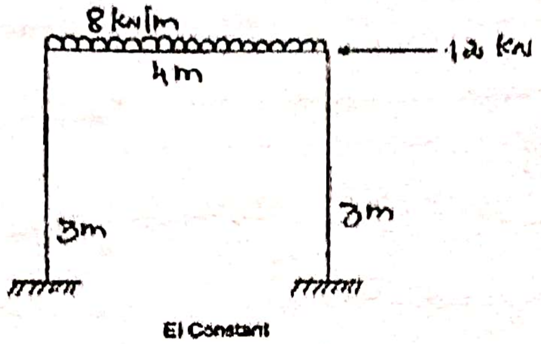
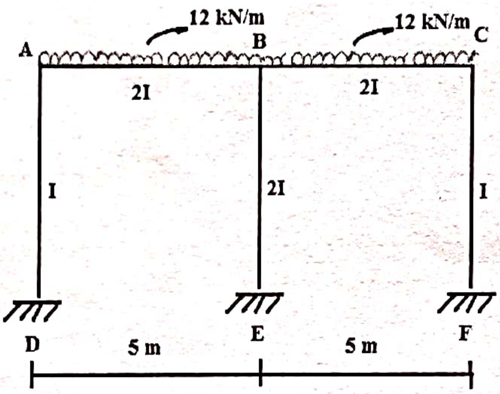
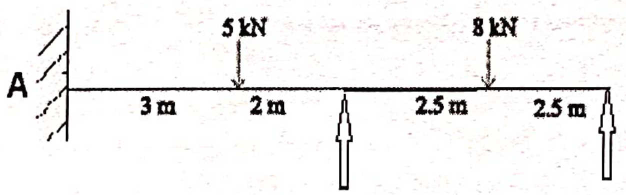
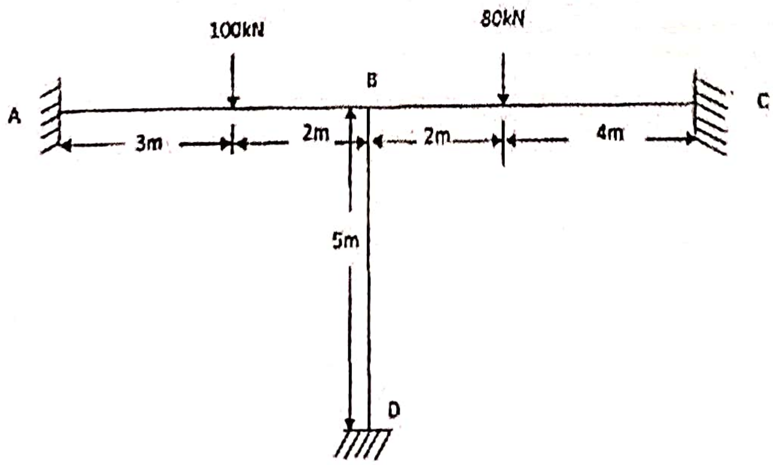
4.	Analyze the frame shown in figure and plot the bending moment and shear force diagram by moment distribution method. (13)	ANALYZE BT-L4	CO3



5.	Analyze the continuous beam ABC shown in figure by moment distribution method. Take EI =constant. **(13)** 	**ANALYZE** **BT-L4**	**CO3**
6.	Analyze the portal frame ABCD shown in fig. by moment distribution method. **(13)** 	**ANALYZE** **BT-L4**	**CO3**
7.	Analyze the frame shown in figure by moment distribution method. **(13)** 	**ANALYZE** **BT-L4**	**CO3**
8.	Determine the support moment for the beam shown in fig. by moment distribution method and sketch the BMD. **(13)** 	**APPLY** **BT-L3**	**CO3**
9.	Analyze the continuous beam given in figure by moment distribution method. **(13)** 	**ANALYZE** **BT-L4**	**CO3**
10.	Analyze the continuous beam shown in figure by the method of moment distribution. **(13)** 	**ANALYZE** **BT-L4**	**CO3**

11.	A continuous beam ABC 24m long is fixed at A, simply supported at B and C. The intermediate support B is at 12m from A and sinks by 30mm. The span AB carries a uniformly distributed load of 3kN/m and the span BC is subjected to a point load of 24 kN at 8m from C. Use moment distribution method and draw the shearing force and bending moment diagrams. Take the flexural rigidity EI as 40,000 kN-m^2 and is constant throughout. **(13)**	**APPLY** **BT-L3**	**CO3**
12.	A continuous beam ABCDE 18m long is simply supported at A and also at B, C and D at 4m, 10m and 16m respectively from the left end A and the portion DE being overhanging over 2m. The span AB carries a point load of 40 kN at its mid-span, the span BC is subjected to a uniformly distributed load of 12kN/m, the span CD carries a point load of 60 kN at 2m from C and the free end (E) carries a point load of 10 kN. Analyze the beam by moment distribution method and draw the shearing force and bending moment diagrams. Consider the flexural rigidity for the portions AB, BC and CD, DE as EI, 3EI and 2EI, 2EI respectively. **(13)**	**ANALYZE** **BT-L4**	**CO3**
13.	Analyze the portal frame shown in figure by moment distribution method and draw the bending moment diagram. Assume flexural rigidity is constant for all the members. **(13)** 	**ANALYZE** **BT-L4**	**CO3**
14.	Analyze the continuous beam loaded as shown in figure by the method of moment distribution. Draw the bending moment and shear force diagrams. **(13)** 	**ANALYZE** **BT-L4**	**CO3**
15.	Analyze the portal frame ABCD with ends A and D are hinged. Joints B and C are rigid, span AB = CD = 4 meters. Span BC = 6 meters. A uniformly distributed load of 8 kN/m acts on the span BC. Determine the bending moments at the supports. Using moment distribution method. **(13)**	**APPLY** **BT-L3**	**CO3**
16.	A continuous beam ABCD consists of three spans with fixed supports on both ends and simple supports at B and C. Span AB = 7m, BC = 6m and CD = 6m. An udl of 3 kN/m acts on AB. A point load of 6 kN acts at 3 m from B. A point load of 9 kN acts at the mid span of CD. EI are I, 2I and I for AB, BC and CD respectively. Determine the bending moments at the supports, using moment distribution method. **(13)**	**APPLY** **BT-L3**	**CO3**

PART C

1.	Analyze the sway frame shown in the figure using moment distribution method. **(15)** 	**ANALYZE** **BT-L4**	**CO3**
2.	Analyze the frame loaded as shown in figure by the moment distribution method. Sketch thebending moment and shear force diagrams. **(15)** 	**ANALYZE** **BT-L4**	**CO3**
3.	Analyze the continuous beam ABC shown in figure by moment distribution method and alsodraw the bending moment diagram. Take EI = constant. **(15)** 	**ANALYZE** **BT-L4**	**CO3**
4.	Analyze the beam by using moment distribution method and draw bending moment & shear force diagram. **(13)** 	**ANALYZE** **BT-L4**	**CO3**

UNIT IV
FLEXIBLITY METHOD
PART A

1.	**Write about flexibility matrix method.**	**REMEMBER BT-L1**	**CO4**
In flexibility matrix method, the forces in the structure are treated as unknowns. The no of equations involved is equal to the degree of static indeterminacy of the structure. This method is also called as force method.			
2.	**What do you mean by joint translation?**	**REMEMBER BT-L1**	**CO4**
In a structure, yielding may occur at the end due to the action of external loads over the structure. This yielding at the end support will cause an unequal amount of displacement. This type of relative settlement phenomenon between the fixed supports is known as joint translation.			
3.	**What is a rigid frame?**	**REMEMBER BT-L1**	**CO4**
A rigid frame is a structural configuration consisting of a frame in which the connections between all of the frame pieces are fixed at particular angles that do not change. Its members can take bending moment, shear and axial loads.			
4.	**What are flexibility coefficients?**	**REMEMBER BT-L1**	**CO4**
A Flexibility coefficient a_{ij} is defined as the displacement at joint 'i' due to a unit load at joint 'j' while all other joints are unloaded. The constant 'a' is known as flexibility of the structure and it has a unit of displacement per unit force.			
5.	**What is a primary structure?**	**REMEMBER BT-L1**	**CO4**
A primary structure is defined as a structure formed by removing the excess or redundant restraints from an indeterminate structure, making it statically determinate. This is required for solving indeterminate structures by flexibility matrix method.			
6.	**What do you mean by static and kinematic indeterminacy?**	**REMEMBER BT-L1**	**CO4**
• If the equilibrium equations are not sufficient to analyze the structure for the unknown forces, the structure is said to be statically indeterminate and is called static indeterminacy. • When a structure composed of several members is subjected to loads, the joints undergo displacements in the form of rotation and translation. The number of independent joint displacements in the structure is called the degree of kinematic indeterminacy.			
7.	**Define force transformation matrix.**	**REMEMBER BT-L1**	**CO4**
The force transformation matrix is defined as the connectivity matrix which relates the internal forces Q and the external forces R. Writing it in a matrix form, $\{Q\} = [b]\{R\}$ Where, Q = member force matrix/vector b = force transformation matrix R = external force/load matrix/ vector			
8.	**Mention any two method of determining the joint deflection of a perfect frame.**	**REMEMBER BT-L1**	**CO4**
The methods of determining the joint deflection of a perfect frame are, • Dummy unit load method. • Using the principle of virtual work.			

9.	**Write down the equation for the degree of static indeterminacy of the pin-jointed frames, explaining the notations used.**	**REMEMBER BT-L1**	**CO4**

- Total indeterminacy = External indeterminacy + Internal indeterminacy = m + R – 2j
- External indeterminacy = No. of reactions – No. of equilibrium equations = R-r
- Internal indeterminacy = m-2j-3

10.	**Compare determinate structure with indeterminate structure.**	**UNDERSTAND BT-L2**	**CO4**

Determinate structure	Indeterminate structure
• Determinate structures are analyzed just by the use of basic equilibrium equations ($\sum H = 0$; $\sum V = 0$; $\sum M = 0$). • By this analysis, the unknown reactions are found for the further determination of stresses.	• Redundant or indeterminate structures are not capable of being analyzed by mere use of basic equilibrium equations. • Along with the basic equilibrium equations, some extra conditions are required to be used like compatibility conditions of deformations etc to get the unknown reactions for drawing bending moment and shear force diagram. • Usually Matrix methods are adopted.

11.	**Why flexibility method is also called as compatibility method or force method?**	**REMEMBER BT-L1**	**CO4**

Flexibility method begins with the superposition of forces and is hence known as force method. Flexibility method leads to equations of displacement compatibility and is hence known as compatibility method.

12.	**Define Degree of Freedom and explain its types.**	**REMEMBER BT-L1**	**CO4**

Degree of freedom is defined as the least no of independent displacements required to define the deformed shape of a structure. There are two types of DOF:

a) Nodal type DOF: This includes the DOF at the point of application of concentrated load or moment, at a section where moment of inertia changes, hinge support, roller support and junction of two or more members.

b) Joint type DOF: This includes the DOF at the point where moment of inertia changes, hinge and roller support and junction of two or more members.

13.	**Define local and global coordinates.**	**REMEMBER BT-L1**	**CO4**

Local coordinates: Coordinates defined along the individual member axes locally.

Global coordinates: Common coordinate system dealing with the entire structure. These are also known as system coordinates.

14.	**What is the relation between the flexibility matrix and stiffness matrix?**	**REMEMBER BT-L1**	**CO4**

The relation between the flexibility matrix and stiffness matrix is that, one is the inverse of the other, when they both exist in a structure.

15.	**What is meant by force method in structural analysis?**	**REMEMBER BT-L1**	**CO4**

A method in which the forces are treated as unknowns is known as force method. The following are the force methods:

- Flexibility matrix method
- Consistent deformation method
- Claypeyron's 3 moment method
- Column analogy method

16.	**Differentiate pin-jointed plane frame and rigid jointed plane frames.**	**UNDERSTAND BT-L2**	**CO4**

Pin jointed frame	**Rigid jointed frame**
• The joints permit change of angle between connected members. • The joints are incapable of transferring any moment to the connected members and vice-versa. • The pins transmit forces between connected members by developing shear.	• The members connected at a rigid joint will maintain the angle between them even under deformation due to loads. • Members can transmit both forces and moments between themselves through the joint. • Provision of rigid joints normally increases the redundancy of the structures.

17.	**Write down the flexibility matrix for a simply supported beam with reference to coordinates shown in figure.**	**UNDERSTAND BT-L2**	**CO4**

$$\alpha_{ij} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

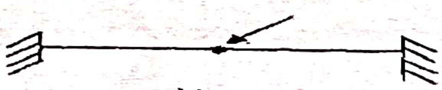
α = flexibility matrix

α_{11} = the displacement at 1 due to a unit force at 1

α_{21} = the displacement at 2 due to a unit force at 1

α_{ij} = the displacement at i due to a unit force at j

18.	**Find degree of indeterminacy of the following.**	**UNDERSTAND BT-L2**	**CO4**



hinge

No. of reaction R = 3+3 = 6

No. of static equilibrium equations + hinge = 3 + 2 = 5

Degree of indeterminacy = 6 – 5 = 1

19.	**Define flexibility of a structure.**	**REMEMBER BT-L1**	**CO4**

The flexibility of structure is defined as that a structure can be pre-defined by a set of co- ordinates. Each element of a flexibility matrix represents a displacement at a co-ordinate due to a force at a co-ordinate it is called flexibility of structure. In general flexibility of a structure is the displacement caused by a unit force.

$$f = \frac{\delta}{P} \text{ or } f = \frac{\theta}{M}$$

where, f = Flexibility, δ = Displacement, P = Force, θ = Rotation, M = Moment

20.	**Write the element flexibility matrix for a truss member.**	**REMEMBER BT-L1**	**CO4**

The element flexibility matrix for a truss member is as follows:

$$f = \frac{L}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

21.	**Give the mathematical expression for the degree of static indeterminacy of rigid jointed plane frames.**	**REMEMBER BT-L1**	**CO4**

The mathematical expression for the degree of static indeterminacy of rigid jointed plane frames is as follows:

Degree of static indeterminacy = (No. of closed loops x 3) – No. of releases

22.	**Find the degree of indeterminacy of a propped cantilever beam.**	**REMEMBER BT-L1**	**CO4**

For propped cantilever, along with the cantilever reactions there will also be a reaction from the free end. But, there are only three equilibrium equations. Therefore,

Degree of indeterminacy = Number of reaction - Number of equilibrium equations

i.e, Indeterminacy = 4−3 =1

Hence, a propped cantilever has one degree of indeterminacy.

23.	**What are the properties which characterize the structure response by means of force- displacement relationship?**	**REMEMBER BT-L1**	**CO4**

The following conditions are the properties of force-displacement relationship:

- The force and displacement are interrelated quantities
- Force including moments, stresses, reaction, etc.,
- Displacements including rotations, strains, twists, etc.,
- Displacements take place due to forces or forces consistent with displacements.
- The relationship of each element must satisfy the stress-strain relationship of the element material.

24.	**Write the formulae for degree of indeterminacy for trusses and frames.**	**REMEMBER BT-L1**	**CO4**

The formula for degree of indeterminacy are as follows:

- Two dimensional pin jointed truss (2D Truss)

  $$i = (m+r) - 2j$$

- Two dimensional rigid frames/plane rigid frames (2D Frames)

  $$i = (m+r) - 3j$$

- Three dimensional space truss (3D Truss)

  $$i = (m+r) - 3j$$

- Three dimensional space frames (3D Frame)

  $$i = (6m+r) - 6j$$

where,

m = no of members

r = no of reactions

j = no of joints

25.	**Define internal and external indeterminacies**	**REMEMBER BT-L1**	**CO4**

Internal indeterminacy: Internal indeterminacy (I.I.) is the excess no of internal forces present in a member that make a structure indeterminate.

External indeterminacy: External indeterminacy (E.I.) is excess no of external reactions in the member that make the structure indeterminate.

Indeterminacy = I.I. + E.I.

E.I. = r − e

where,

r = no of support reactions

e = equilibrium conditions

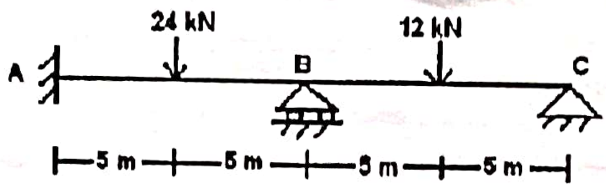
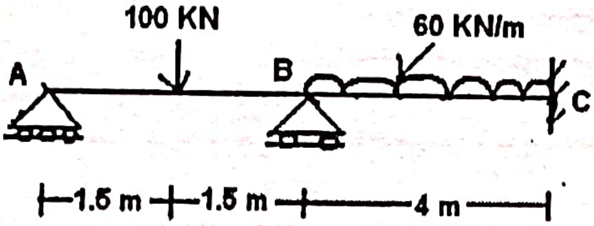
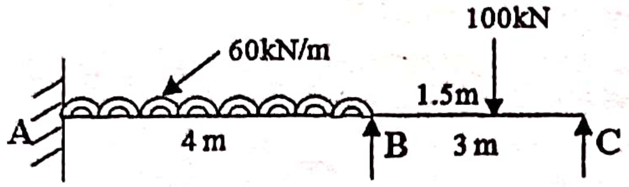
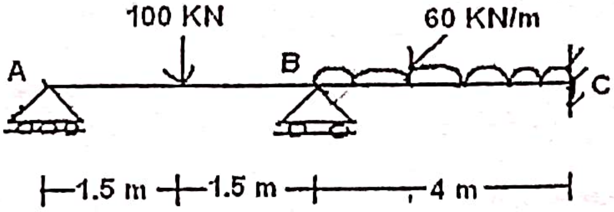
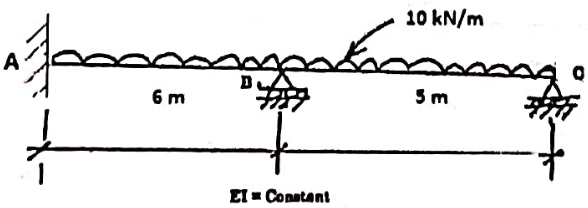
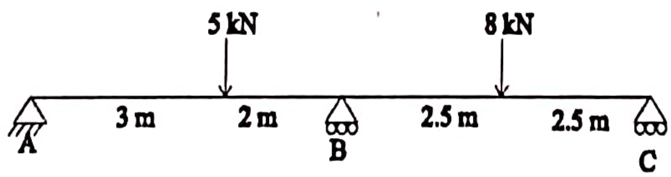
I.I. = i − EI

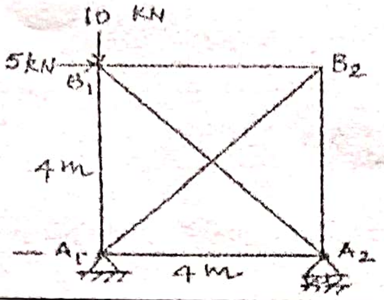
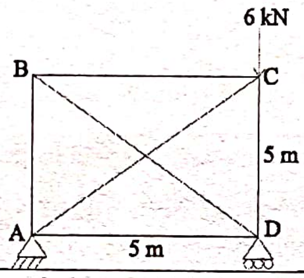
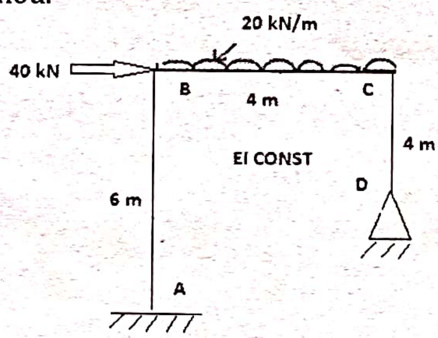
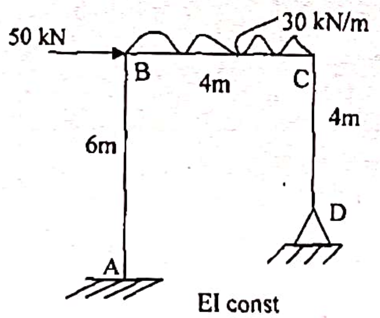
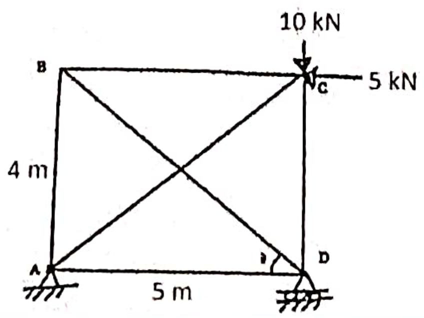
where,

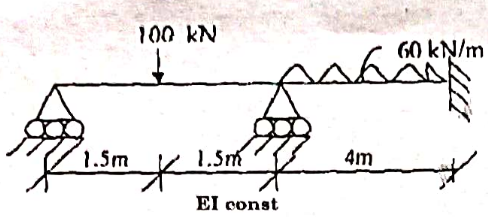
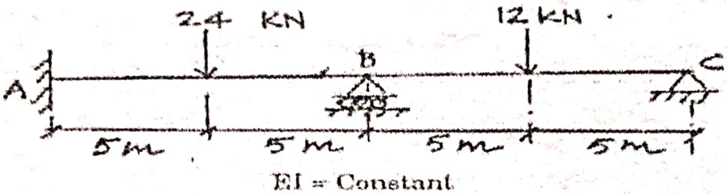
e = 3 (plane frames)

e = 6 (space frames)

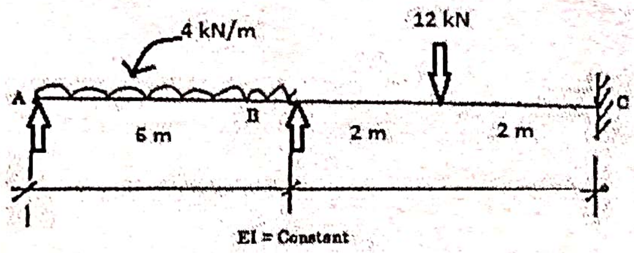
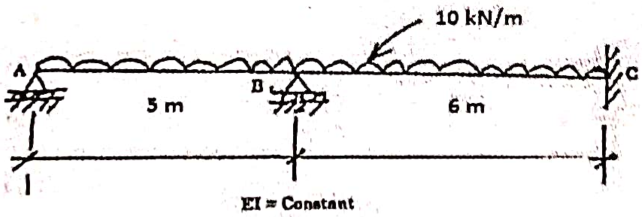
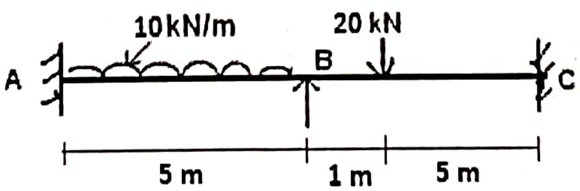
PART B

<table>
<tr><td>1.</td><td>Analyze the continuous beam ABC as shown in the following figure by the flexible matrix method and draw the bending moment diagram. (13)
</td><td>ANALYZE
BT-L4</td><td>CO4</td></tr>
<tr><td>2.</td><td>Analyze the continuous beam shown in the figure by the flexiblity matrix method and draw the bending moment diagram. (13)
</td><td>ANALYZE
BT-L4</td><td>CO4</td></tr>
<tr><td>3.</td><td>Analyze the continuous beam shown in the figure by direct flexibility approach. Take EI constant throughout. (13)
</td><td>ANALYZE
BT-L4</td><td>CO4</td></tr>
<tr><td>4.</td><td>Analyze the continuous beam shown in the following figure by the flexible matrix method and draw the bending moment diagram. (13)
</td><td>ANALYZE
BT-L4</td><td>CO4</td></tr>
<tr><td>5.</td><td>Analyze the beam ABC shown in figure by flexibility matrix method. (13)
</td><td>ANALYZE
BT-L4</td><td>CO4</td></tr>
<tr><td>6.</td><td>Analyze the continuous beam shown in figure by flexibility approach. EI is constant throughout. (13)
</td><td>ANALYZE
BT-L4</td><td>CO4</td></tr>
</table>

7.	Analyze the pin-jointed plane frame shown in figure by flexibility matrix method. Theflexibility for each member is constant. **(13)** 	**ANALYZE BT-L4**	**CO4**
8.	Analyze the truss shown in figure by flexibility approach. AE is constant for all members. **(13)** 	**ANALYZE BT-L4**	**CO4**
9.	Examine the moment of portal frame ABCD shown in figure using by flexibility matrix method. **(13)** 	**APPLY BT-L3**	**CO4**
10.	Analyze the frame given in figure by flexibility matrix method or force method. Take EI asconstant. **(13)** 	**ANALYZE BT-L4**	**CO4**
11.	Find the forces in the members of a pin jointed plane frame shown in figure by flexibilitymatrix method. AE is constant for all the members.**(13)** 	**APPLY BT-L3**	**CO4**

12.	Analyze the continuous beam shown in figure using force methods. (13) 	ANALYZE BT-L4	CO4
13.	Analyze the beam given in figure by flexibility matrix method. (13) 	ANALYZE BT-L4	CO4
14.	A cantilever of length 15 meters is subjected to a single concentrated load of 50 kN at the middle of the span. Find the deflection at the free end using flexibility matrix method. EI is uniform throughout. (13)	APPLY BT-L3	CO4
15.	A two span continuous beam ABC is fixed at A and hinged at supports B and C. Span of AB = span of BC = 6 m. Interpret flexibility influence co-efficient matrix assuming vertical reaction at B & C as redundant. (13)	APPLY BT-L3	CO4

PART C

1.	Analyze the continuous beam ABC shown in figure by flexibility matrix method and sketch thebending moment diagram. (15) 	ANALYZE BT-L4	CO4
2.	Analyze the continuous beam ABC shown in figure by flexibility matrix method and sketch thebending moment diagram. (15) 	ANALYZE BT-L4	CO4
3.	Analyze the continuous beam shown in figure using flexibility matrix method. (15) 	ANALYZE BT-L4	CO4

UNIT V
STIFFNESS METHOD
PART A

1.	**Write about stiffness matrix method.**	**REMEMBER BT-L1**	**CO5**
	Stiffness matrix method is also called the displacement method in which the displacements that occur in the structure are treated as unknowns. The number of displacements involved is equal to the number of degrees of freedom of the structure.		
2.	**Define stiffness coefficient.**	**REMEMBER BT-L1**	**CO5**
	A Stiffness coefficient k_{ij} is defined as the force developed at joint i due to a unit displacement at joint 'j' while all other joints are fixed. The constant 'k' is known as stiffness of the structure and it has a unit of force per unit displacement.		
3.	**Define the term rigidity of a structure.**	**REMEMBER BT-L1**	**CO5**
	Rigidity is the property of a structure that it does not bend or flex under an applied force. The opposite of rigidity is flexibility. The term 'stiffness' refers to the rigidity of a structural element. In general rigidity is the extent to which the element is able to resist deformation or deflection under the action of an applied force.		
4.	**Why the stiffness matrix method is also called equilibrium method or displacement method?**	**REMEMBER BT-L1**	**CO5**
	Stiffness method is based on the superposition of displacements and hence is also known as the displacement method and since it leads to the equilibrium equations, the method is also known as equilibrium method.		
5.	**What is the basic aim of the stiffness method?**	**REMEMBER BT-L1**	**CO5**
	The aim of the stiffness method is to evaluate the values of generalized coordinates 'r' knowing the structure stiffness matrix 'K' and nodal loads 'R' through the structure equilibrium equation. $\{R\} = [K]\{r\}$		
6.	**Write about static indeterminacy of a structure.**	**REMEMBER BT-L1**	**CO5**
	The excess number of reactions that make a structure indeterminate is called static indeterminacy. Static indeterminacy = No. of reactions – Equilibrium conditions		
7.	**How the basic equations of stiffness matrix obtained?**	**REMEMBER BT-L1**	**CO5**
	The basic equations of stiffness matrix are obtained as • Equilibrium forces • Compatibility of displacements • Force displacement relationships		
8.	**Write about generalized coordinates.**	**UNDERSTAND BT-L2**	**CO5**
	The generalized coordinates is defined as specifying a configuration of a system, a certain minimum number of independent coordinates are necessary. The least number of independent coordinates that are needed to specify the configuration is known as generalized coordinates.		
9.	**Write the formula for the size of the global stiffness matrix.**	**REMEMBER BT-L1**	**CO5**
	The formula for the size of the global stiffness matrix is as follows: The size of the global stiffness matrix (GSM) = No of nodes x Degrees of freedom per node.		

10.	**Write the relationship between stiffness matrix and flexibility matrix.**	**REMEMBER BT-L1**	**CO5**
The element stiffness matrix is the inverse of element stiffness matrix and vice versa. $f = 1/k \quad \& \; k = 1/f$ where, f = flexibility matrix k = stiffness matrix			
11.	**Define the perfect frame with an example.**	**REMEMBER BT-L1**	**CO5**
A perfect frame may be defined as that one which is made up of members just sufficient to keep the frame in equilibrium, when loaded without any change in the shape. The simplest example of a perfect frame is a triangle.			
12.	**Define displacement vector.**	**REMEMBER BT-L1**	**CO5**
The displacement vector of an object is defined as the vector distance from some initial point to a final point. It is therefore distinctly different from the distance traveled expect in the case of straight line motion.			
13.	**What is Rotation matrix?**	**REMEMBER BT-L1**	**CO5**
$$R = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$ where R is the Rotation matrix. Rotation matrices can only be used to describe rotations about the origin of the coordinate system. Rotation matrices provide an algebraic description of such rotations, and are used extensively for analysis of both determinate and indeterminate structures.			
14.	**List the properties of the stiffness matrix**	**REMEMBER BT-L1**	**CO5**
The properties of the stiffness matrix are, • It is a symmetric matrix • The sum of elements in any column must be equal to zero. • It is an unstable element therefore the determinant is equal to zero.			
15.	**Is it possible to develop the flexibility matrix for an unstable structure?**	**REMEMBER BT-L1**	**CO5**
No, it is not possible to develop the flexibility matrix for an unstable structure. In order to develop the flexibility matrix for a structure, it has to be stable and determinate			
16.	**Write down the equation of element stiffness matrix as applied to 2D plane element.**	**REMEMBER BT-L1**	**CO5**
The equation of element stiffness matrix for 2D plane element can be written as $$K = \frac{EI}{L}\begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$$ where, k is the stiffness L is the length of the member & EI is the flexural rigidity			
17.	**What are the types of structures that can be solved using stiffness matrix method?**	**REMEMBER BT-L1**	**CO5**
Structures such as simply supported, fixed beams and portal frames can be solved using stiffness matrix method. Stiffness method is based on the superposition of displacements of the structure and the equilibrium equations.			

18.	**Write the element stiffness for a truss element.**	**REMEMBER BT-L1**	**CO5**

The element stiffness matrix for a truss element is given by,

$$k = EA/L$$

where, k is the stiffness
E is the Young's Modulus
A is the cross-sectional area of the element &
L is the length of the element

19.	**Compare the flexibility and stiffness matrix method.**	**UNDERSTAND BT-L2**	**CO5**

Flexibility matrix method	Stiffness matrix method
• The redundant forces are treated as basic unknowns.	• The joint displacements are treated as basic unknowns.
• The number of equations involved is equal to the degree of static indeterminacy of the structure.	• The number of displacements involved is equal to the no of degrees of freedom of the structure.
• The method is the generalization of consistent deformation method.	• The method is the generalization of the slope deflection method.
• Different procedures are used for determinate and indeterminate structures.	• The same procedure is used for both determinate and indeterminate structures.

20.	**Write a short note on global stiffness matrices.**	**REMEMBER BT-L1**	**CO5**

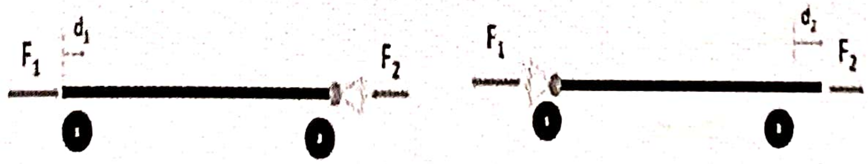
The global stiffness matrix can be obtained by summing the stiffness matrix for each element, the formulation is

$$K = \sum_{e=1}^{N} k^{(e)}$$

where,
K = Global stiffness matrix
k = Local element matrix
N = Total number of element
e = Index

21.	**Mention the stiffness coefficient for an axial element.**	**UNDERSTAND BT-L2**	**CO5**

For an axial member shown below stiffness coefficient is given by:



$$F_1 = \frac{AE}{L} d_1 - \frac{AE}{L} d2 \qquad \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix} = \frac{AE}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} \begin{Bmatrix} d_1 \\ d_2 \end{Bmatrix}$$

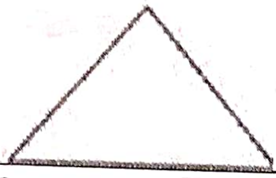
$$F_2 = \frac{-AE}{L} d_1 + \frac{AE}{L} d2 \qquad \begin{Bmatrix} F_1 \\ F_2 \end{Bmatrix} = \begin{bmatrix} k_{11} & k_{12} \\ k_{21} & k_{22} \end{bmatrix} \begin{Bmatrix} d_1 \\ d_2 \end{Bmatrix}$$

$k_{11} = k_{22} = AE/L$
$k_{21} = k_{12} = -AE/L$
where, $k_{11}, k_{22}, k_{21}, k_{12}$ are the stiffness coefficients.

22. Write about stability of a structure. — REMEMBER BT-L1 — CO5

The stability of structure includes external stability and internal stability. The external stability deals with support reaction whereas internal stability deals within the structure.

23. For the truss shown below, what is the DOF? — UNDERSTAND BT-L2 — CO5



For a pin-jointed plane frame/truss

DOF / Dk = 2j – r

where, r = no of reactions; j = no of joints

24. Develop the stiffness matrix for a simply supported beam. — UNDERSTAND BT-L2 — CO5

The stiffness matrix for a simply supported beam is as follows:

Second column:

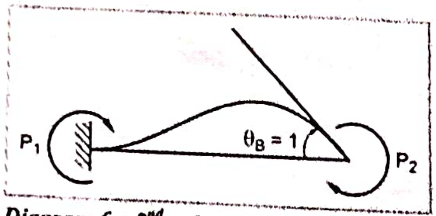


Diagram for 2[nd] column of stiffness matrix

$$P_{12} = \frac{2EI\theta_B}{l} = \frac{2EI}{l}$$

and $$P_{22} = \frac{4EI\theta_B}{l} = \frac{4EI}{l}$$

$$\therefore\ k = \begin{bmatrix} \frac{4EI}{l} & \frac{2EI}{l} \\ \frac{2EI}{l} & \frac{4EI}{l} \end{bmatrix}$$

First column:

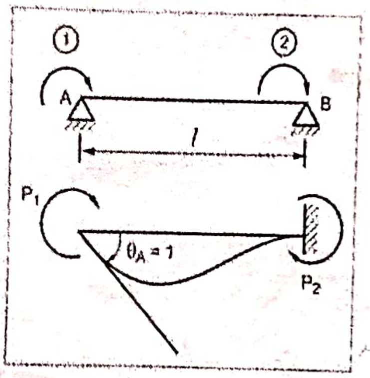


Diagram for 1[st] column of stiffness matrix

When $\theta_A = 1$,

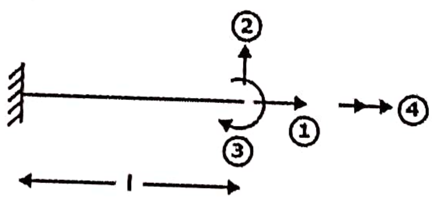
$$P_{11} = \frac{4EI\theta_A}{l} = \frac{4EI}{l}$$

and $$P_{21} = \frac{2EI\theta_A}{l} = \frac{2EI}{l}$$

where k is the stiffness matrix

25. Show the stiffness for various cases of a structure. — UNDERSTAND BT-L2 — CO5

Stiffness for various cases are as follows:



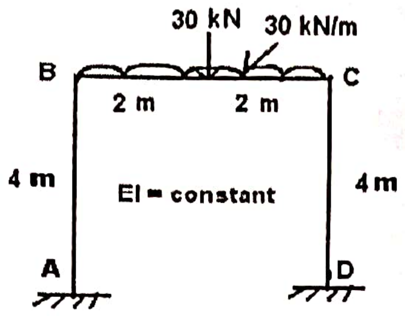
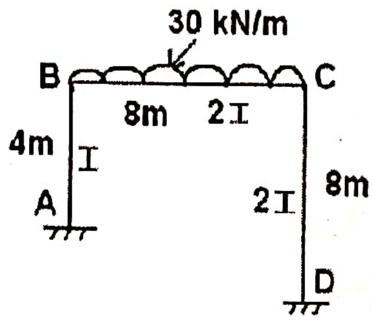
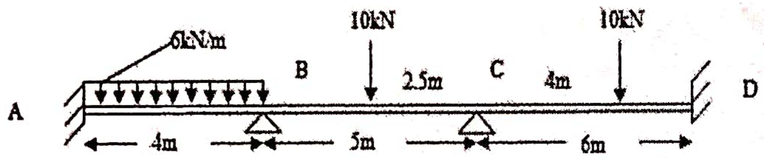
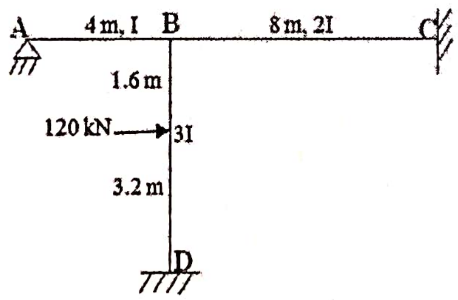
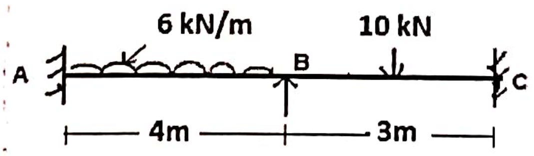
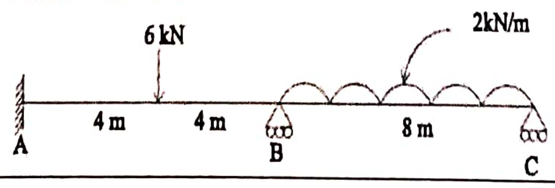
(1) Axial stiffness (k_{11}) = $\frac{AE}{l}$

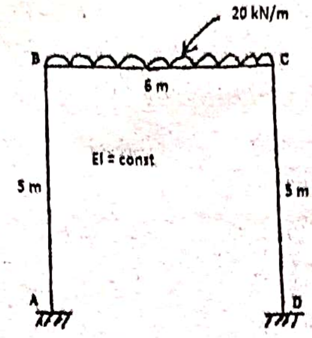
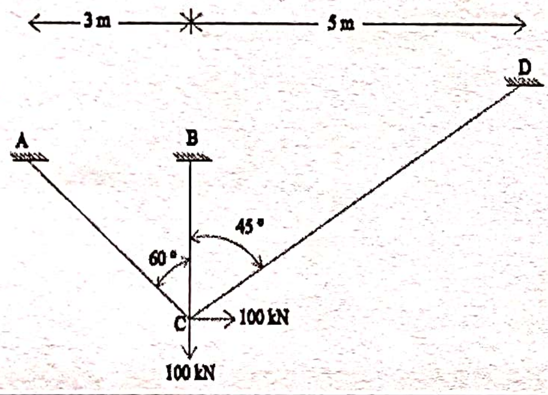
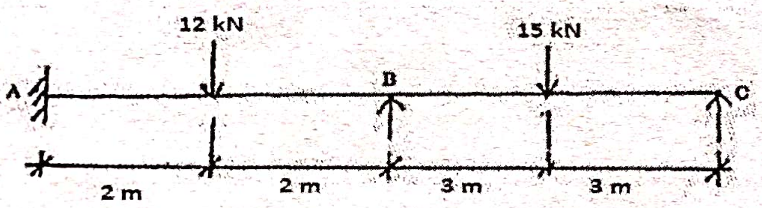
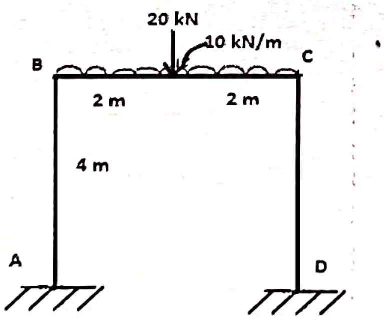
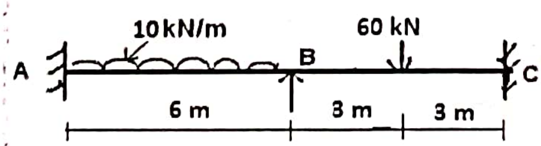
(2) Transverse stiffness (k_{22}) = $\frac{12EI}{l^3}$

(3) Flexural stiffness (k_{33}) = $\frac{4EI}{l}$

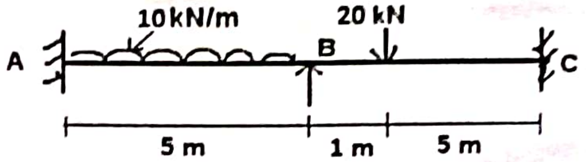
(4) Torsional stiffness (k_{44}) = $\frac{GJ}{l}$

PART B

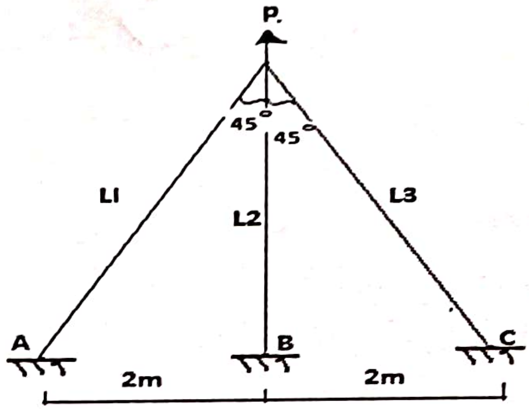
1.	Analyze the portal frame ABCD using stiffness method shown in figure and draw the bending moment diagram. (13) 	ANALYZE BT-L4	CO5
2.	Analyze the frame shown in figure by the matrix stiffness method. (13) 	ANALYZE BT-L4	CO5
3.	Analyze the beam shown in figure using direct stiffness approach. (13) 	ANALYZE BT-L4	CO5
4.	Using the direct stiffness approach, analyze the frame shown in figure. (13) 	ANALYZE BT-L4	CO5
5.	Analyze the beam ABC shown in figure by stiffness method. (13) 	ANALYZE BT-L4	CO5
6.	Interpret the moments for the beam shown in figure by stiffness method. EI is constant for all members. (13) 	ANALYZE BT-L4	CO5

7.	Analyze the portal frame ABCD shown in figure by stiffness matrix method. (13) 	ANALYZE BT-L4	CO5
8.	Analyze the truss shown in figure by stiffness method. AE is constant for all members. (13) 	ANALYZE BT-L4	CO5
9.	Analyze the continuous beam ABC shown in figure by stiffness matrix method and also draw the bending moment diagram. (13) 	ANALYZE BT-L4	CO5
10.	Analyze the continuous beam ABCD shown in figure by stiffness matrix method and also sketch the bending moment diagram. (13) 	ANALYZE BT-L4	CO5
11.	Analyze the continuous beam shown in figure by stiffness method. Draw the bending moment diagram. (13) 	ANALYZE BT-L4	CO5

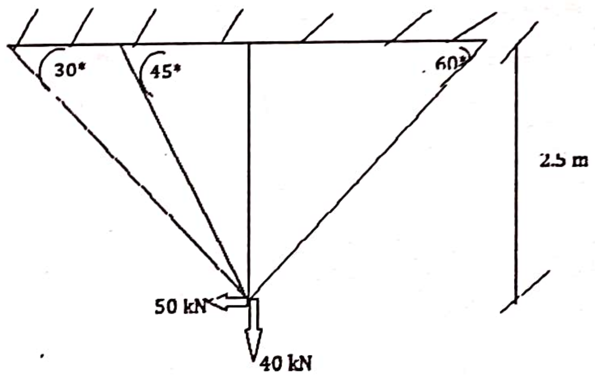
12. Analyze the continuous beam shown in figure using stiffness matrix method. **(13)** — **ANALYZE BT-L4** — **CO5**



13. Interpret the frame given in figure by stiffness matrix method. AE is equal to unity. **(13)** — **ANALYZE BT-L4** — **CO5**

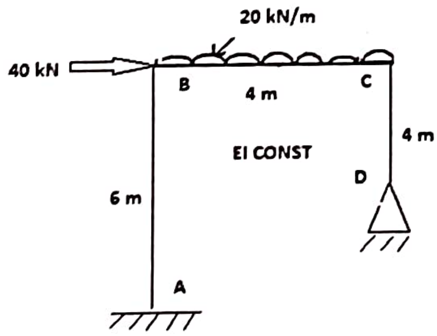


14. Analyze the pin – jointed truss shown in by using stiffness method. Area of cross section for all members =1000 mm2 and modulus of elasticity E=200kN/mm². **(13)** — **ANALYZE BT-L4** — **CO5**

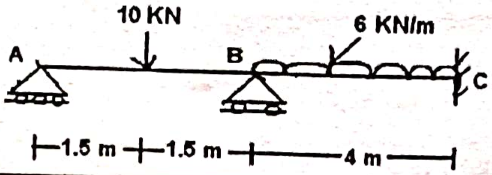
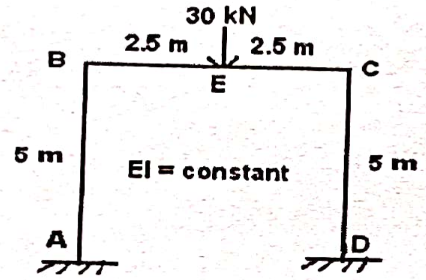
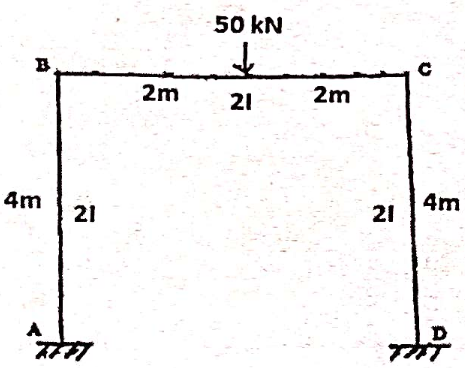


15. A two span continuous beam ABC is fixed at A and simply supported over the supports B and C.AB = 10 m and BC = 6 m. Moment of inertia is constant throughout. A single concentrated load of 12 Tons acts over AB and a uniformly distributed load of 11 Ton/m acts over BC. Analyze the beam by stiffness matrix method. **(13)** — **ANALYZE BT-L4** — **CO5**

16. Analyze the portal frame ABCD shown in figure using by stiffness matrix method. **(13)** — **ANALYZE BT-L4** — **CO5**



PART C

1.	Analyze the continuous beam ABC of figure using the stiffness method and also draw the bending moment diagram. (15) 	ANALYZE BT-L4	CO5
2.	Analyze the portal frame ABCD shown in figure using stiffness method and also draw the bending moment diagram. (15) 	ANALYZE BT-L4	CO5
3.	A two span continuous beam ABC is fixed at A and simply supported over the supports B and C. AB = 10 m and BC = 8 m. Moment of inertia is constant throughout. A single concentrated central load of 10 Tons acts on AB and a uniformly distributed load of 8 Ton/m acts over BC. Analyze the beam by stiffness matrix method. (15)	ANALYZE BT-L4	CO5
4.	Analyze the portal frame ABCD shown in figure by Stiffness matrix method and draw the bending moment diagram. (15) 	ANALYZE BT-L4	CO5

---------------------------X---------------------------

verified K.C... 26/7/23

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
BATCH (2021-2025) - STUDENT NAMELIST

YEAR/SEM: III / V **TOTAL STRENGTH : 21**

Roll No	Register Number	Student Name
1	821121103001	AKALYA J
2	821121103002	ANITHA B
3	821121103003	ARULPANDIYAN A
4	821121103004	ARUNKUMAR M
5	821121103006	MADHAN D S
6	821121103007	MANIKKARAJ R
7	821121103008	MATHANKUMAR S
8	821121103009	MOHAN S
9	821121103010	NAAVINIYAA G V
10	821121103012	PASHAGAN G (VOC)
11	821121103013	PRAGADISH M
12	821121103014	PRASANNA R
13	821121103015	SARAVANAN K
14	821121103016	SURYA.V
15	821121103017	TAMILARASAN T
16	821121103018	VENKATACHALAM D
17	821121103019	VIJAY S
18	821121103301	MOHAMMED RIYAS J
19	821121103302	SINDHU G
20	821121103303	SURUTHI A
21	821121103701	SANJAIMANI M

26/07/2023 26/07/2023

CLASS COORDINATOR
(Mr.K.ARUN)

HOD/CIVIL
(Dr.R.SARAVANAN)

Format-QP06

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DEPARTMENT OF CIVIL ENGINEERING

TIME TABLE (JULY' 2023 – NOV' 2023, ODD SEM)

B.E – CIVIL (Reg. 21) - With Effect from 27.7.2023 – Tentative Last Working Day – 17.11.2023

Batch:2021 - 2025 — Strength:21

Year: III — Semester: V — Class Room: 235 — Block: II

Session	1	2	10.45 am - 11.00 am	3	4	12.30 pm - 01.10 pm	5	6	02.40 pm - 02.50 pm	7	8
Day	09.15am - 10.00am	10.00am - 10.45am		11.00am - 11.45am	11.45am - 12.30pm		01.10pm - 01.55pm	01.55pm - 02.40pm		02.50pm - 03.35pm	03.35pm - 04.20pm
MON	CE3502	MX3084	BREAK	CE3503	CE3025	LUNCH BREAK	CE3005	CE3050	BREAK	SPORTS	
TUE	CE3501	CE3501		T&P (A)	CE3502		CE3050	CE3503		CE3025	CE3005
WED	CE3050	CE3005		CE3501	CE3025		T&P(SS)	MX3084		CE3503	CE3502
THU	CE3501	CE3503		CE3502	NPTEL		VAC			GATE/CE	CE3025
FRI	CE3502	CE3050		CE3005	MX3084		CE3511			CE3511	
SAT	CE3025	CE3050		LIB/NET	CE3503		CE3501	CE3005		CC	

SUB CODE	NAME OF THE SUBJECT	CATEGORY	CREDITS	NAME OF THE STAFF	DEPT	PERIODS/WEEK
TUTORIAL (T), PROFESSIONAL ELECTIVE (PE), VERTICAL(V), MANDATORY COURSE(MC)						
CE3501	Design of Reinforced Concrete structural Elements	PCC	3	Mr.A.Sagaya Albert	CIVIL	5
CE3502	Structural Analysis I	PCC	3	Mr.K.Arun	CIVIL	5
CE3503	Foundation Engineering	PCC	3	Mrs.A.Suganya	CIVIL	5
CE3005	Rehabilitation/Heritage Restoration	PEC	3 (PE-I)	Mr.R.Sundharam	CIVIL	5
CE3025	Airports and Harbours	PEC	3 (PE-II)	Mr.R.Ramchandar	CIVIL	5
CE3050	Finance for Engineers	PEC	3 (PE-III)	Dr.K.Sudhakar	T&P	5
MX3084	Disaster Risk Reduction And Management	MC	0(MC-I)	Dr.B.Sureshbabu	T&P	3
PRACTICAL						
CE3511	Highway Engineering Laboratory	PC	2	Mrs.A.Suganya	CIVIL	4
CE3512	Survey Camp	EEC	1	Mr.R.Sundharam	CIVIL	-
VALUE ADDITION INTIATIVES (VAI)						
CC	Certification Course on AutoCADD		VAI	Mrs.A.Suganya	CIVIL	2
GATE / CE	GATE / Competitive Exam		VAI	Mr.A.Sagaya Albert	CIVIL	1
LIB/NET	Library / Internet		VAI	Mr.K.Arun	CIVIL	1
NPTEL	NPTEL Swayam Courses		VAI	Mr.K.Arun	CIVIL	1
S	Sports		VAI	Mr.K.Arun	CIVIL	2
T&P (A)	Training & Placement - Aptitude		VAI	Ms.P.Suganya	T&P	1
T&P(SS)	Training & Placement - Softskill		VAI	Dr.K.Sudhakar	T&P	1
VAC	Value Added Course on Urban Planning		VAI	Mr.D.Nandakumar	CIVIL	2

CLASS CO-ORDINATOR	NAME OF THE REPRESENTATIVES	ROLL NO
Mr.K.Arun	J.Akalya	01
	J.Mohammed Riyaz	18
CLASS COMMITTEE CHAIR PERSON	Mr.D.Nandakumar	

R. Ramchandar 26/7/2023 — DEPT. TTC

R. Saravanan 26/07/2023 — HOD

J. [illegible] 26/7/2023 — PRINCIPAL

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DEPARTMENT OF CIVIL ENGINEERING

TIME TABLE (JULY' 2023 – NOV' 2023, ODD SEM)

B.E – CIVIL (Reg. 21) - With Effect from 27.7.2023 – Tentative Last Working Day – 17.11.2023

No.of Periods / Week : 19

Staff Name: Mr.K.Arun / Asst.Prof

Session / Day	1 09.15am - 10.00am	2 10.00am - 10.45am	10.45 am - 11.00am	3 11.00am - 11.45am	4 11.45am - 12.30pm	12.30 pm - 01.10 pm	5 01.10pm - 01.55pm	6 01.55pm - 02.40pm	02.40 pm - 02.50 pm	7 02.50pm - 03.35pm	8 03.35pm - 04.20pm
MON	CE3502		BREAK			LUNCH BREAK		CE8711	BREAK	SPORTS	
TUE					CE3502					CE8711	
WED										CE8711	CE3502
THU				CE3502	NPTEL					CE8711	
FRI	CE3502									CE8711	
SAT				LIB/NET						CE8711	

SUB CODE	SUBJECT NAME	YEAR	CREDITS	PERIODS/ WEEK
	THEORY			
CE3502	Structural Analysis I	III	3	5
	PRACTICAL			
CE8711	Creative and Innovative Project	IV	2	10
	VALUE ADDED INITIATIVE (VAI)			
LIB/NET	Library/Internet	III	-	1
NPTEL	NPTEL/SWAYAM Online Course	III	-	1
S	Sports	III	-	2

R. Ramchandran 26/07/2023
DEPT. TTC

R. Sandaram 26/07/2023
HOD

J. [signature] 26/7/2023
PRINCIPAL

KINGS COLLEGE OF ENGINEERING

CONTINUOUS ASSESSMENT TEST I (SEPTEMBER 2023

CE3502-STRUCTURAL ANALYSIS I

Class / Sem : III CIVIL / 05 | **Date / Session: 16.09.2023/AN**

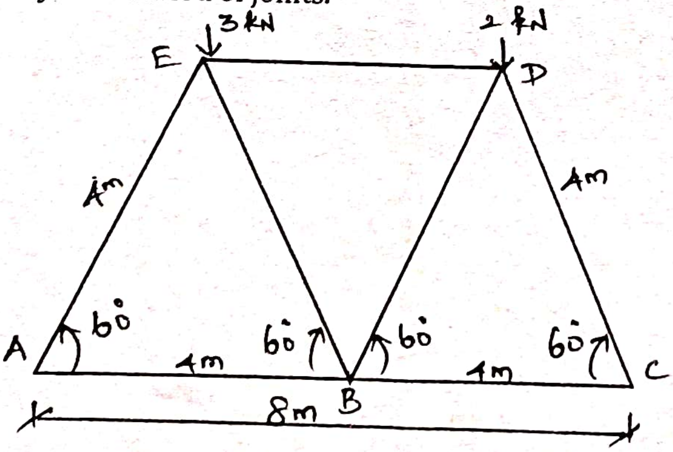
Maximum : 100 Marks | **Time : 01.10 p.m. - 04.10 p.m.**

Answer ALL questions

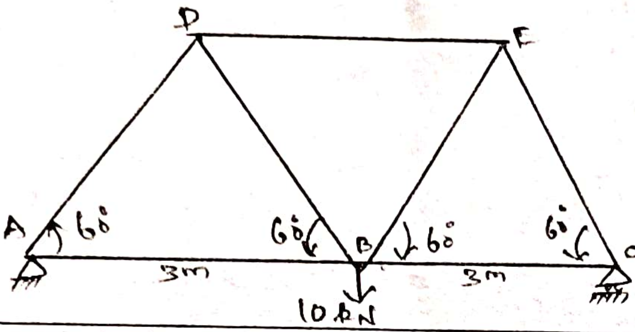
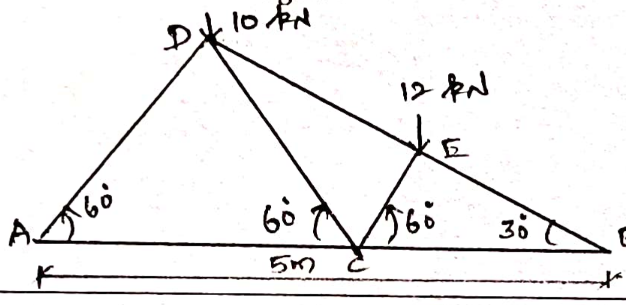
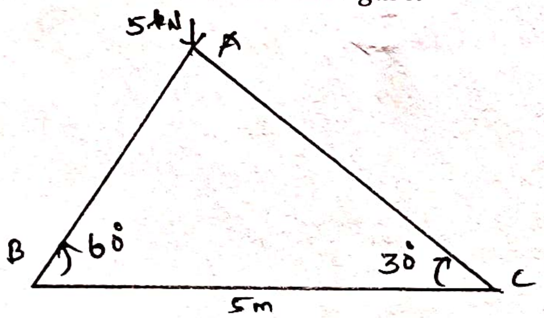
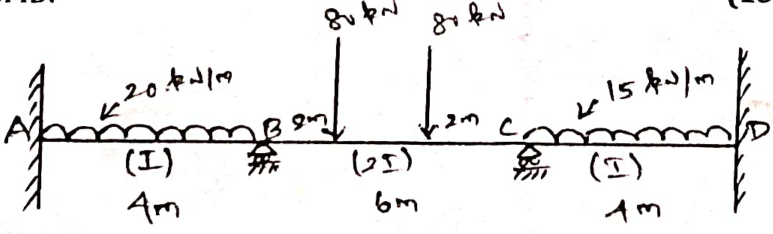
PART – A (10 x 2= 20 Marks)

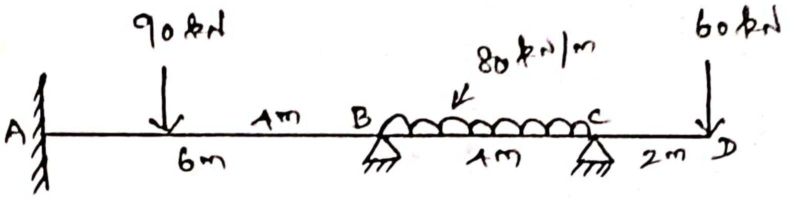
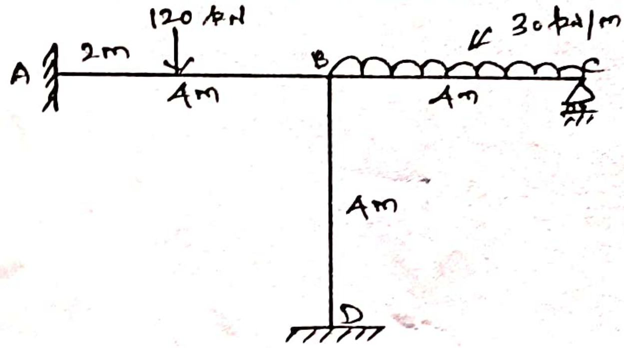
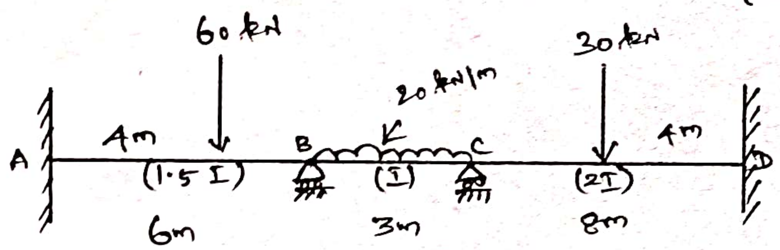
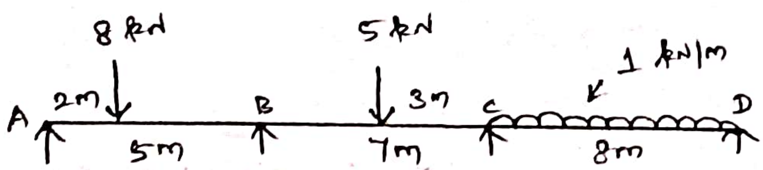
Q. No	Question	BT Level	CO
1.	Outline determinate and indeterminate structures.	UNDERSTAND BT- L2	CO1
2.	What is meant by redundant frame and deficient frame?	REMEMBER BT-L1	CO1
3.	List the classification of frames.	REMEMBER BT-L1	CO1
4.	Define tension coefficient.	REMEMBER BT-L1	CO1
5.	State the assumptions made in the slope deflection method.	REMEMBER BT-L1	CO2
6.	Write about the effect of support displacement in a structure.	UNDERSTAND BT- L2	CO2
7.	How many slope deflection equations are available for two span continuous beam?	UNDERSTAND BT- L2	CO2
8.	What is a sway frame?	REMEMBER BT-L1	CO2
9.	Write about distribution factor.	REMEMBER BT-L1	CO3
10.	Define carry over factor.	REMEMBER BT-L1	CO3

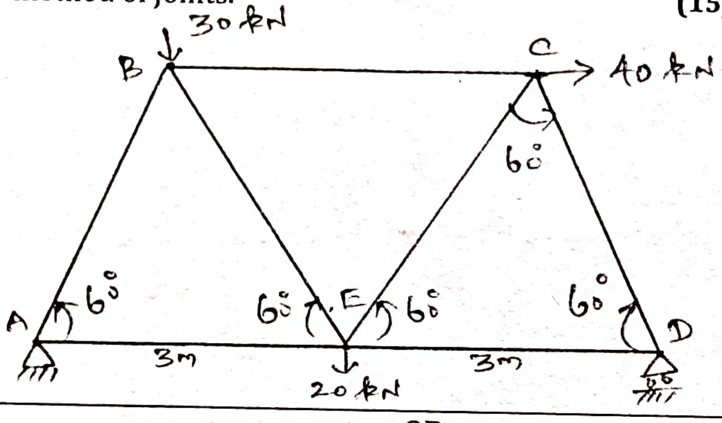
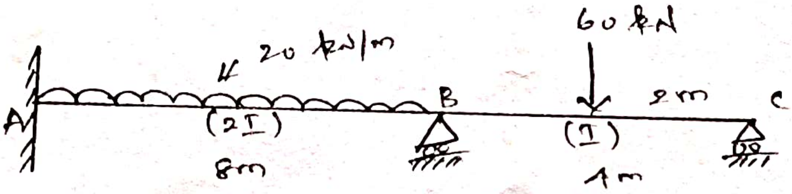
PART – B (5 x 13 = 65 Marks)

Q. No	Question	BT Level	CO
11.(a)	Analyze the pin jointed plane determinate truss shown in the figure by the method of joints. (13) 	ANALYZE BT-L4	CO1

OR

<table>
<tr><td>11.(b)</td><td>Determine the forces in all the members of the truss given in the figure. Use method of joints. (13)

</td><td>ANALYZE
BT-L4</td><td>CO1</td></tr>
<tr><td>12.(a)</td><td>Using method of joints, analyze the forces in all the members of the truss shown in the figure. (13)

</td><td>ANALYZE
BT-L4</td><td>CO1</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>12.(b)</td><td>Using method of sections, analyze the forces in all the members of the truss shown in the figure. (13)

</td><td>ANALYZE
BT-L4</td><td>CO1</td></tr>
<tr><td>13.(a)</td><td>A continuous beam ABC is fixed at A and simply supported at B and C. The span AB is 5m and carries a concentrated load of 80kN at its mid-span and the span BC is 8m and carries a uniformly distributed load of 12kN/m. Take the flexural rigidity for portion AB as EI and that for portion BC as 2EI. Adapt slope deflection method and draw the bending moment diagram. (13)</td><td>APPLY
BT-L3</td><td>CO2</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>13.(b)</td><td>Using slope deflection method, solve the continuous beam of three spans, which is loaded as shown in figure. Draw SFD & BMD. (13)

</td><td>APPLY
BT-L3</td><td>CO2</td></tr>
</table>

<table>
<tr><td>14.(a)</td><td>Analyze the continuous beam shown in the figure by the slope deflection method and draw the shear force and bending moment diagram. Take the value of the EI as constant. (13)

</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>14.(b)</td><td>Analyze the portal frame ABCD shown in figure by slope deflection method. Take EI = constant. (13)

</td><td>ANALYZE
BT-L4</td><td>CO2</td></tr>
<tr><td>15.(a)</td><td>Using moment distribution method, solve the continuous beam, which is loaded as shown in figure. Draw SFD & BMD. (13)

</td><td>APPLY
BT- L3</td><td>CO3</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>15.(b)</td><td>Using moment distribution method, determine the forces in all the members of the beam shown in the figure. EI is constant throughout. (13)

</td><td>APPLY
BT- L3</td><td>CO3</td></tr>
</table>

	PART – C (1 x 15 = 15 Marks)		
16.(a)	Analyze the determinate truss loaded as shown in the figure by the method of joints. **(15)** 	ANALYZE BT-L4	CO1
	OR		
16.(b)	Analyze the continuous beam shown in the figure by slope deflection method, if joint B sinks by 10mm. Given EI = 4000 kNm^2. Draw SFD & BMD **(15)** 	ANALYZE BT-L4	CO2

Blooms Taxonomy	Level-1 Remember	Level-2 Understand	Level-3 Apply	Level-4 Analyze	Level-5 Evaluate	Level-6 Create
			Question Number			
Part-A	2,3,4,5,8,9,10	1,6,7				
Part-B			13 (a,b) 15 (a,b)	11 (a,b) 12 (a,b) 14 (a,b)		
Part-C				16 (a,b)		
Total	14	06	26	54		
Distribution	20		80		-	

K. [signature] 12/09/2023
COURSE IN-CHARGE

K. [signature] 12/09/2023
DEPT. IQAC MEMBER

R. Saravanan 12/09/2023.
HOD/CIVIL

24

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-2024 (ODD SEM)
CE3502 – STRUCTURAL ANALYSIS I
CAT 1 EXAMINATION – ANSWER KEY

CLASS/SEM : III / V **19.09.2023**

PART - A

1. Outline determinate and indeterminate structures.

Determinate structure: A structure is considered statically determinate if all of its support reactions and member forces can be calculated using only the equations of static equilibrium.

Indeterminate structure: A structure is termed as statically indeterminate, if it cannot be analyzed from principles of statics alone, i.e. $\sum H = 0, \sum V = 0, \sum M = 0$.

2. What is redundant frame and deficient frame?

If the number of members are more than (2j – 3), then the frame is known as redundant frame. **(n> 2j-3)**

Also, if the number of members are less than (2j – 3), then the frame is known as deficient frame. **(n< 2j-3)**

3. List the classification of frames.

Frames are classified as follows:

- Perfect frame
- Deficient frame
- Redundant frame
- Statically determinate frame
- Statically indeterminate frame

4. Define tension coefficient.

The force per unit length of a member is known as tension coefficient. It is given by, **T = F/ L** where, T is tension coefficient, F is the force and L is length of the member.

5. State the assumptions made in the slope deflection method.

Following are the assumptions made in slope deflection method,

- All the joints of the frame are rigid, i.e, the angle between the members at the joints do not change, when the frame is loaded.
- Whenever the beams or frames are deflected, the rigid joints are considered to rotate as a whole, i.e, the angle between the tangents to the various branches of the elastic curve meeting at a joint, remain the same as those in the original structure.
- Distortions, due to axial and shear stresses, being very small, are neglected.

6. Write about the effect of support displacement in a structure.

The statically determinate structure changes their shape due to support settlement and this would in turn include reactions and stresses in the system. Since there is not external force system acting on the structures, these forces form a balanced force system by themselves and the structure would be in equilibrium.

7. **How many slope deflection equations are available for two span continuous beam?**

Two numbers of slope-deflection equations are available for each span, describing the moment at each end of the span and hence four slope deflection equations are available for two span continuous beam.

8. **What is sway frame?**

Sway is the lateral movement of joints in a portal frame due to the un-symmetry in geometry of the frame, un-symmetry in loading, moments of inertia, end conditions, settlement of one end of frame and horizontal loading on the column of the frame.

9. **Write about distribution factor.**

Distribution factor for the member at a joint is the ratio of the relative stiffness of a member to the total stiffness of all the members meeting at the joint.

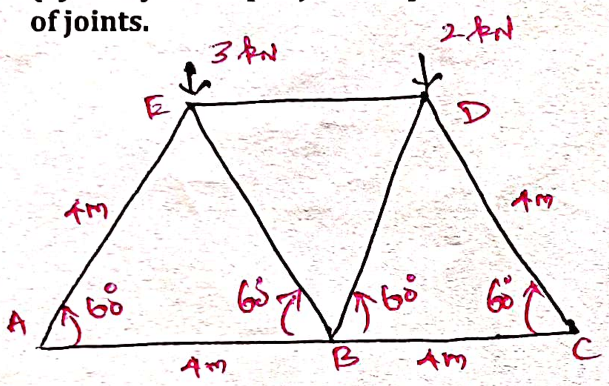
Distribution factor = K / ∑K

10. **Define carry over factor.**

Carry over factor is defined as the ratio of the induced moment to the applied moment. It is the one in which half of the balanced moment is carried to far fixed end (ie.CO=0.5). The carry over factor is zero if the end is hinged/pin connected.

PART - B

11. (a) Analyze the pin jointed plane determinate truss shown in the figure by the method of joints.



R_A = 2.75 kN (03)

R_C = 2.25 kN

F_{DE} = 1.15 kN (C) (10)

F_{AE} = 3.17 kN (C)

F_{AB} = 1.58 kN (T)

F_{DC} = 2.59 kN (C)

F_{CB} = 1.295 kN (T)

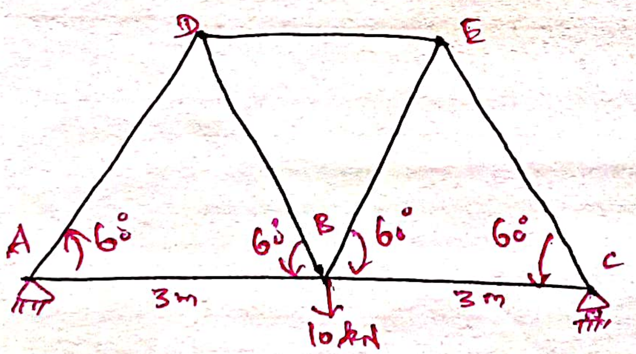
F_{BD} = 0.29 kN (T)

F_{BE} = 0.29 kN (C)

11.(b) Determine the forces in all the members of the truss given in the figure. Use method of joints.

R_A = 0.33 kN (02)

R_B = 0.67 kN



F_{CA} = 0.67 kN (C) (10)

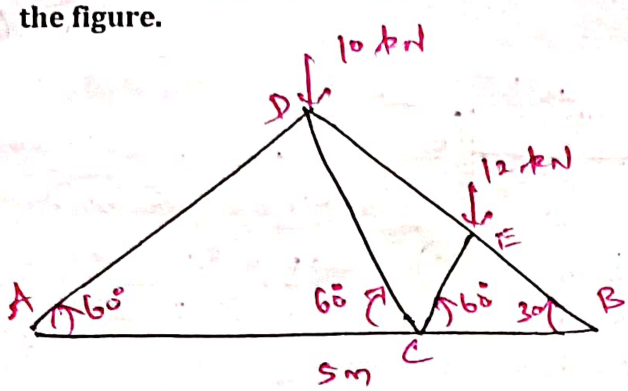
F_{AD} = 0.58 kN (T)

F_{BC} = 1.33 kN (C)

F_{CD} = 1.15 kN (T)

F_{BD} = 1.16 kN (T)

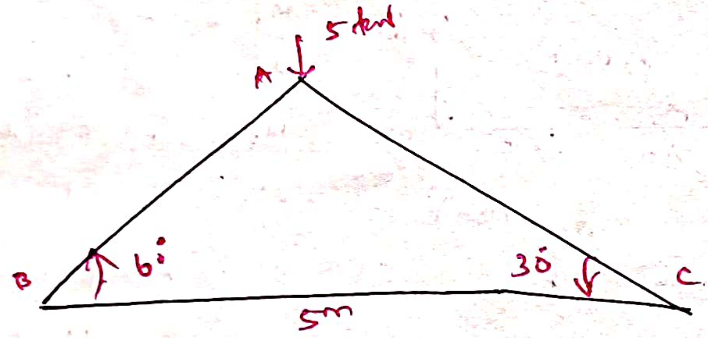
12. (a) Using method of joints, analyze the forces in all the members of the truss shown in the figure.



AD = 2.5 m (02) (03)
AF = 1.25 m
BE = 2.165 m
BG = 1.875 m
AG = 3.125 m
RA = 12 kN
RB = 10 kN

(08)
FDA = 13.86 kN (C)
FAC = 6.93 kN (T)
FEB = 20 kN (C)
FBC = 17.32 kN (T)
FEC = 10.89 kN (C)
FDC = 10.29 kN (T)
FED = 14.4 kN (T)

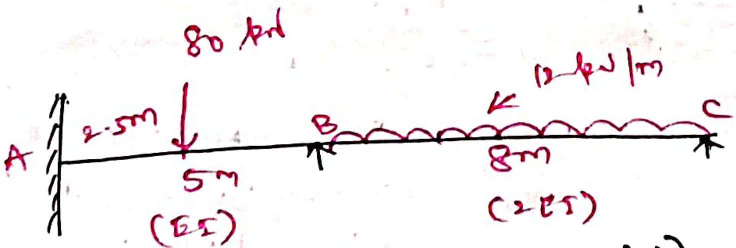
12.(b) Using method of sections, analyze the forces in all the members of the truss shown in the figure.



(02) (03)
AB = 2.5 m
BX = 1.25 m
RC = 1.25 kN
RB = 3.75 kN

(08)
FAB = 4.33 kN (C)
FBC = 2.17 kN (T)
FAC = 2.5 kN (C)

13. (a) A continuous beam ABC is fixed at A and simply supported at B and C. The span AB is 5m and carries a concentrated load of 80kN at its mid-span and the span BC is 8m and carries a uniformly distributed load of 12kN/m. Take the flexural rigidity for portion AB as EI and that for portion BC as 2EI. Adapt slope deflection method and draw the bending moment diagram.



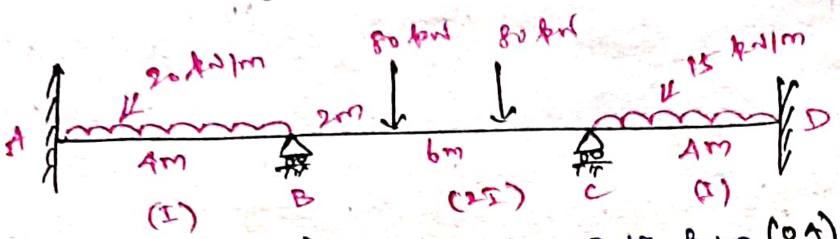
MFAB = −50 kNm (03)
MFBA = 50 kNm
MFBC = −64 kNm
MFCB = 64 kNm

MAB = −11.42 kNm (04)
MBA = 37.14 kNm
MBC = −37.14 kNm
MCB = 0

Span AB = 40 kNm (03)
BC = 90 kNm

S.F & B.M ⇒
S.FD & B.M.D = (03)

13.(b) Using slope deflection method, solve the continuous beam of three spans, which is loaded as shown in figure. Draw SFD & BMD.



$M_{FAB} = -26.67$ kNm (03)
$M_{FBA} = 26.67$ kNm
$M_{FBC} = -106.67$ kNm
$M_{FCB} = 106.67$ kNm
$M_{FCD} = -20$ kNm
$M_{FDC} = 20$ kNm

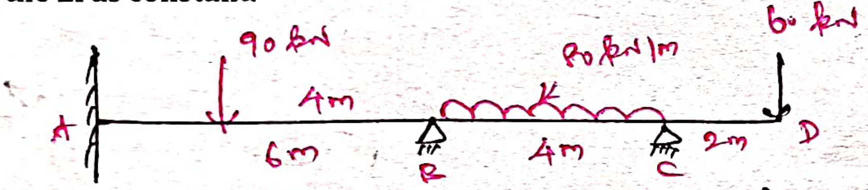
$EI\theta_B = 49$ (02)
$EI\theta_C = -51.3$

$M_{AB} = -2.17$ kNm (04)
$M_{BA} = 45.67$ kNm
$M_{BC} = -75.67$ kNm
$M_{CB} = 71.22$ kNm
$M_{CD} = -71.22$ kNm
$M_{DC} = -5.61$ kNm

S.F & B.M ⇒ AB = 40 kNm (02)
BC = 106.67 kNm
CD = 30 kNm

S.F.D & B.M.D (02)

14.(a) Analyze the continuous beam shown in the figure by the slope deflection method and draw the shear force and bending moment diagram. Take the value of the EI as constant.



$M_{FAB} = -80$ kNm (03)
$M_{FBA} = 40$ kNm
$M_{FBC} = -106.67$ kNm
$M_{FCB} = 106.67$ kNm

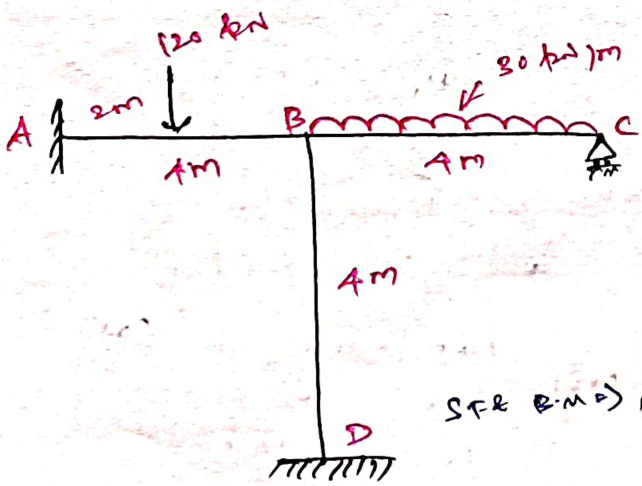
$EI\theta_B = 84.57$ (02)
$EI\theta_C = -148.92$

$M_{AB} = -52.11$ kNm (04)
$M_{BA} = -96.62$ kNm
$M_{BC} = 96.62$ kNm
$M_{CB} = 0$

S.F & B.M ⇒ AB = 120 kNm (02)
BC = 160 kNm

S.F.D & B.M.D (02)

14. (b) Analyze the portal frame ABCD shown in figure by slope deflection method. Take EI = constant.



$M_{FAB} = -60$ kNm (03)
$M_{FBA} = 60$ kNm
$M_{FBC} = -40$ kNm
$M_{FCB} = 40$ kNm
$M_{FBD} = M_{FDB} = 0$

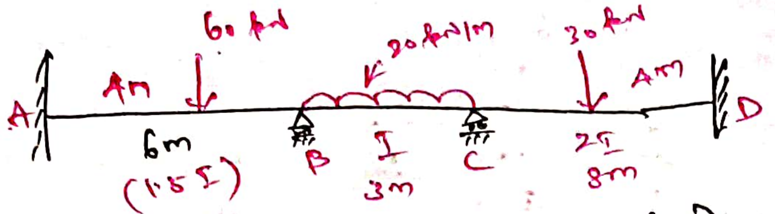
$EI\theta_B = 0$ (02)
$EI\theta_C = -40$

$M_{AB} = -60$ kNm (04)
$M_{BA} = 60$ kNm
$M_{BC} = -60$ kNm
$M_{BD} = M_{DB} = 0$

SF & B.M ⇒ AB = 120 kNm (02)
BC = 60 kNm

S.F.D & B.M.D (02)

15.(a) **Using moment distribution method, solve the continuous beam, which is loaded as shown in figure. Draw SFD & BMD.**



MFAB = −26.67 kNm (02)
MFBA = 53.33 kNm
MFBC = −15 kNm
MFCB = 15 kNm
MFCD = −30 kNm
MFDC = 30 kNm

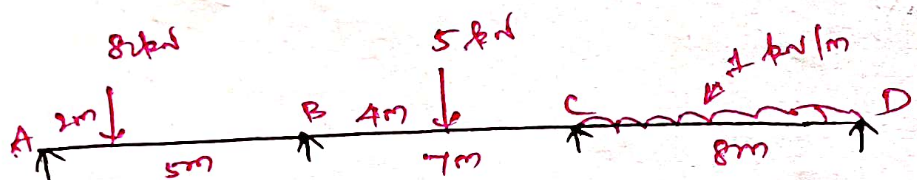
D.F ⇒ BA = 0.43 (02)
BC = 0.57
CB = 0.57
CD = 0.43

MAB = 36.56 (04)
MBA = 33.45
MBC = −33.45
MCB = 17.91
MCD = −17.91
MDC = 36.04

S.F & B.M ⇒ AB = 80 kNm (02)
BC = 22.5 kNm
CD = 60 kNm

S.F.D & B.M.D (02)

15.(b) **Using moment distribution method, determine the forces in all the members of the beam shown in the figure. EI is constant throughout.**



MFAB = −5.76 kNm (03)
MFBA = 5.12 kNm
MFBC = −7.68 kNm
MFCB = 4.89 kNm
MFCD = −5.33 kNm
MFDC = 5.33 kNm

DF ⇒ AB = 1 (02)
BA = 0.59
BC = 0.41
CB = 0.60
CD = 0.40
DC = 1.00

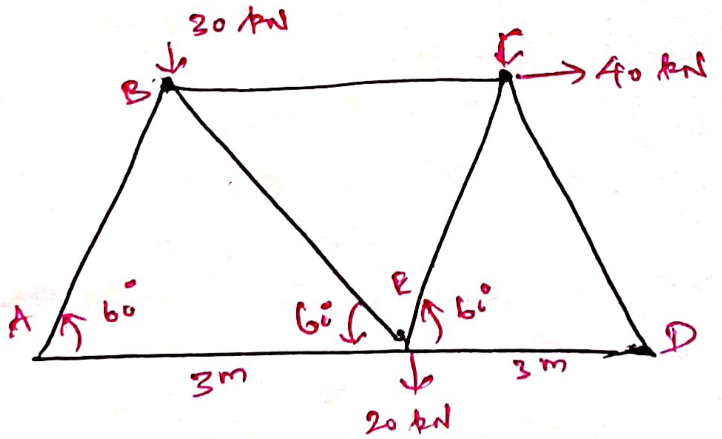
MAB = 0 (04)
MBA = 3.472
MBC = −3.472
MCB = 4.273
MCD = −4.272
MDC = 0

S.F & B.M ⇒ AB = 9.6 kNm (02)
BC = 8.57 kNm
CD = 8 kNm

S.F.D & B.M.D (02)

PART - C

16. (a). **Analyze the determinate truss loaded as shown in the figure by the method of joints.**



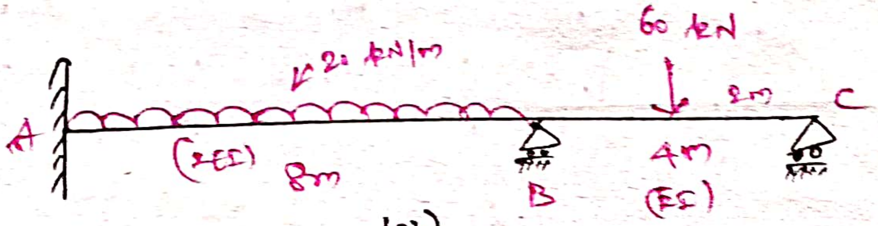
(12)

MAB = 17.5 kN (C)
MAE = 48.75 kN (T)
MBE = 17.1 kN (C)
MBC = 0.2 kN (C)
MCD = 40.2 kN (C)
MCE = 40.2 kN (T)
MDE = 20.1 kN (T)

Ex = 2.6m (03)

RD = 34.8 kN
RA = 15.2 kN
HA = 40 kN

16.(b). Analyze the continuous beam shown in the figure by slope deflection method, if joint B sinks by 10mm. Given EI = 4000 kNm². Draw SFD & BMD.



(03)
$M_{FAB} = -106.67$ kNm
$M_{FBA} = 106.67$ kNm
$M_{FBC} = -30$ kNm
$M_{FCB} = 30$ kNm

$\theta_B = -5.8 \times 10^{-3}$ (03)
$\theta_C = -8.6 \times 10^{-4}$

(04)
$M_{AB} = -125.77$ kNm
$M_{BA} = 68.47$ kNm
$M_{BC} = -68.5$ kNm
$M_{CB} = 0$

(03)
S.F & B.M → AB = 160 kNm
BC = 60 kNm

SFD & B.M.D (01)

K. [signature] 19/09/2023
STAFF INCHARGE

R. [signature] 19/09/2023
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CONTINUOUS ASSESSMENT TEST – I / II / MODEL EXAMINATION

College Code	8	2	1	1	College Name	KINGS COLLEGE OF ENGINEERING							
Register Number	8	2	1	1	2	1	1	0	3	0	0	9	Semester: V
Roll No.	21CE08		Year / Branch / Section	III rd - Civil									
Subject Code / Subject Name	CE3502 - STRUCTURAL ANALYSIS - I												
Date / Session	16/09/2023 / AN		No. of Pages used	21									
K. Abinaya Name of the Invigilator			Signature of the Invigilator with date: [signature] 16/9/23										

Instructions to the Candidate: Put Tick mark (✓) for the questions attended in the tick mark column against each question

PART – A			PART – B & C							
Question No.	✓	Marks	Question No.		(i) ✓	(i) Marks	(ii) ✓	(ii) Marks	Total Marks	Grand Total (In words)
1	✓	1	11	a						
2	✓	2		b	✓	08			08	
3	✓	2	12	a						Six Zero
4		–		b	✓	10			10	
5		–	13	a						
6		–		b						
7	✓	2	14	a	✓	12			12	
8		–		b						
9	✓	0	15	a	✓	10			10	
10		0		b						Grand Total
			16	a	✓	13			13	60
				b						
Total		07							53	

S. [signature] 22/09/23 Signature of the student with date after Evaluation	Aswini R Name of the Examiner	[signature] 21/9/23 Signature of the Examiner with date

Instructions to the candidates

1. You are prohibited from writing your NAME in any part of the answer book.
2. You are prohibited from writing or leaving any distinguishing marks so as to identify your answer book.
3. Use both side of the paper for answering questions (Except front page).
4. Check the regulation, Degree, Branch, Semester, Subject code and Subject Title of the Question Paper before answering the questions.
5. Possession of any incriminating material and Malpractice of any nature shall be punishable as rules.

* Concentrate on 2 marks Questions

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
III YEAR CIVIL / V SEM - CAT I MARK STATEMENT
CE3502 / STRUCTURAL ANALYSIS I

S.No.	Reg. Number	Student Name	CAT I (100 MARKS)
1	821121103001	AKALYA J	40
2	821121103002	ANITHA B	20
3	821121103003	ARULPANDIYAN A	35
4	821121103004	ARUNKUMAR M	30
5	821121103006	MADHAN D S	25
6	821121103007	MANIKKARAJ R	AB
7	821121103008	MATHANKUMAR S	AB
8	821121103009	MOHAN S	60
9	821121103010	NAAVINIYAA G V	50
10	821121103012	PASHAGAN G (VOC)	AB
11	821121103013	PRAGADISH M	04
12	821121103014	PRASANNA R	AB
13	821121103015	SARAVANAN K	AB
14	821121103016	SURYA.V	45
15	821121103017	TAMILARASAN T	50
16	821121103018	VENKATACHALAM D	32
17	821121103019	VIJAY S	25
18	821121103301	MOHAMMED RIYAS J	34
19	821121103302	SINDHU G	55
20	821121103303	SURUTHI A	50
21	821121103701	SANJAIMANI M	AB

Total Strength - 21
Absent - 06
Passed - 05
Failed - 10
Pass % - 33.33%
Less than 10 - 01

21/09/2023
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21/09/2023
HOD/CIVIL

KINGS COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
III YEAR CIVIL / V SEM - CAT I MARK STATEMENT
CE3502/ STRUCTURAL ANALYSIS I

S.No.	Reg. Number	Student Name	CAT I (60 MARKS)	ASSIGNMENT (40 MARKS)	TOTAL (100 MARKS)
1	821121103001	AKALYA J	40	40	80
2	821121103002	ANITHA B	20	40	60
3	821121103003	ARULPANDIYAN A	35	40	75
4	821121103004	ARUNKUMAR M	30	40	70
5	821121103006	MADHAN D S	25	40	65
6	821121103007	MANIKKARAJ R	AB	38	38
7	821121103008	MATHANKUMAR S	AB	38	38
8	821121103009	MOHAN S	60	40	100
9	821121103010	NAAVINIYAA G V	50	40	90
10	821121103012	PASHAGAN G	AB	36	36
11	821121103013	PRAGADISH M	4	38	42
12	821121103014	PRASANNA R	AB	38	38
13	821121103015	SARAVANAN K	AB	38	38
14	821121103016	SURYA.V	45	40	85
15	821121103017	TAMILARASAN T	50	40	90
16	821121103018	VENKATACHALAM D	32	40	72
17	821121103019	VIJAY S	25	40	65
18	821121103301	MOHAMMED RIYAS J	34	40	74
19	821121103302	SINDHU G	55	40	95
20	821121103303	SURUTHI A	50	40	90
21	821121103701	SANJAIMANI M	AB	37	37

22/09/2023
STAFF INCHARGE

22/09/2023
HOD/CIVIL

KINGS COLLEGE OF ENGINEERING

CONTINUOUS ASSESSMENT TEST II (OCTOBER 2023)

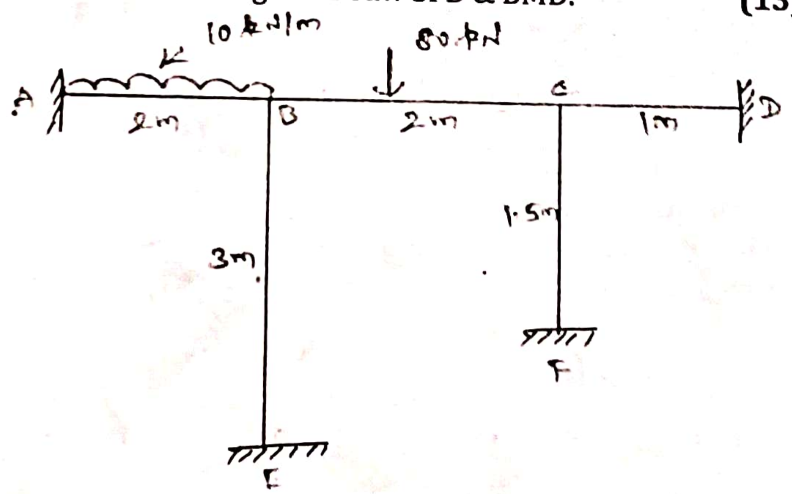
CE3502-STRUCTURAL ANALYSIS I

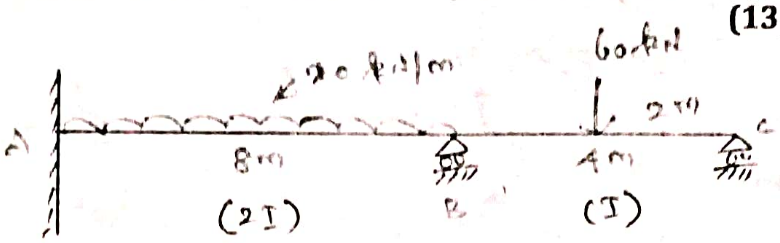
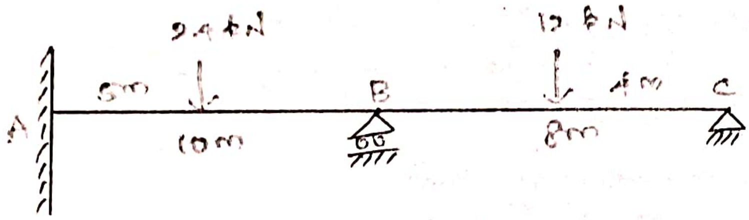
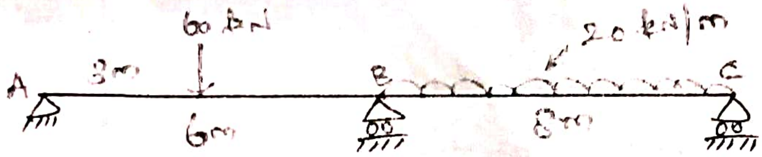
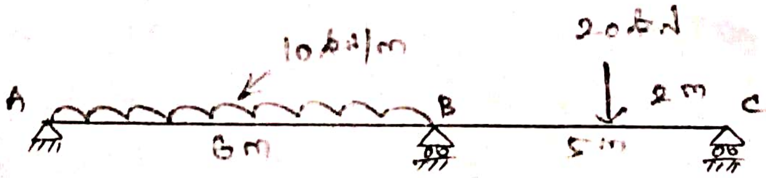
Class / Sem : III CIVIL / 05 | **Date / Session: 31.10.2023/AN**

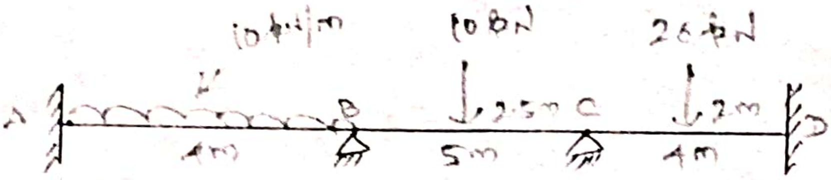
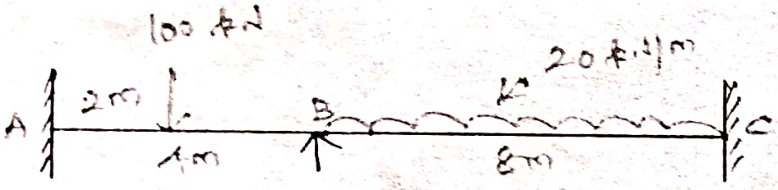
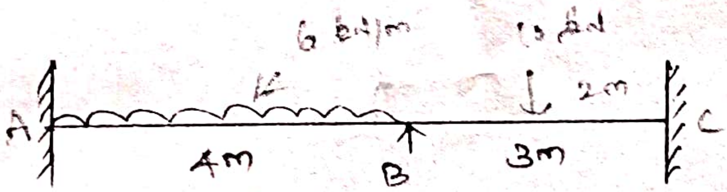
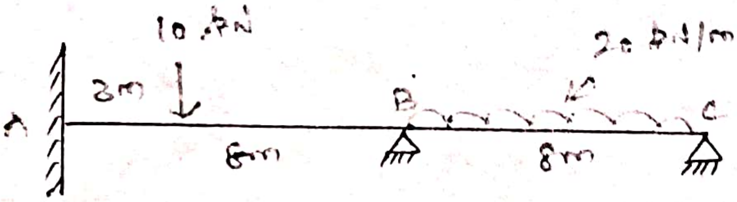
Maximum : 100 Marks | **Time : 01.10 p.m. - 04.10 p.m.**

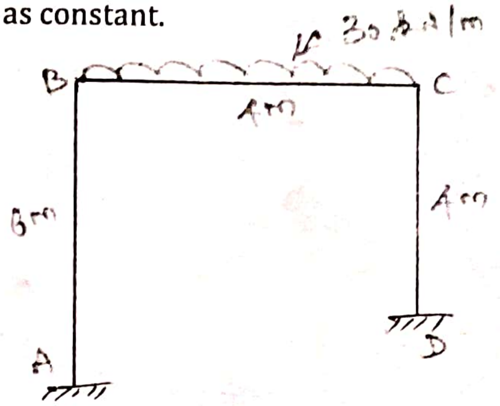
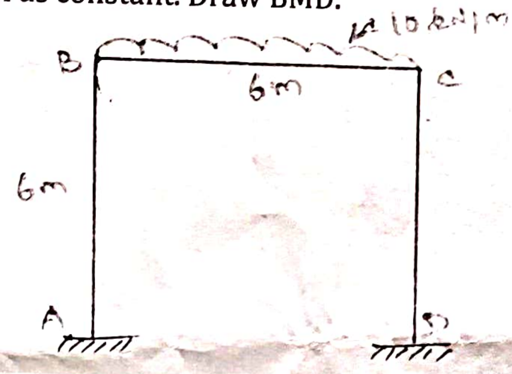
Answer ALL questions

PART – A (10 x 2= 20 Marks)

Q. No	Question	BT Level	CO
1.	Define moment distribution method.	REMEMBER BT-L1	CO3
2.	What is meant by side sway?	REMEMBER BT-L1	CO3
3.	Write about flexibility matrix method.	UNDERSTAND BT- L2	CO4
4.	What do you mean by joint translation?	REMEMBER BT-L1	CO4
5.	What are flexibility coefficients?	REMEMBER BT-L1	CO4
6.	Define force transformation matrix.	REMEMBER BT-L1	CO4
7.	Write about static indeterminacy of a structure.	UNDERSTAND BT- L2	CO5
8.	Define stiffness coefficient.	REMEMBER BT-L1	CO5
9.	Write about stiffness matrix method.	UNDERSTAND BT- L2	CO5
10.	Why the stiffness matrix method is also called as equilibrium method or displacement method?	REMEMBER BT-L1	CO5
	PART – B (5 x 13 = 65 Marks)		
11.(a)	Using moment distribution method, solve the frame, which is loaded as shown in figure. Draw SFD & BMD. **(13)** 	APPLY BT-L3	CO3
	OR		

11.(b)	Using moment distribution method, solve the continuous beam, which is loaded as shown in figure. Draw SFD & BMD. **(13)**  	APPLY BT-L3	CO3
12.(a)	Analyze the continuous beam ABC shown in the following figure by the flexible matrix method and draw the shear force diagram and bending moment diagram. **(13)**  	ANALYZE BT-L4	CO4
OR			
12.(b)	Using flexible matrix method, analyze the continuous beam shown in the figure. Draw SFD & BMD. **(13)**  	ANALYZE BT-L4	CO4
13.(a)	A two span continuous beam ABC is fixed at A and hinged at supports B and C. Span ofAB = span of BC = 6 m. Analyze using flexibility influence co-efficient matrix assuming verticalreaction at B & C as redundant. **(13)**	ANALYZE BT-L4	CO4
OR			
13.(b)	Analyze the continuous beam ABC shown in the following figure by the flexible matrix method and draw the shear force diagram and bending moment diagram. **(13)**  	ANALYZE BT-L4	CO4

14.(a)	Analyze the continuous beam shown in the figure by the stiffness method and draw the shear force and bending moment diagram. Take the value of the EI as constant. **(13)** 	ANALYZE BT-L4	CO5
	OR		
14.(b)	Analyze the beam shown in figure using direct stiffness approach. **(13)** 	ANALYZE BT-L4	CO5
15.(a)	Interpret the moments for the beam shown in figure by stiffness method. EI is constant for all members. **(13)** 	APPLY BT- L3	CO5
	OR		
15.(b)	Using stiffness method, determine the forces in all the members of the beam shown in the figure. Draw SFD & BMD. **(13)** 	APPLY BT- L3	CO5

PART – C (1 x 15 = 15 Marks)			
16.(a)	Analyze the frame given in figure by flexibility matrix method. Take EI as constant. **(15)** 	ANALYZE BT-L4	CO4
OR			
16.(b)	Analyze the frame shown in the figure by stiffness matrix method. Take EI as constant. Draw BMD. **(15)** 	ANALYZE BT-L4	CO5

Blooms Taxonomy	Level-1 Remember	Level-2 Understand	Level-3 Apply	Level-4 Analyze	Level-5 Evaluate	Level-6 Create
			Question Number			
Part-A	1,2,4,5,6,8,10	3,7,9				
Part-B			11 (a,b) 15 (a,b)	12 (a,b) 13 (a,b) 14 (a,b)		
Part-C				16 (a,b)		
Total	14	06	26	54		
Distribution	20		80		-	

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K. [signature] 26/10/23
COURSE IN-CHARGE

K. [signature] 26/10/23
DEPT. IQAC MEMBER

[signature] 26/10/23
HOD/CIVIL

KINGS COLLEGE OF ENGINEERING
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Approved by AICTE, New Delhi.
Affiliated to Anna University, Chennai.

DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-2024 (ODD SEM)
CE3502 – STRUCTURAL ANALYSIS I
CAT II EXAMINATION – ANSWER KEY

CLASS/SEM : III / V **31.10.2023**

PART - A

1. Define moment distribution method.

Moment distribution method is widely used for the analysis of indeterminate structures. In this method, all the members of the structure are assumed to be fixed in position and fixed end moments due to external loads are obtained. It is also known as Hardy cross method.

2. What is meant by side sway?

The lateral movement of the frames is known as side sway. If the loading system (or) the geometry of the system is not symmetric, the frame will have side sway. Side sway may be prevented in a frame by providing shear or partition walls and fixing the top of frame with adjoining rigid structures.

3. Write about flexibility matrix method.

In flexibility matrix method, the forces in the structure are treated as unknowns. The no of equations involved is equal to the degree of static indeterminacy of the structure. This method is also called as force method.

4. What do you mean by joint translation?

In a structure, yielding may occur at the end due to the action of external loads over the structure. This yielding at the end support will cause an unequal amount of displacement. This type of relative settlement phenomenon between the fixed supports is known as joint translation.

5. What are flexibility coefficients?

A Flexibility coefficient aij is defined as the displacement at joint 'i' due to a unit load at joint 'j' while all other joints are unloaded. The constant 'a' is known as flexibility of the structure and it has a unit of displacement per unit force.

6. Define force transformation matrix.

The force transformation matrix is defined as the connectivity matrix which relates the internal forces Q and the external forces R. Writing it in a matrix form,

$$\{Q\} = [b]\{R\}$$

Where, Q = member force matrix/vector
b = force transformation matrix
R = external force/load matrix/ vector

7. Write about static indeterminacy of a structure.

The excess number of reactions that make a structure indeterminate is called static indeterminacy.

Static indeterminacy = No. of reactions – Equilibrium conditions

8. Define stiffness coefficient.

A Stiffness coefficient kij is defined as the force developed at joint i due to a unit displacement at joint 'j' while all other joints are fixed. The constant 'k' is known as stiffness of the structure and it has a unit of force per unit displacement.

9. Write about stiffness matrix method.

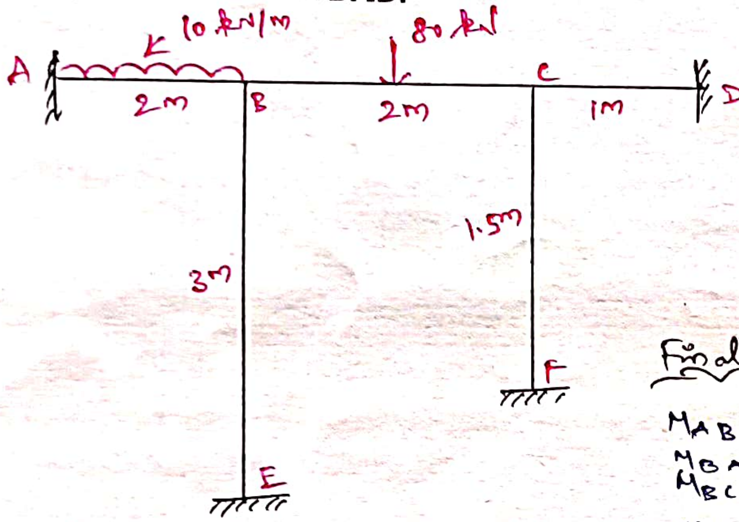
Stiffness matrix method is also called the displacement method in which the displacements that occur in the structure are treated as unknowns. The number of displacements involved is equal to the number of degrees of freedom of the structure.

10. Why the stiffness matrix method is also called as equilibrium method or displacement method?

Stiffness method is based on the superposition of displacements and hence is also known as the displacement method and since it leads to the equilibrium equations, the method is also known as equilibrium method.

PART - B

11. (a) Using moment distribution method, solve the frame, which is loaded as shown in figure. Draw SFD & BMD.



FEM:- (03)

$M_{FAB} = \frac{-wl^2}{12} = -10$ kNm

$M_{FBA} = \frac{wl^2}{12} = 10$ kNm

$M_{FBC} = \frac{-wl}{8} = \frac{80 \times 2}{8} = -20$ kNm

$M_{FCB} = \frac{wl}{8} = 20$ kNm

$M_{FCD} = M_{FDC} = M_{FBE} = M_{FCF} = 0$

Final Moments:- (08)

$M_{AB} = -$

$M_{BA} = 41.56$

$M_{BC} = -41.56$

$M_{CB} = 28.23$ kNm

$M_{CD} = -28.23$ kNm

$M_{BE} = 0$

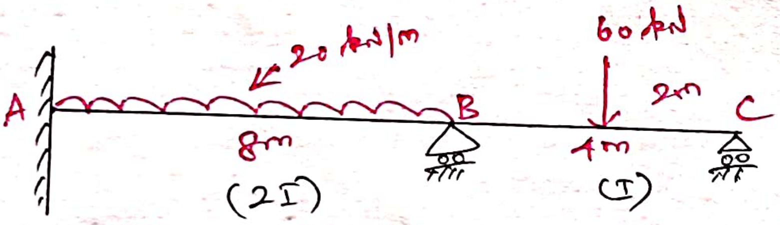
$M_{CE} = 0$

SS BM (02)

$M_{AB} = \frac{wl^2}{8} = 18$ kNm

$M_{BC} = \frac{wl}{4} = 40$ kNm

11. (b) Using moment distribution method, solve the continuous beam, which is loaded as shown in figure. Draw SFD & BMD.



FEM:- (03)

$M_{FAB} = \frac{-wl^2}{12} = -106.67$ kNm

$M_{FBA} = \frac{wl^2}{12} = 106.67$ kNm

$M_{FBC} = \frac{-wl}{8} = -30$ kNm

$M_{FCB} = \frac{wl}{8} = 30$ kNm

Final moments:- (08)

$M_{AB} = -124.02$ kNm

$M_{BA} = 71.37$ kNm

$M_{BC} = -71.37$ kNm

$M_{CB} = 0$

S.F (01)

$R_{B1} = 73.41$ kN

$R_A = 86.59$ kN

$R_C = 12.1$ kN

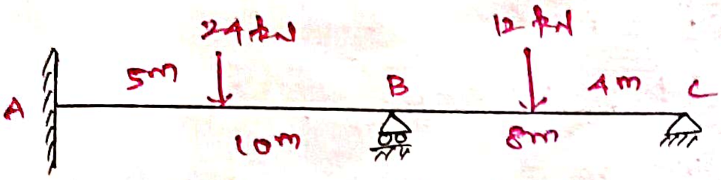
$R_{B2} = 47.9$ kN

B.M (01)

$M_{AB} = 160$ kNm

$M_{BC} = 60$ kNm

12.(a) Analyze the continuous beam ABC shown in the following figure by the flexible matrix method and draw the shear force diagram and bending moment diagram.



F.E.M (03)

$M_{FAB} = -\frac{wl}{8} = -30$ kN/m

$M_{FBA} = \frac{wl}{8} = 30$ kN/m

$M_{FBC} = -\frac{wl}{8} = -12$ kN/m

$M_{FCB} = \frac{wl}{8} = 12$ kN/m

Final moments:- (08)

$M_{AB} = 32.10$ kN/m $M_{BC} = -23.54$ kN/m

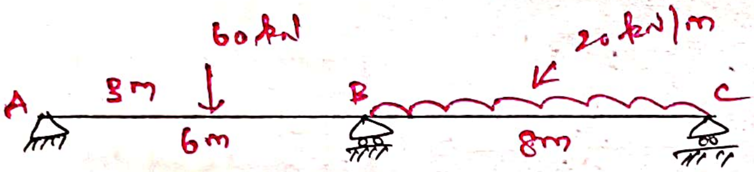
$M_{BA} = +23.54$ kN/m $M_{CB} = 0$

S.S. B.M (02)

$M_{AB} = \frac{wl}{4} = 60$ kN/m

$M_{BC} = \frac{wl}{4} = \frac{12 \times 8}{4} = 24$ kN/m

12.(b) Using flexible matrix method, analyze the continuous beam shown in the figure. Draw SFD & BMD.



F.E.M (03)

$M_{FAB} = -\frac{wl}{8} = -\frac{60 \times 6}{8} = -45$ kN/m

$M_{FBA} = \frac{wl}{8} = 45$ kN/m

$M_{FBC} = -\frac{wl^2}{12} = -106.67$ kN/m

$M_{FCB} = 106.67$ kN/m

Final moments:- (08)

$M_{AB} = 0$

$M_{BA} =$

$M_{BC} =$

$M_{CB} = 0$

S.S. Bending Moment:- (02)

$R_A = 30$ kN

$R_{B2} = 39.38$

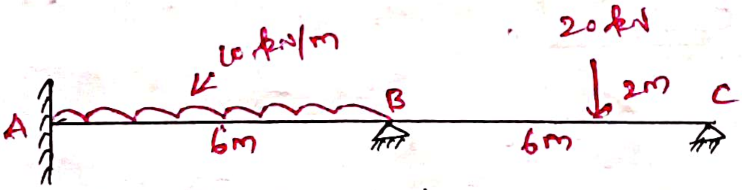
$R_{B1} = 39.38$

$R_C = 20.63$ kN

$M_{AB} = \frac{wl}{4} = 90$ kN/m

$M_{BC} = \frac{wl^2}{8} = 160$ kN/m

13.(a) A two span continuous beam ABC is fixed at A and hinged at supports B and C. Span ofAB = span of BC = 6 m. Analyze using flexibility influence co-efficient matrix assuming verticalreaction at B & C as redundant.



FEM (03)

$M_{FAB} = -30$ kN/m $M_{FBC} = -17.77$ kN/m

$M_{FBA} = 30$ kN/m $M_{FCB} = 10$ kN/m

Final moments:- (08)

$M_{AB} = 8.56$ kN/m

$M_{BA} = +12.67$ kN/m

$M_{BC} = -12.67$ kN/m

$M_{CB} = 0$

S.S. B.M (02)

$R_{B1} = 9.56$ kN

$R_{B2} = 19.33$ kN

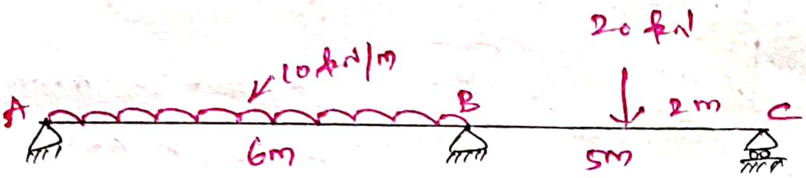
$R_A = 20.44$ kN

$R_C = 20.67$ kN

$M_{AB} = \frac{wl^2}{8} = 45$ kN/m

$M_{BC} = \frac{wab}{l} = 26.67$ kN/m

13.(b) **Analyze the continuous beam ABC shown in the following figure by the flexible matrix method and draw the shear force diagram and bending moment diagram.**



F.E.M (03)

$M_{FAB} = -\frac{wl^2}{12} = -30$ kNm

$M_{FBA} = \frac{wl^2}{12} = 30$ kNm

$M_{FBC} = -\frac{wab^2}{l^2} = -9.6$ kNm

$M_{FCB} = \frac{wa^2b}{l^2} = 6.4$ kNm

S.S. BM (02)

$M_{AB} = \frac{wl^2}{8} = 45$ kNm

$M_{BC} = \frac{wab}{l} = 24$ kNm

Final moments :- (08)

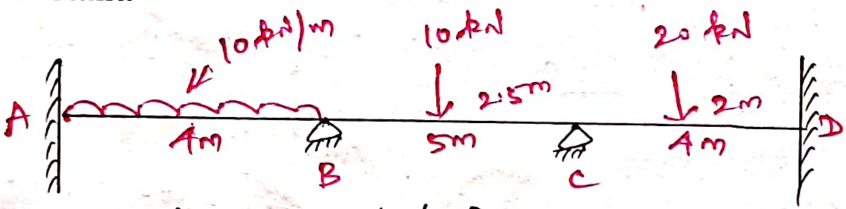
$M_{AB} = 0$

$M_{BC} = 10.58$ kNm

$M_{CB} = -10.58$ kNm

$M_{CD} = 0$

14.(a) **Analyze the continuous beam shown in the figure by the stiffness method and draw the shear force and bending moment diagram. Take the value of the EI as constant.**



F.E.M (03)

$M_{FAB} = -13.33$ kNm

$M_{FBA} = 13.33$ kNm

$M_{FBC} = -6.25$ kNm

$M_{FCB} = 6.25$ kNm

$M_{FCD} = -10$ kNm

$M_{FDC} = 10$ kNm

S.S - BM (02)

$M_{AB} = 20$ kNm

$M_{BC} = 12.5$ kNm

$M_{CD} = 20$ kNm

Final moments :- (08)

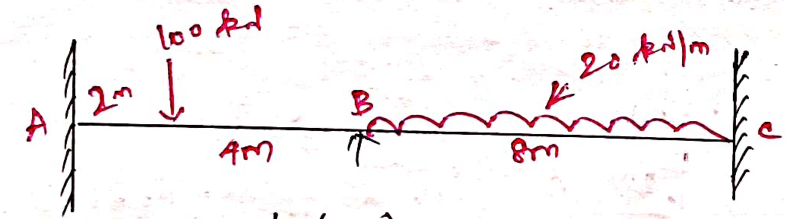
$M_{AB} = 33.6$ kNm $M_{CD} = -83.9$ kNm

$M_{BA} = 88.66$ kNm $M_{DC} = 50.1$ kNm

$M_{BC} = -88.66$ kNm

$M_{CB} = 83.9$ kNm

14. (b) **Analyze the beam shown in figure using direct stiffness approach.**



F.E.M (03)

$M_{FAB} = -\frac{wl}{8} = -50$ kNm

$M_{FBA} = \frac{wl}{8} = 50$ kNm

$M_{FBC} = -\frac{wl^2}{12} = -106.67$ kNm

$M_{FCB} = \frac{wl^2}{12} = 106.67$ kNm

S.S. BM (02)

$M_{AB} = \frac{wl}{4} = \frac{100 \times 4}{4} = 100$ kNm

$M_{BA} = \frac{wl^2}{8} = 160$ kNm

Final moments (08)

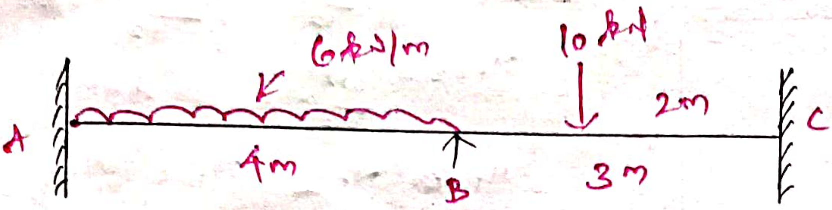
$M_{AB} = -23.73$ kNm

$M_{BA} = 77.75$ kNm

$M_{BC} = -77.75$ kNm

$M_{CB} = 111.21$ kNm

15.(a) **Interpret the moments for the beam shown in figure by stiffness method. EI is constant for all members.**



F.E.M :- (03)

$M_{FAB} = -\frac{wl^2}{12} = -8$ kNm

$M_{FBA} = \frac{wl^2}{12} = 8$ kNm

$M_{FBC} = -\frac{wa^2b}{l^2} = -6.67$ kNm

$M_{FCB} = \frac{wab^2}{l^2} = 13.33$ kNm

Final moments :- (08)

$M_{FAB} = -17.56$ kNm

$M_{FBA} = 8.67$ kNm

$M_{BC} = -8.67$ kNm

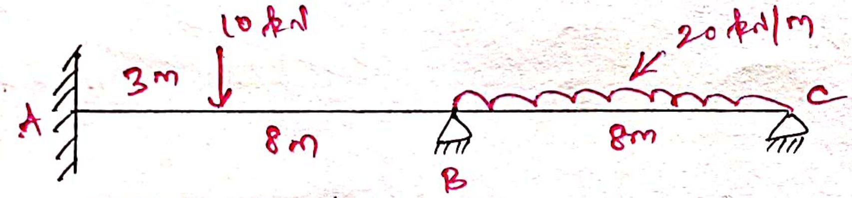
$M_{CB} = +12.34$ kNm

SS B.M (02)

$M_{AB} = \frac{wl^2}{8} = 12$ kNm

$M_{BC} = \frac{wab}{l} = 6.67$ kNm

15.(b) **Using stiffness method, determine the forces in all the members of the beam shown in the figure. Draw SFD & BMD.**



FEM :- (03)

$M_{FAB} = -\frac{wa^2b}{l^2} = -7.03$ kNm

$M_{FBA} = \frac{wab^2}{l^2} = 11.72$ kNm

$M_{FBC} = -\frac{wl^2}{12} = 106.67$ kNm

$M_{FCB} = \frac{wl^2}{12} = 106.67$ kNm

Final moments :- (08)

$M_{FAB} = 22.7$ kNm

$M_{FBA} = 110$ kNm

$M_{FBC} = 110$ kNm

$M_{CB} = 0$

SS B.M (02)

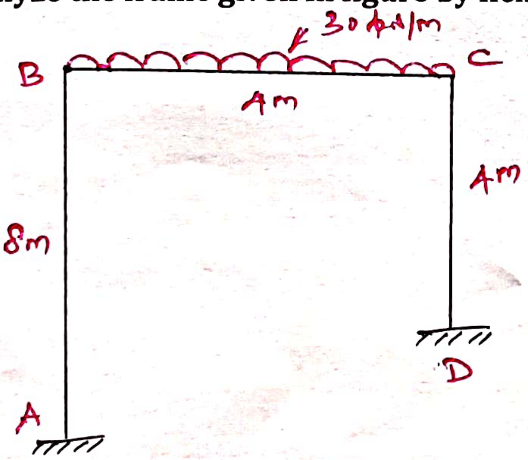
$M_{AB} = \frac{wab}{l} = 18.75$ kNm

$M_{BC} = \frac{wl^2}{8} = 160$ kNm

S.F.D & B.M.D

PART - C

16. **(a). Analyze the frame given in figure by flexibility matrix method. Take EI as constant.**



FEM :-

$M_{FBA} = M_{FAB} = M_{FCD} = M_{FDC} = 0$ (04)

$M_{FBC} = -\frac{wl^2}{12} = -\frac{30 \times 4^2}{12} = -40$ kNm

$M_{FCB} = \frac{wl^2}{12} = 40$ kNm

Final moments :- (08)

$M_{AB} = 6.85$ kNm

$M_{BA} = 22.58$ kNm

$M_{BC} = -20.87$ kNm

$M_{CB} = 21.56$ kNm

$M_{CD} = -17.82$ kNm

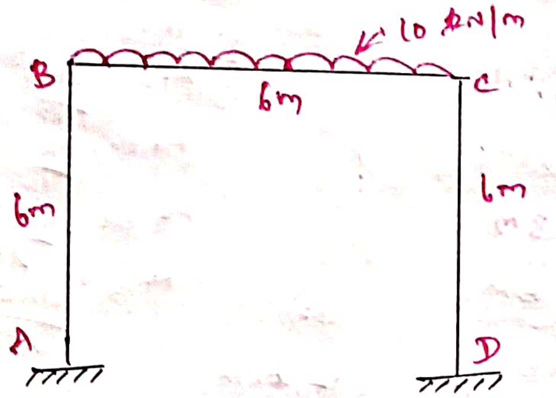
$M_{DC} = -11.57$ kNm

SS moments :- (03)

$M_{BC} = \frac{wl^2}{8} = \frac{30 \times 4^2}{8} = 60$ kNm

S.F.D & B.M.D

16.(b). Analyze the frame shown in the figure by stiffness matrix method. Take EI as constant. Draw BMD.



FBM:-

$M_{FBC} = -\frac{wl^2}{12} = -\frac{10\times6^2}{12} = -30$ kNm (04)

$M_{FCB} = \frac{wl^2}{12} = 30$ kNm

$M_{FAB} = M_{FBA} = M_{FCD} = M_{FDC} = 0$

Final Moments:- (08)

$M_{AB} = 5.89$ kNm

$M_{BA} = 12.56$ kNm

$M_{BC} = -12.56$ kNm

$M_{CB} = 12.56$ kNm

$M_{CD} = -12.56$ kNm

$M_{DC} = 5.89$ kNm

SS moments:- (03)

$M_{BC} = \frac{wl^2}{8} = \frac{10\times6^2}{8} = 45$ kNm

S.F.D & B.M.D

K. [signature] 31/10/2023

STAFF INCHARGE

[signature] 01/11/23

HOD/CIVIL

AB - NIL

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CONTINUOUS ASSESSMENT TEST – I / II / MODEL EXAMINATION

College Code	8	2	1	1	College Name	Kings College of Engineering						
Register Number	8	2	1	1	2	1	1	0	3	0	0	1
Semester	05											
Roll No.	21CE01				Year / Branch /Section	III / Civil Engineering						
Subject Code / Subject Name	CE3502 / Structural Analysis - I											
Date / Session	31.10.2023 / AN				No. of Pages used							
Name of the Invigilator	Dr. T. Pasupathi				Signature of the Invigilator with date	T. Ponnu...						

Instructions to the Candidate: Put Tick mark (✓) for the questions attended in the tick mark column against each question

PART – A Question No.	✓	Marks	PART – B & C Question No.		(i) ✓	(i) Marks	(ii) ✓	(ii) Marks	Total Marks
1		0	11	a	12				12
2		0		b					
3		0	12	a	08				08
4		0		b					
5		0	13	a					
6		2		b	08				08
7		0	14	a					
8		0		b	–				–
9		2	15	a					
10		0		b	03				03
			16	a					
				b	–				–
Total		04							31

Grand Total (In words): THREE FIVE

Grand Total: 35

Signature of the student with date after Evaluation	Name of the Examiner	Signature of the Examiner with date
S. Akshya / 01/11/2023	Arun K	01/11/2023

Instructions to the candidates

1. You are prohibited from writing your NAME in any part of the answer book.
2. You are prohibited from writing or leaving any distinguishing marks so as to identify your answer book.
3. Use both side of the paper for answering questions (Except front page).
4. Check the regulation, Degree, Branch, Semester, Subject code and Subject Title of the Question Paper before answering the questions.
5. Possession of any incriminating material and Malpractice of any nature shall be punishable as rules.

* Practice more problems to complete the Examination time
* Need more hardwork to get pass marks.

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
III YEAR CIVIL / V SEM - CAT II MARK STATEMENT
CE3502/ STRUCTURAL ANALYSIS I

S.No.	Reg. Number	Student Name	CAT II (100 MARKS)
1	821121103001	AKALYA J	35
2	821121103002	ANITHA B	38
3	821121103003	ARULPANDIYAN A	50
4	821121103004	ARUNKUMAR M	27
5	821121103006	MADHAN D S	24
6	821121103007	MANIKKARAJ R	16
7	821121103008	MATHANKUMAR S	08
8	821121103009	MOHAN S	43
9	821121103010	NAAVINIYAA G V	50
10	821121103012	PASHAGAN G	02
11	821121103013	PRAGADISH M	17
12	821121103014	PRASANNA R	-0-
13	821121103015	SARAVANAN K	-0-
14	821121103016	SURYA.V	25
15	821121103017	TAMILARASAN T	52
16	821121103018	VENKATACHALAM D	30
17	821121103019	VIJAY S	26
18	821121103301	MOHAMMED RIYAS J	33
19	821121103302	SINDHU G	60
20	821121103303	SURUTHI A	29
21	821121103701	SANJAIMANI M	-0-

Total Strength - 21
Absent - NIL
Passed - 04
Failed - 17
Pass % - 19.05%
Less than 10 - 05

01/11/2023
STAFF INCHARGE

03/11/2023
HOD/CIVIL

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
III YEAR CIVIL / V SEM - CAT II MARK STATEMENT
CE3502/ STRUCTURAL ANALYSIS I

S.No.	Reg. Number	Student Name	CAT II (60 MARKS)	ASSIGNMENT (40 MARKS)	TOTAL (100 MARKS)
1	821121103001	AKALYA J	21	40	61
2	821121103002	ANITHA B	23	40	63
3	821121103003	ARULPANDIYAN A	30	40	70
4	821121103004	ARUNKUMAR M	16	40	56
5	821121103006	MADHAN D S	14	38	52
6	821121103007	MANIKKARAJ R	10	36	36
7	821121103008	MATHANKUMAR S	5	39	39
8	821121103009	MOHAN S	26	40	66
9	821121103010	NAAVINIYAA G V	30	40	70
10	821121103012	PASHAGAN G	1	36	36
11	821121103013	PRAGADISH M	10	37	47
12	821121103014	PRASANNA R	0	38	38
13	821121103015	SARAVANAN K	0	38	38
14	821121103016	SURYA.V	15	40	55
15	821121103017	TAMILARASAN T	31	40	71
16	821121103018	VENKATACHALAM D	18	40	58
17	821121103019	VIJAY S	16	40	56
18	821121103301	MOHAMMED RIYAS J	20	40	60
19	821121103302	SINDHU G	36	40	76
20	821121103303	SURUTHI A	17	40	57
21	821121103701	SANJAIMANI M	0	36	36

01/11/2023
STAFF INCHARGE

01/11/2023
HOD/CIVIL

REMEDIAL MEASURE

CLASS TESTS

KINGS COLLEGE OF ENGINEERING
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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
III YEAR CIVIL / V SEM - CLASS TEST MARK STATEMENT
CE3502/ STRUCTURAL ANALYSIS I

S.No.	Reg. Number	Student Name	16/08/23	17/08/23	04/09/23					
			15	RETEST	15					
1	821121103001	AKALYA J	AB	13	11					
2	821121103002	ANITHA B	10		10					
3	821121103003	ARULPANDIYAN A	12		10					
4	821121103004	ARUNKUMAR M	10		12					
5	821121103006	MADHAN D S	-0-	07	11					
6	821121103007	MANIKKARAJ R	-0-	07	09					
7	821121103008	MATHANKUMAR S	-0-	11	10					
8	821121103009	MOHAN S	12		12					
9	821121103010	NAAVINIYAA G V	10		11					
10	821121103012	PASHAGAN G (VOC)	-0-	07	08					
11	821121103013	PRAGADISH M	-0-	05	10					
12	821121103014	PRASANNA R	-0-	08	09					
13	821121103015	SARAVANAN K	02	AB	07					
14	821121103016	SURYA.V	08	12	12					
15	821121103017	TAMILARASAN T	14		13					
16	821121103018	VENKATACHALAM D	03	12	12					
17	821121103019	VIJAY S	AB	08	12					
18	821121103301	MOHAMMED RIYAS J	11		12					
19	821121103302	SINDHU G	10		12					
20	821121103303	SURUTHI A	14		11					
21	821121103701	SANJAIMANI M	01	06	AB					
No of Students Present			19	11	20					
No of Students Absent			02	01	01					
Staff Signature			16/08/23	17/8/23	5/9/23					
HOD Signature			16/8/23	17/8/23	03/11/23					

05/09/2023
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03/11/2023
HOD/CIVIL

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

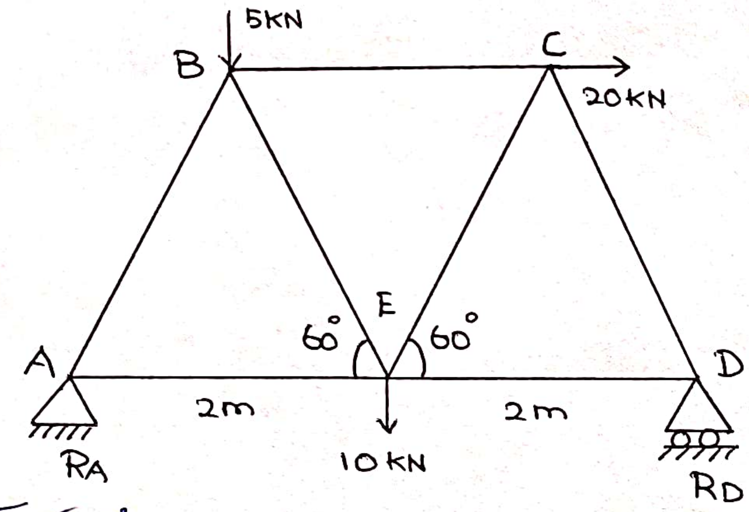
CLASS TEST-1

Class : III /CIVIL | **Date & Session: 16.08.2023**

Max. Marks : 15 | **Time: 45mins**

Answer all the questions

1. What about the imperfect frame and its types. **(2 m)**
2. Analyze the frame shown in the figure using method of joints. **(13 m)**



16/08/2023

STAFF INCHARGE

16/08/2023

HOD/CIVIL

Avoid careless mistake

10/15

16/08/2023

Name : G.V.Naaviniyaa

Branch : III-yr civil Engg

Sub-code / subject : CE 3502 - Structural Analysis - I

Date : 16.08.2023

1. **Imperfect Frame :**

When an external load is applied in a frame and if the members are not sufficient to keep the frame in equilibrium then the frame is known as imperfect frame. That is given by $n \neq 2j-3$

Types of frames :

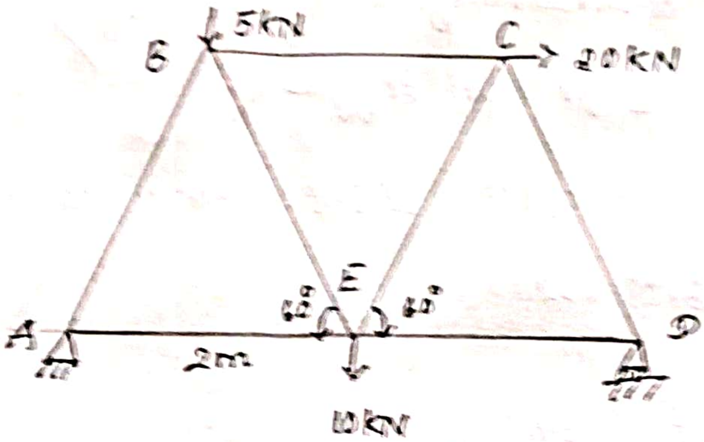
i) Reduntant frame

If 'n' is greater than $2j-3$ then the frame is known as reduntant frame.

ii) Deficient frame

If 'n' is less than $2j-3$ then the frame is known as deficient frame.

2.



To find :

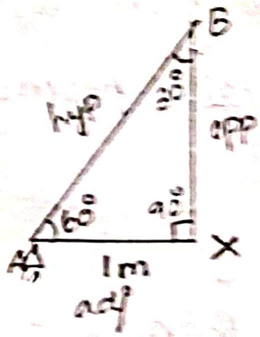
$F_{AB} = ?$ $F_{CE} = ?$ $F_{AE} = ?$

$F_{BC} = ?$ $F_{DC} = ?$

$F_{BE} = ?$ $F_{DE} = ?$

solution :

consider triangle ABx,



$$\tan 60° = \frac{BX}{AX}$$

$$BX = AX \tan 60°$$

$$= 1 \tan 60°$$

$$\boxed{BX = 1.73 \text{ kN}}$$ 1.73m

Taking moment about A,

$$R_D \times 4 - 10 \times 2 - 5 \times 1 - 20 \times 1.73 = 0$$

$$4R_D - 20 - 5 - 34.6 = 0$$

$$4R_D - 59.6 = 0$$

$$4R_D = 59.6$$

$$R_D = \frac{59.6}{4}$$

$$\boxed{R_D = 14.9 \text{ kN}}$$

Sum of upward forces = sum of downward forces

$$R_A + R_D = 10 + 5$$

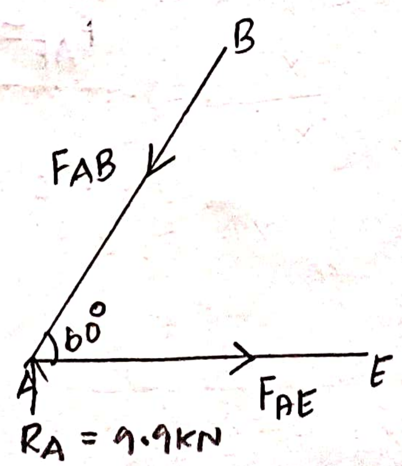
$$R_A + 14.9 = 15$$

$$R_A = 15 - 14.9$$

$$\boxed{R_A = 9.9 \text{ kN}}$$

6.1 kN

Joint : A



Resolving forces vertically,

$$R_A - F_{AB} \sin 60° = 0$$

$$R_A = F_{AB} \sin 60°$$

$$F_{AB} = \frac{R_A}{\sin 60°}$$

$$= \frac{9.9}{\sin 60°}$$

$$\boxed{F_{AB} = 11.43 \text{ KN}} \text{ (c)}$$

Resolving forces horizontally,

$$F_{AE} \cos 60° - F_{AB} \cos 60° = 0$$

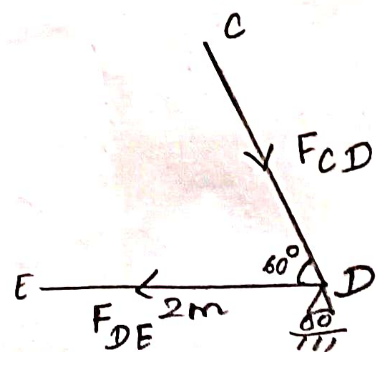
$$F_{AE} \cos 60° = F_{AB} \cos 60°$$

$$F_{AE} = \frac{F_{AB} \cos 60°}{\cos 60°}$$

$$= \frac{11.43 \cos 60°}{\cos 60°}$$

$$\boxed{F_{AE} = 11.43 \text{ KN}} \text{ (c)}$$

Joint : D



Resolving forces vertically,

$$R_D - F_{CD} \sin 60^\circ = 0$$

$$R_D = F_{CD} \sin 60^\circ$$

$$F_{CD} = \frac{R_D}{\sin 60^\circ}$$

$$= \frac{14.9}{\sin 60^\circ}$$

$$\boxed{F_{CD} = 17.20 \text{ kN}} \ (C)$$

Resolving forces horizontally,

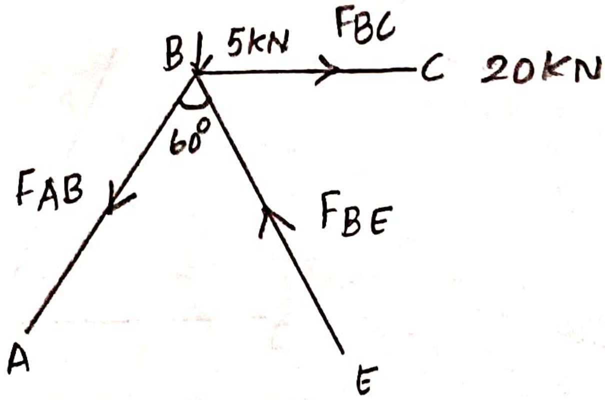
$$F_{DE} \cos 60^\circ - F_{CD} \cos 60^\circ = 0$$

$$F_{DE} \cos 60^\circ = F_{CD} \cos 60^\circ$$

$$F_{DE} = \frac{17.20 \cos 60^\circ}{\cos 60^\circ}$$

$$\boxed{F_{DE} = 17.2 \text{ kN}} \ (C)$$

Joint : B



Resolving forces vertically,

$$F_{AB} - F_{BE} \sin 60^\circ = 0$$

$$11.43 - F_{BE} \sin 60^\circ = 0$$

$$F_{BE} = \frac{11.43}{\sin 60^\circ}$$

$$\boxed{F_{BE} = 13.19 \text{ kN (c)}}$$

Resolving forces Horizontally,

$$-F_{AB} - 40 + F_{BC} \cos 60^\circ = 0$$

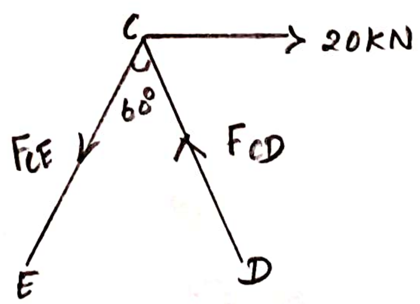
$$-13.9 - 40 + F_{BC} \cos 60^\circ = 0$$

$$-53.9 + F_{BC} \cos 60^\circ = 0$$

$$F_{BC} = \frac{53.9}{\cos 60^\circ}$$

$$\boxed{F_{BC} = 107.8 \text{ kN}} \text{ (T)}$$

Joint : C



Resolving forces vertically,

$$F_{CE} - F_{CD} \sin 60^\circ = 0$$

$$F_{CE} = F_{CD} \sin 60^\circ$$

$$= 17 \cdot 2 \sin 60^\circ$$

$$\boxed{F_{CE} = 14 \cdot 89 \text{ KN}} \text{ (T)}$$

Result :

Members	Forces	Nature of forces
AB	11·43 KN	C
BC	107·8 KN	T
BE	13·19 KN	T
CE	14·89 KN	T
DC	17·2 KN	C
DE	17·2 KN	C
AE	11·43 KN	C

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

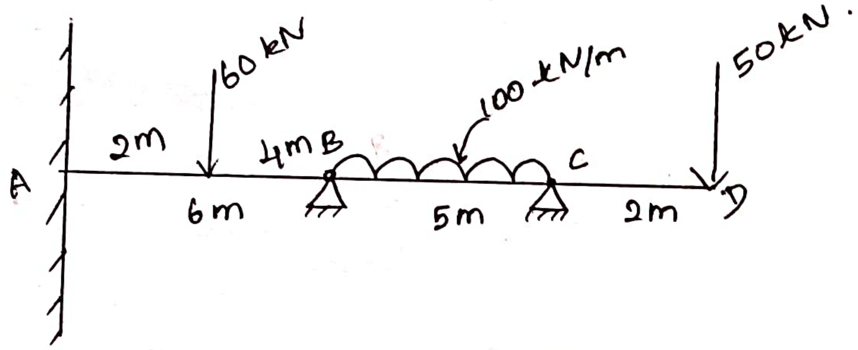
CLASS TEST-2

Class : III /CIVIL
Max. Marks : 15

Date & Session: 04.09.2023
Time: 45mins

Answer all the questions

1. Write down the steps involved in slope deflection method. **(2 m)**
2. Analyze the beam shown in the figure using slope deflection method. **(13 m)**



04/09/2023
STAFF INCHARGE

04/09/2023
HOD/CIVIL

Weekly Test -2.

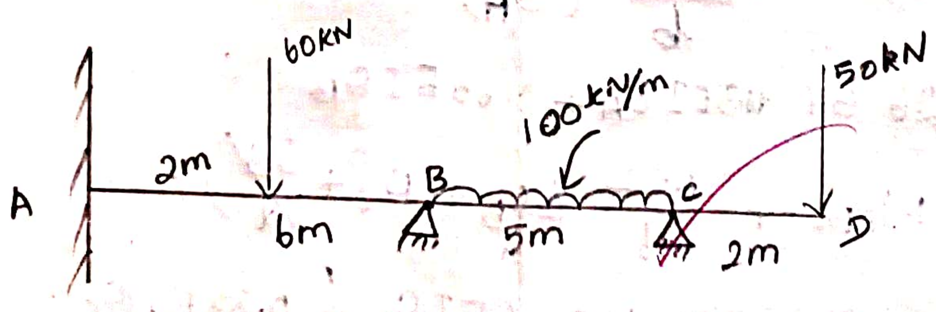
12/15

Name: G. Sindhu
Rollno: 19
Sub : SA-I
Sub code: CE3502
Date : 4.09.23.

1. Steps Envolved in Slope Deflection method:

* To Calculate FEM for giving Load.
* For each member in the write down the slope equation.
* For each member write down the joint equilibrium equation.
* For equilibrium equation to get unknown displacement.
* Calculate the final moment.
* draw the Bending Moment.

2. Slope deflection method.



Step 1:

To Calculate FEM.

*Span AB

$M_{FAB} = -\frac{wab^2}{l^2} = \frac{-60(2)(4)^2}{6^2} = -53.33$ kNm

$M_{FBA} = \frac{wa^2b}{l^2} = \frac{60(2)^2(4)}{6^2} = 26.67$ kNm

*Span BC.

$M_{FBC} = \frac{-wl^2}{12} = \frac{-100(5)^2}{12} = -208.33$ kNm

$M_{FCB} = \frac{wl^2}{12} = \frac{100(5)^2}{12} = 208.33$ kNm

*Span CD

$M_{FCD} =$?

STEP-2:

Slope deflection equation:

$M_{AB} = M_{FAB} + \frac{2EI}{l}\left(2\theta_A + \theta_B + \frac{3\Delta}{l}\right).$

$= -53.33 + \frac{2EI}{6}(\theta_B)$

$= -53.33 + 0.33EI\theta_B.$

$M_{BA} = M_{FBA} + \frac{2EI}{l}\left(\theta_A + 2\theta_B + \frac{3\Delta}{l}\right).$

$= 26.67 + \frac{2EI}{6}(\theta_A)$

$= 26.67 + 0.33EI\theta_A + 0.66EI\theta_B$

$M_{BC} = M_{FBC} + \frac{2EI}{L}\left(2\theta_B + \theta_C + \frac{3\Delta}{l}\right).$

$= -208.33 + 0.66EI\theta_B + 0.33EI\theta_C.$

$$M_{CB} = M_{FCB} + \frac{2EI}{l}\left(2\theta_B + 2\theta_C + \frac{3\Delta}{l}\right)$$

$$= 208.33 + \frac{2EI}{6}\theta_B + \frac{4EI\theta_C}{6}$$

$$= 208.33 + 0.33\,EI\theta_B + 0.66\,EI\theta_B.$$

STEP-3.

Joint equilibrium condition:

Joint B $\quad M_{BA} + M_{BC} = 0$

$$(26.67 + 0.33EI\theta_A + 0.66EI\theta_B) + (-208.33 + 0.66EI\theta_B + 0.33EI\theta_C) = 0$$

$$-181.66 + 0.33EI\theta_A + 1.32\,EI\theta_B + 0.33EI\theta_C = 0$$

(1) ← $0.33EI\theta_A + 1.32\,EI\theta_B + 0.33EI\theta_C = 181.66$

Joint C:

$M_{CB} + M_{CD}.$

$$[208.33 + 0.33EI\theta_B + 0.66EI\theta_B] + [\;] = 0.$$

$$0.33EI\theta_B + 0.66EI\theta_B = 0.$$

$$EI\theta_B = \frac{208.33}{181.66}.$$

$EI\theta_B = 1.146$

$EI\theta_C = 2.36.$

STEP-4:

Calculate Moment using SD equation.

$$M_{AB} = -53.33 + 0.33EI\theta_B.$$

$$= -53.33 + 0.33 \times (1.146)$$

$$= -52.95.$$

$M_{BA} = 26.67 + 0.33 EI\theta_A + 0.66 I\theta_B$.

$= 2.667 * 0.33 * 0.66 \times 2.36$

$= 4.736$.

$M_{BC} = -208.33 + 0.66 EI\theta_B + 0.33 EI\theta_C$

$= -208.33 + 0.66 \times 2.56 + 0.33 \times 2.36$.

$= 213.02$.

$M_{CB} = 208.33 + 0.33 \times 1.146 \times 0.66$.

$= 3.473$.

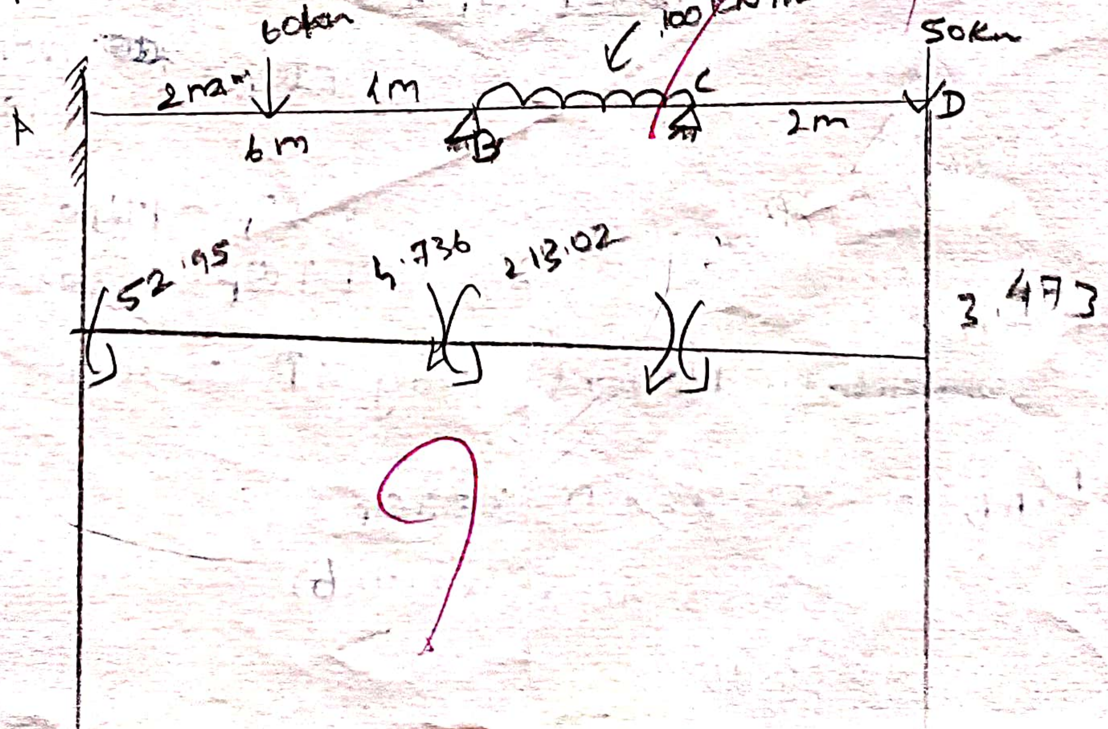
Step :5.

Calculate SSM:

$M_{AB} = \frac{-wab^2}{L^2} = -\frac{60 \times 2 \times (4)^2}{6^2} = 53.33$.

$M_{BC} = \frac{wl^2}{12} = \frac{100 \times 5^2}{12} = 208.33$.

Step :6



REVISION TESTS

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-24 (ODD SEM)
III YEAR CIVIL / V SEM - REVISION TEST MARK STATEMENT
CE3502/ STRUCTURAL ANALYSIS I

S.No.	Reg. Number	Student Name	16/10/23	20/10/23	25/10/23	15/11/23		
			20	40	40	40		
1	821121103001	AKALYA J	19	27	AB	38		
2	821121103002	ANITHA B	19	24	26	26		
3	821121103003	ARULPANDIYAN A	18	33	27	36		
4	821121103004	ARUNKUMAR M	17	34	AB	33		
5	821121103006	MADHAN D S	AB	AB	AB	23		
6	821121103007	MANIKKARAJ R	AB	AB	AB	20		
7	821121103008	MATHANKUMAR S	17	12	15	20		
8	821121103009	MOHAN S	AB	38	35	AB		
9	821121103010	NAAVINIYAA G V	20	28	34	39		
10	821121103012	PASHAGAN G	16	18	17	19		
11	821121103013	PRAGADISH M	17	18	AB	18		
12	821121103014	PRASANNA R	AB	AB	AB	17		
13	821121103015	SARAVANAN K	AB	AB	AB	20		
14	821121103016	SURYA.V	AB	AB	22	AB		
15	821121103017	TAMILARASAN T	AB	38	27	32		
16	821121103018	VENKATACHALAM D	AB	19	20	AB		
17	821121103019	VIJAY S	AB	OD	30	27		
18	821121103301	MOHAMMED RIYAS J	18	AB	22	34		
19	821121103302	SINDHU G	19	33	38	38		
20	821121103303	SURUTHI A	19	26	30	38		
21	821121103701	SANJAIMANI M	16	18	12	14		
No of Students Present			12	15	14	18		
No of Students Absent			09	06	07	03		
Staff Signature			16/10/23	20/10/23	25/10/23	16/11/23		
HOD Signature			16/10/23	20/10/23	26/10/23	17/11/23		
Principal Signature			17/10/23	21/10	26/10	17/11		

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

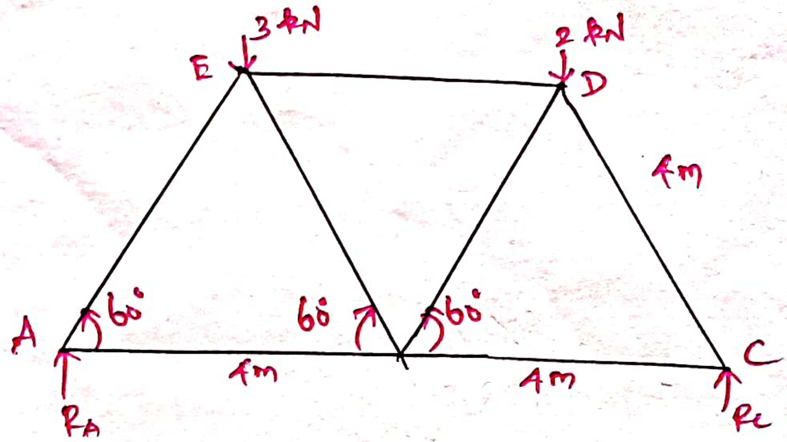
CE3502 – STRUCTURAL ANALYSIS I

REVISION TEST-1

Class : III /CIVIL | **Date & Session: 16.10.2023**
Max. Marks : 20 | **Time: 45mins**

Answer all the questions

1. What short notes on imperfect frame. **(2 m)**
2. Write short notes on rigid joints. **(2m)**
3. Analyze the frame shown in the figure using method of joints. **(16 m)**



16/10/2023
STAFF INCHARGE

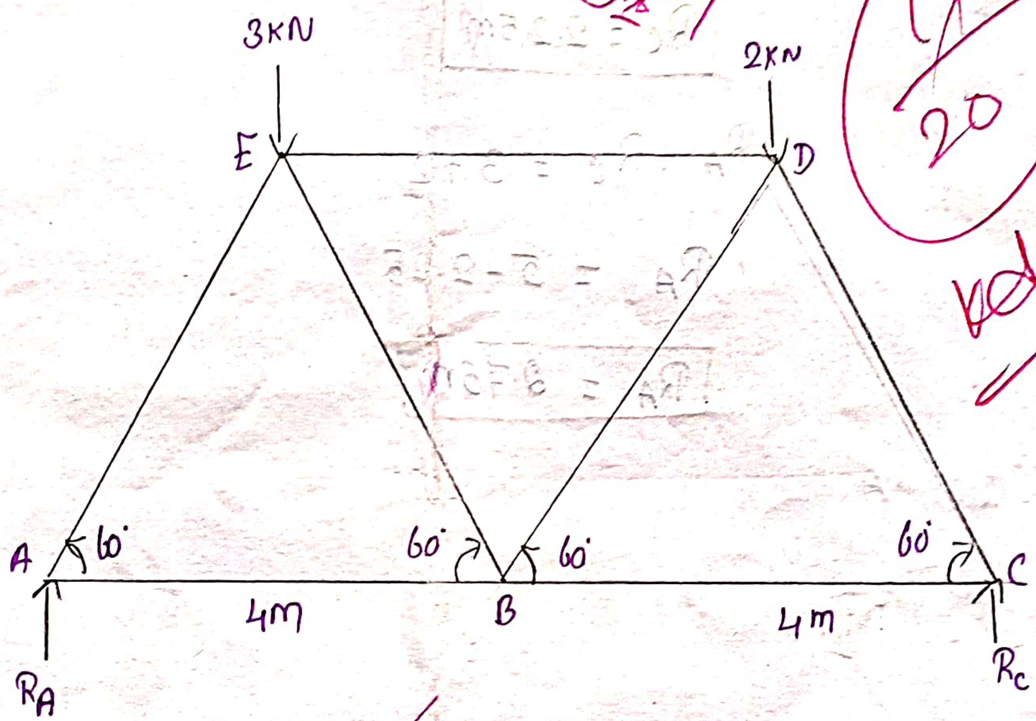
16/10/2023
HOD/CIVIL

Name : J Akolya
Dept : III - year civil
Roll No : 21CE01
Sub/ code : SA-I / CE3502

Revision Test - 1

19/20

1) Analyse the frame shown in the figure using methods of Joints.



To Find:

F_{AB} = ? F_{DE} = ? F_{DB} = ?

F_{BC} = ? F_{EA} = ?

F_{CD} = ? F_{EB} = ?

Soln:

Calculate reaction force R_A & R_E

Taking moment about A.

$$R_C \times 8 - 2 \times 6 - 3 \times 2 = 0$$

$$8R_C = 18$$

$$R_C = \frac{18}{8}$$

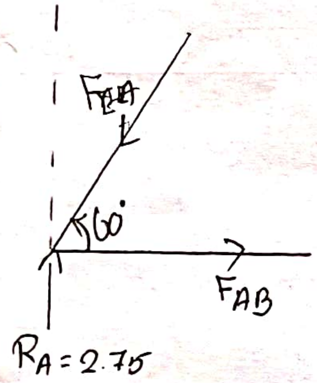
$$\boxed{R_C = 2.25 m}$$

$$R_A + R_C = 3 + 2$$

$$R_A = 5 - 2.25$$

$$\boxed{R_A = 2.75 m}$$

Joint A:



Resolving forces vertically

$$R_A - F_{AE} \sin 60° = 0$$

$$F_{AE} = \frac{R_A}{\sin 60°}$$

$$F_{AE} = \frac{2.75}{\sin 60°}$$

$$\boxed{F_{AE} = 3.17 \text{ KN (C)}}$$

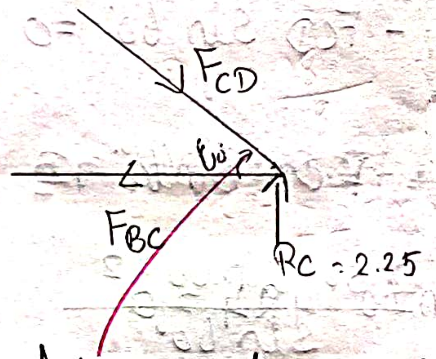
Resolving forces horizontally.

$$F_{AB} - F_{EA}\cos 60^\circ = 0$$

$$F_{AB} = 3.17\cos 60^\circ$$

$$\boxed{F_{AB} = 1.59\ kN\ (T)}$$

Joint C:



Resolving forces vertically

$$R_C - F_{CD}\sin 60^\circ = 0$$

$$F_{CD} = \frac{R_C}{\sin 60^\circ} = \frac{2.25}{\sin 60^\circ}$$

$$\boxed{F_{CD} = 2.59\ kN\ (C)}$$

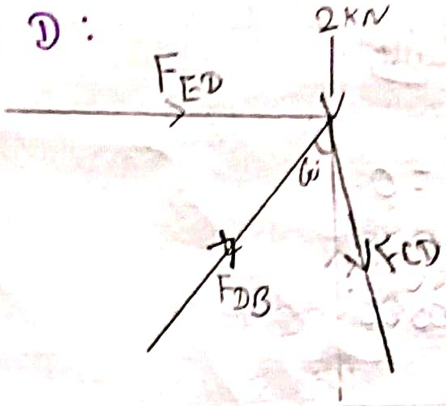
Resolving forces Horizontally

$$F_{BC} - F_{ED}\cos 60^\circ = 0$$

$$F_{BC} = 2.59\cos 60^\circ$$

$$\boxed{F_{BC} = 1.29\ kN\ (T)}$$

Joint D :



Resolving force vertically

$F_{DB} \sin 60° - 2 - F_{CD} \sin 60° = 0$

$F_{DB} \sin 60° - 2 = ~~F_{CD} \sin 60° + 2~~$

$F_{DB} = \frac{2.59 \sin 60° - 2}{\sin 60°}$

$F_{DB} = \frac{0.24}{\sin 60°}$

$\boxed{F_{DB} = 0.28 \text{ KN (C)}}$

Resolving forces Horizontally

$-F_{ED} - F_{DB} \cos 60° + F_{CD} \cos 60° = 0$

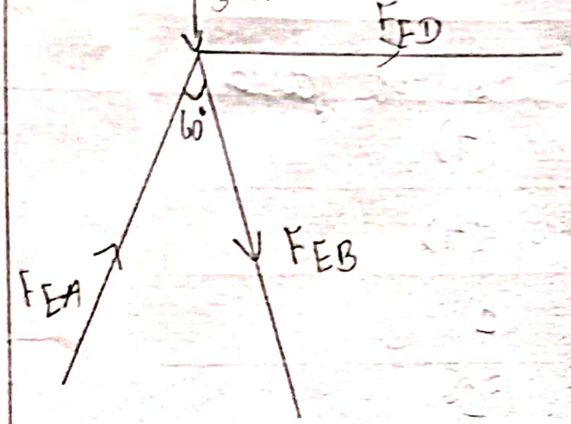
$-F_{ED} - 0.28 \cos 60° + 2.59 \cos 60° = 0$

$-F_{ED} = 0.28 \cos 60° - 2.59 \cos 60°$

$F_{ED} = 0.14 - 1.295$

$\boxed{F_{ED} = -1.155 \text{ kN (C)}}$

Joint E



Resolving forces Vertically

$$F_{EA}\sin 60° - 3 - F_{EB}\sin 60° = 0$$

~~$F_{EA}\sin 60°$~~ $$F_{EB} = \frac{F_{EA}\sin 60° + 3}{\sin 60°}$$

$$F_{EA} = \frac{3.17\sin 60° + 3}{\sin 60°}$$

$$F_{EA} = \frac{5.74}{\sin 60°}$$

$$\boxed{F_{EA} = 6.63\,kN\ (C)}$$

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

REVISION TEST 2

Class : III /CIVIL
Max. Marks : 40

Date & Session: 20.10.2023 (FN)
Time: 90mins

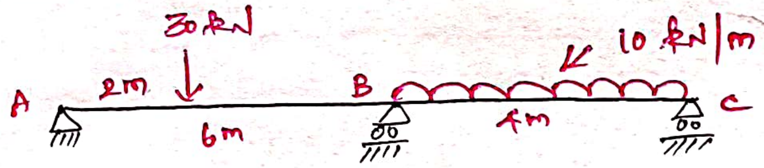
Answer all the questions

PART – A (5 x 2 = 10 Marks)

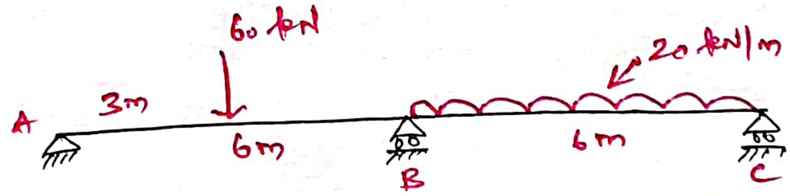
1. Write about flexibility matrix method.
2. Define force transformation matrix.
3. What are flexibility coefficients?
4. Write about stiffness matrix method.
5. Write about static indeterminacy of a structure.

PART – B (2 x 15 = 30 Marks)

6. Analyze the continuous beam ABC as shown in the following figure by the flexible matrix method and draw the bending moment diagram.



7. Analyze the continuous beam shown in the figure by direct flexibility approach. Take EI constant throughout.



STAFF INCHARGE 19/10/2023

HOD/CIVIL 19/10/2023

A Good Answer Neatly

38/40

Good

20/10/23

Revision – II

NAME :- T.Tamilarasan

CLASS :- 3rd year civil

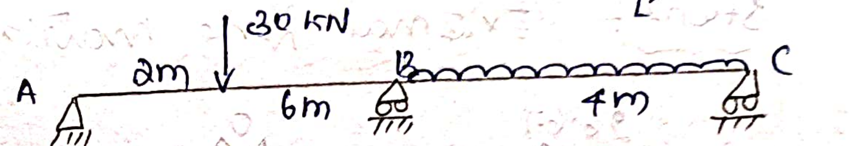
SUB :- SA-1

SUB CODE :- CE3502

DATE :- 20/10/2023

PART–B.

1. Flexibility matrix method, Draw SFD & BMD.



Step:- 1

calculate Statically Indeterminancy.

DS = R – r

DS = 4 – 3

DS = 1.

The structure is statical determinancy in the 1st degree RB.

Step 2:- Calculate FEM.

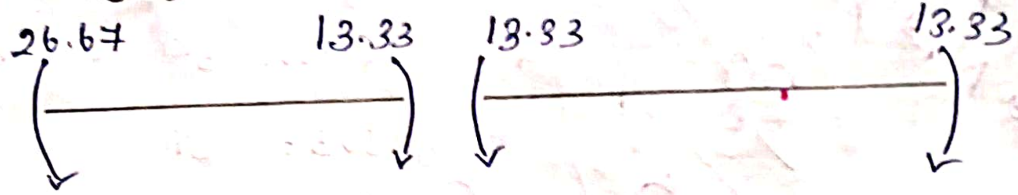
$$MFAB = \frac{-wab^2}{L^2} = -\frac{30 \times 2 \times 4^2}{6^2} = -26.67 \text{ kNm}$$

$$MFBA = \frac{wa^2b}{L^2} = \frac{30 \times 2^2 \times 4}{6^2} = 13.33 \text{ kNm}$$

$$MFBC = \frac{-wL^2}{12} = \frac{-10 \times 4^2}{12} = -13.33 \text{ kNm}$$

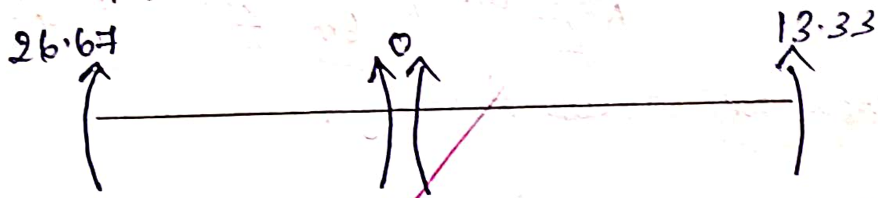
$$MFCB = \frac{wL^2}{12} = \frac{10 \times 4^2}{12} = 13.33 \text{ kNm}$$

Step 3:- Internal force matrix [Q].



$$Q = \begin{bmatrix} -26.67 \\ 13.33 \\ -13.33 \\ 13.33 \end{bmatrix}$$

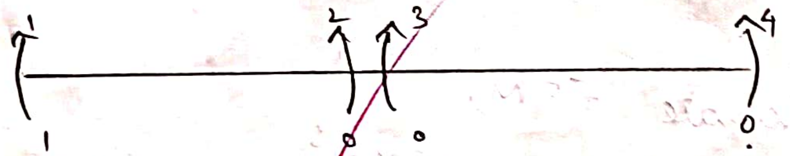
Step 4:- External force matrix [R]



$$R = \begin{bmatrix} 26.67 \\ 0 \\ -13.33 \end{bmatrix}$$

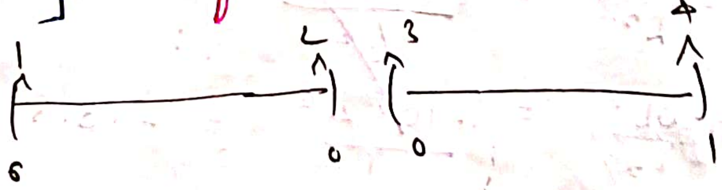
Step 5:- Force transformation matrix [bR].

$[b_{R1}] =$



$$[b_{R1}] = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

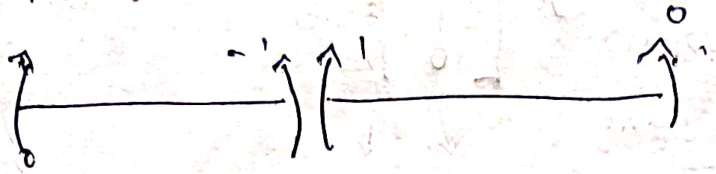
$[b_{R2}] =$



$$[b_{R2}] = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$b_R = \begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}$$

Step :- 6: Moment transformation matrix.



$$bx = \begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}$$

Step 7:- Assembled force matrix.

$$F = \frac{L}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

Span AB :-

$$F = \frac{6}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

$$F = \frac{1}{EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

span BC :-

$$F = \frac{4}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

$$= \frac{0.67}{EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} = \frac{}{EI}\begin{bmatrix} 1.34 & -0.67 \\ 0.67 & 1.34 \end{bmatrix}$$

$$F = \frac{1}{EI}\begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & 0 & 0 \\ 0 & 0 & 1.34 & -0.67 \\ 0 & 0 & -0.67 & 1.24 \end{bmatrix}$$

Step 8:- unassembled force matrix.

$$Fxx = [bx]^T [F] [bx]$$

$$= \begin{bmatrix} 0 & -1 & 1 & 0 \end{bmatrix} \frac{1}{EI}\begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & 0 & 0 \\ 0 & 0 & 1.24 & -0.67 \\ 0 & 0 & -0.67 & 1.34 \end{bmatrix}\begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}$$

$$= \frac{1}{EI}\begin{bmatrix} 1 & -2 & 1.34 & -0.67 \end{bmatrix}_{1\times 4} \begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}_{4\times 1}$$

$$= \frac{1}{EI}\left[0 + 2 + 1.34 + 0\right]$$

$$f_{xx} = \frac{3.34}{EI}$$

Step 9:- Redutant force matrix [x]

$$x = [F_{xx}]^{-1}[F_{xR}][R]$$

$$[F_{xR}] = [b_x]^T[F][b_R]$$

$$= \frac{1}{EI}\begin{bmatrix} 1 & -2 & 1.34 & -0.67 \end{bmatrix}_{1\times 4} \begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}_{4\times 2}$$

$$= \frac{1}{EI}\begin{bmatrix} 1 & -0.67 \end{bmatrix}$$

$$F_{xR} = \frac{0.33}{EI},$$

$$x = \left[\frac{EI}{3.34}\right]\left[\frac{0.33}{EI}\right]\begin{bmatrix} 26.67 \\ 0 \\ -13.33 \end{bmatrix}$$

$$= [1.10]_{1\times 1}\begin{bmatrix} 26.67 \\ 0 \\ -13.33 \end{bmatrix}_{3\times 1}$$

$$= 29.34 - 14.66$$

$$x = 14.68$$

Step 10 Final force matrix [Q]

$$Q = [b_x][x] + [b_R][R] + [FEM]$$

$$= \begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}_{4\times1} [14.68]_{1\times1} + \begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}_{4\times2} \begin{bmatrix} 26.67 \\ -13.33 \end{bmatrix}_{2\times1} + \begin{bmatrix} -26.67 \\ 13.33 \\ -13.33 \\ 13.33 \end{bmatrix}$$

$$= [-14.68 + 14.68] + \begin{bmatrix} 26.67 \\ 0 \\ 0 \\ -13.37 \end{bmatrix} + \begin{bmatrix} -26.67 \\ 13.33 \\ -13.33 \\ 13.33 \end{bmatrix}$$

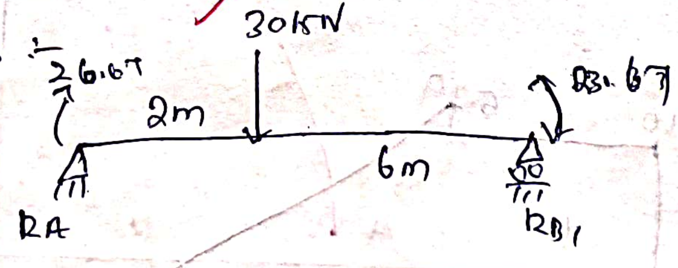
$$= [0]$$

$$= \begin{bmatrix} 0 \\ 13.33 \\ -13.33 \\ \text{[illegible]} \end{bmatrix} \qquad Q = \begin{bmatrix} 0 \\ 13.33 \\ -13.33 \\ 0 \end{bmatrix}$$

Step 11:- SF and BMD.

Shear force.

Span AB :-



$6R_{B1} + \sout{13.33}\ 2.61 = 30 \times 2$

$\sout{19.33}\ 6\ R_{B1} = 60 / 2.67$

$R_{B_1} = \dfrac{60}{\sout{19.33}\ 2.67}$

RB1 = 9.55 kN.

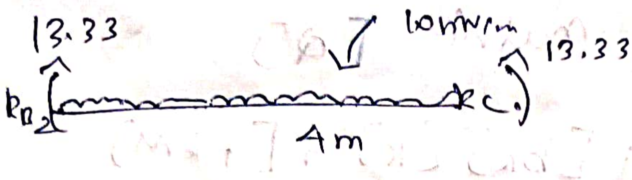
$R_A + R_{B1} = \sout{26.67}\ 30$

$R_A + 3.10 = \sout{26.67}\ 30 - 9.55$

RA = − 20.45

~~RA = 8.6 kN.~~

Span BC :



$4R_C \mp 2.67$ (~~13.33~~) $= 10 \times 4 \times 4/2$

4 (~~17.33~~) $R_C = 80 + 2.67 = \frac{82.67}{4}$ = 20.67 kN

~~$R_C = \frac{40}{17.33} = 2.3$ kN.~~

~~$R_{B2} + R_C = 19.33$~~

~~$R_{B2} + 2.3 = 13.3$~~

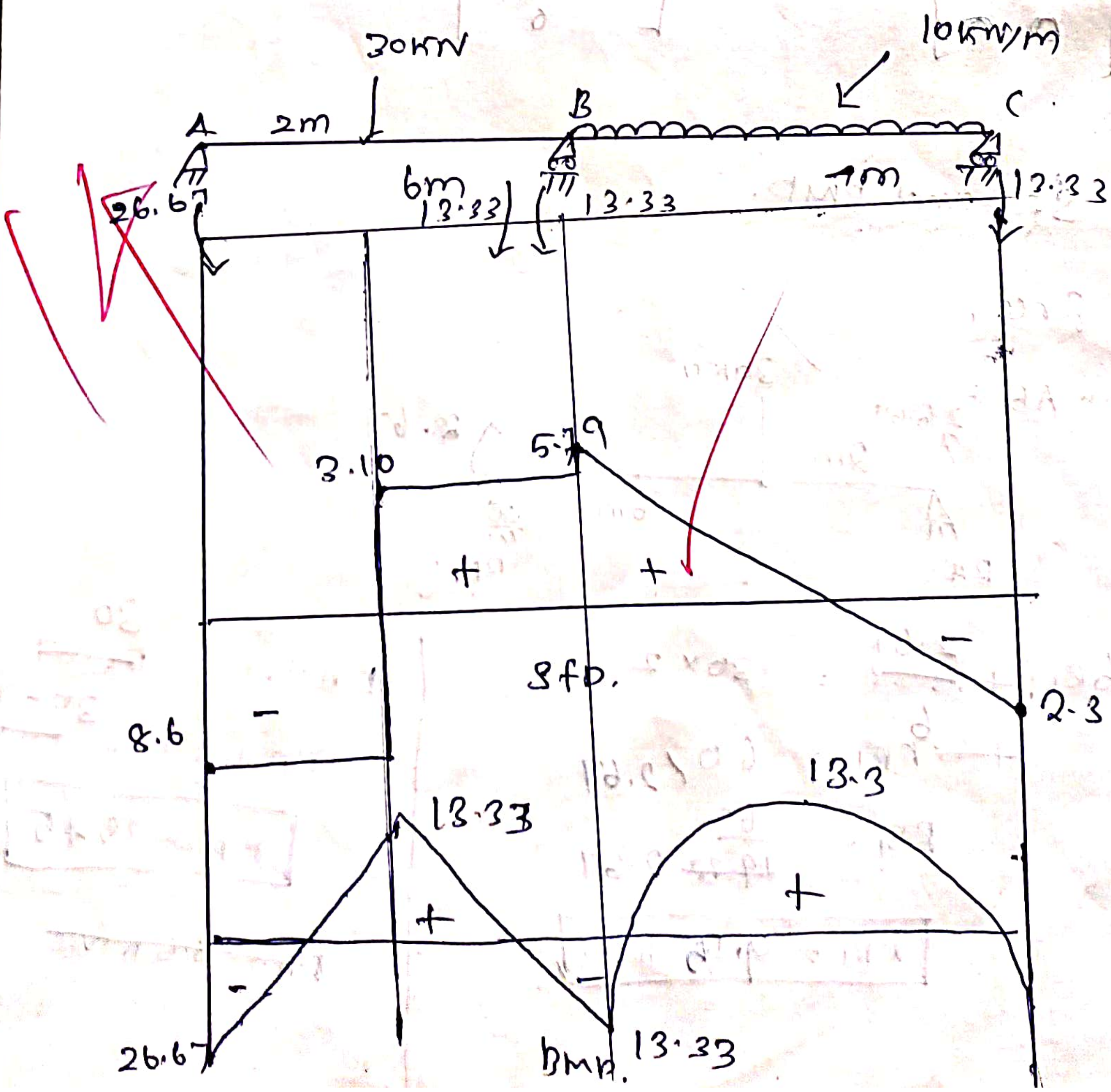
~~$R_{B2} = \frac{13.33}{2.3} = 5.79$ kN~~

$R_{B2} + R_C = 40$

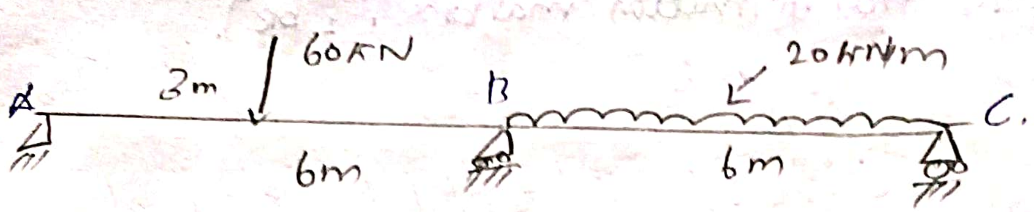
$R_{B2} = 40 - 20.67$

$R_{B2} = 19.33$ kW

Step 12 :- SF and BM Diagrame :-



Q)



Step :- 1 Calculate static Indeterminancy.

$D_S = R - r$

$= 4 - 3$

$= 1$

The structure is statical determinancy 1st degree.

Step 2 :- Calculate FEM

$MF_{AB} = \frac{-WL}{8} = \frac{-60 \times 6}{8} = -45$ KN/m

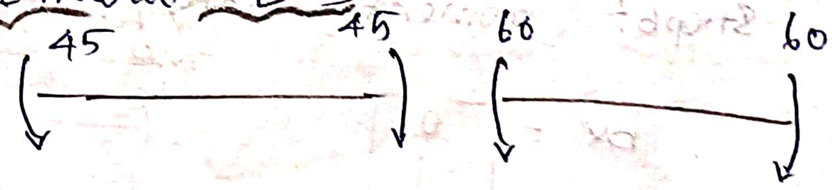
$MF_{BA} = \frac{WL}{8} = \frac{60 \times 6}{8} = 45$ KN/m

$MF_{BC} = \frac{-WL^2}{12} = \frac{-20 \times 6^2}{12} = -60$ KN/m

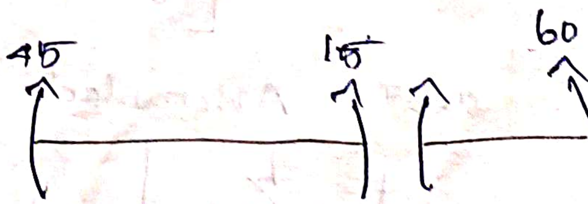
$MF_{CB} = \frac{WL^2}{12} = \frac{20 \times 6^2}{12} = 60$ KN/m

Step 3 :- Internal force matrix [Q]

$$Q = \begin{bmatrix} -45 \\ 45 \\ -60 \\ 60 \end{bmatrix}$$



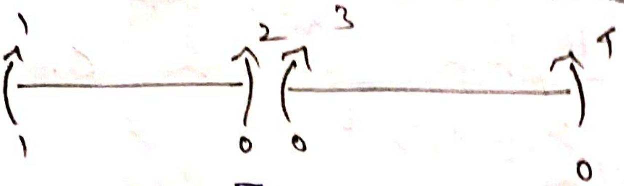
Step 4 :- External force matrix [R]



$$R = \begin{bmatrix} 45 \\ 15 \\ -60 \end{bmatrix}$$

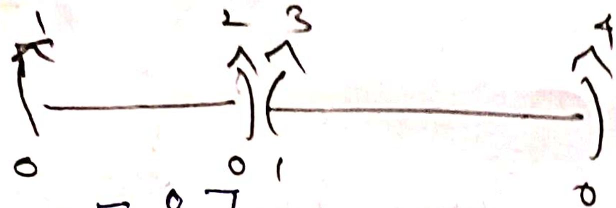
Step 5:- Force transformation matrix. [bR].

[bR1] =



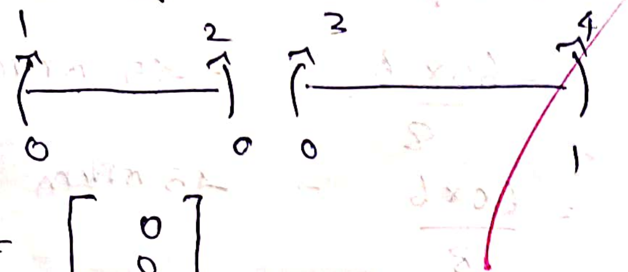
$$[b_{R1}] = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

[bR2] =



$$[b_{R2}] = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

[bR3 =



$$[b_{R3}] = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$b_R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Step 6:- moment transformation matrix. [bx]

$$b_x = \begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}$$

Step 7:- Assembled force matrix [F].

$$F = \frac{L}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

Span AB:-

$$F = \frac{6}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} = \frac{1}{EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

span BC

$$F = \frac{6}{6EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} = \frac{1}{EI}\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

$$F = \frac{1}{EI}\begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & 0 & 0 \\ 0 & 0 & 2 & -1 \\ 0 & 0 & -1 & 2 \end{bmatrix}$$

Step 8:- unassembled forcematrix.

$$F_{xx} = [b_x]^T [F] [b_x]$$

$$= \underset{1\times 4}{\begin{bmatrix} 0 & -1 & 1 & 0 \end{bmatrix}} \; \frac{1}{EI}\underset{4\times 4}{\begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & 0 & 0 \\ 0 & 0 & 2 & -1 \\ 0 & 0 & -1 & 2 \end{bmatrix}} \begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}$$

$$= \frac{1}{EI}\underset{1\times 4}{\begin{bmatrix} 1 & -2 & 2 & -1 \end{bmatrix}} \underset{4\times 1}{\begin{bmatrix} 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}}$$

$$= \frac{1}{EI}\begin{bmatrix} 0 + 2 + 2 + 0 \end{bmatrix} = \frac{4}{EI}.$$

Step 9:- redundant force matrix [X].

$$X = [F_{xx}]^{-1} [F_{xR}] [R]$$

$$F_{xR} = [b_x]^T [F] [b_R]$$

$$= \frac{1}{EI}\underset{1\times 4}{\begin{bmatrix} 1 & -2 & 2 & -1 \end{bmatrix}} \underset{4\times 3}{\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}}$$

$$= \frac{1}{EI}\begin{bmatrix} 1 & 2 & -1 \end{bmatrix}$$

$$x = \left[\frac{1}{4}\right][1 \quad 2 \quad -1]\begin{bmatrix}45\\15\\-60\end{bmatrix}$$

$$= \frac{1}{4}[1 \quad 2 \quad -1]\begin{bmatrix}45\\15\\-60\end{bmatrix}$$

$$= [4 \quad 8 \quad -4]\begin{bmatrix}45\\15\\-60\end{bmatrix} \qquad = \frac{135}{4} = 33.75$$

1×3 3×1

$$= [130 + 120 - 240] \qquad x = 33.75$$

$$x = [10]$$

Step 10:- Final force matrix [Q]

$$Q = [bx][x] + [bR][R] + FEM$$

$$= \begin{bmatrix}0\\-1\\1\\0\end{bmatrix}[33.75] + \begin{bmatrix}1&0&0\\0&0&0\\0&1&0\\0&0&1\end{bmatrix}\begin{bmatrix}45\\15\\-60\end{bmatrix} + \begin{bmatrix}-45\\45\\-60\\60\end{bmatrix}$$

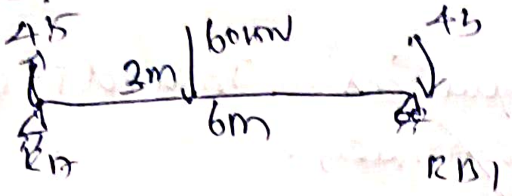
$$= \begin{bmatrix}0\\-33.75\\33.75\\0\end{bmatrix} + \begin{bmatrix}45\\0\\15\\-60\end{bmatrix} + \begin{bmatrix}-45\\45\\-60\\60\end{bmatrix}$$

$$Q = \begin{bmatrix}0\\11.25\\-11.25\\0\end{bmatrix}$$

~~Step 6: Moment [illegible]~~

Step 11: SF and BM

Span AB:



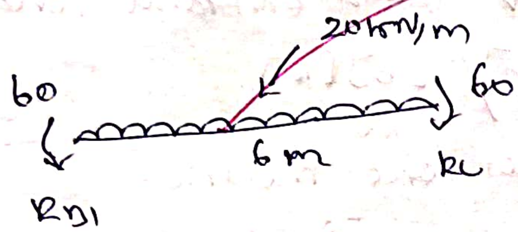
$6 R_{B1} = 60 \times 3$

$R_{B1} = \frac{180}{6}$ 3

$R_{B1} = 30\,kN$

$R_A = 30\,kN$

Span BC:



$6 R_{C1} = 20 \times 6 \times 6/2$

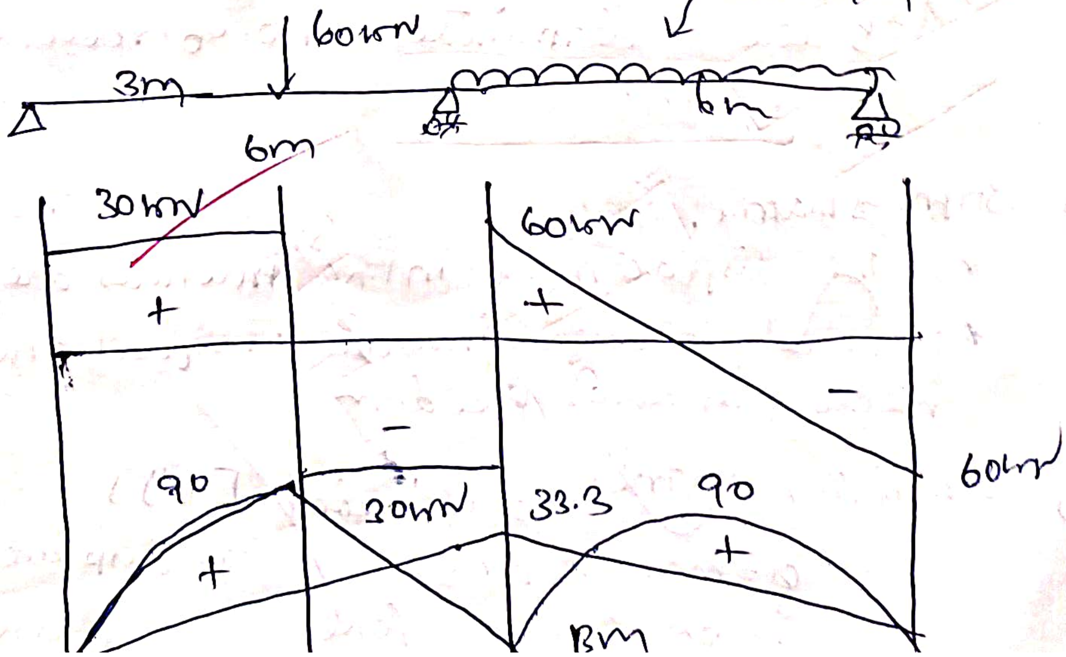
$R_C = 60\,kN$

$R_{B2} + R_C = 20 \times 6$

$R_{B2} = 60$

Step 12: BM & SF Diagram

14



PART-A.

①. * The displacement forces in the structure are treated as unknown..

* The no of displacement equations involved is equal to the degree of static indeterminacy.

* The method is also called as force method.

②. Force transformation matrix

It is defined as connectivity matrix which is the internal force Q and external force R.

Where, [Q] = [b] [R].

Q = member force matrix.

b = Force transformation matrix

R = External force matrix.

③ Static Indeterminancy

The excess no of reactions that make the structure indeterminate is known as static Indeterminancy

Static indeterminate = no. of reaction - equilibrium conditions

④ Stiffness matrix:

*) The displacement in the structures are treated unknown

*) The displacement involved is equal to the degree of static method is also freedom

5) Flexibility matrix: co-efficient [aij]

a = moment force

i = displacement force

J = displacement due to unit load

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

REVISION TEST-3

Class : III /CIVIL **Date & Session: 25.10.2023 (FN)**
Max. Marks : 40 **Time: 90mins**

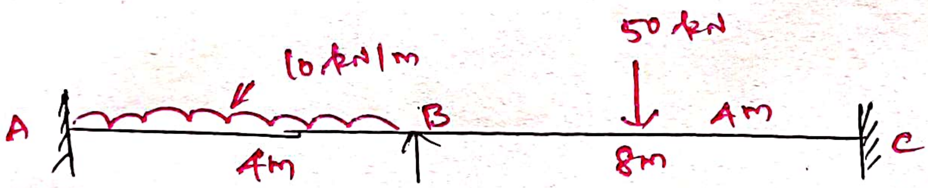
<u>Answer all the questions</u>

PART – A (5 x 2 = 10 Marks)

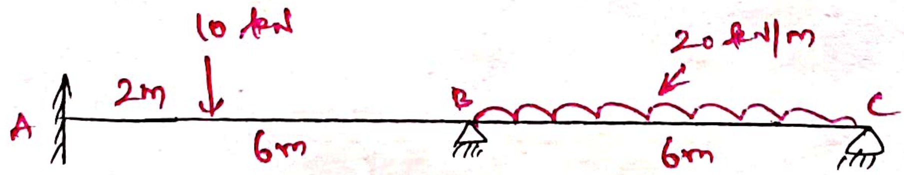
1. What is a rigid frame?
2. What is a primary structure?
3. Define stiffness coefficient.
4. Define the term rigidity of a structure.
5. What is the basic aim of the stiffness method?

PART – B (2 x 15 = 30 Marks)

6. Analyze the continuous beam shown in the following figure by stiffness matrix method and draw the bending moment diagram.



7. Analyze the continuous beam shown in the figure by stiffness matrix approach. Take EI constant throughout.



STAFF INCHARGE 25/10/2023 HOD/CIVIL 25/10/2023

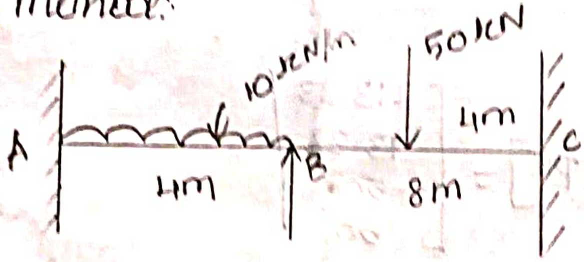
Name : G. Sindhu
Year : III
Branch: CIVIL
Sub : SA - I
Subcode: CE3502
Date : 25-10-23

Revision Test - 3.

Part - B.

38/40 Very Good 25/10/23

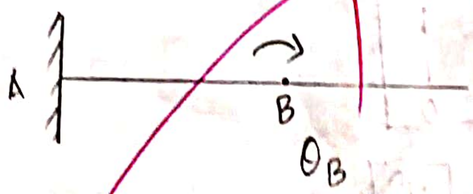
6. Stiffness method:



Solu:

Step 1:

calculate Kinematic Indeterminancy.



so there, the structure is kinematic Indeterminancy is 1 degree.

consider θ_B is known as independent determinancy.

Step 2:

Calculate FEM:

$$M_{FAB} = \frac{-wl^2}{12} = \frac{-10\times4^2}{12} = -13.33 \text{ kNm}$$

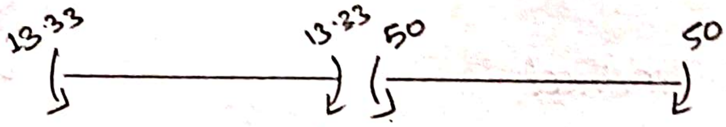
$$M_{FBA} = \frac{wl^2}{12} = \frac{10\times4^2}{12} = 13.33 \text{ kNm}.$$

$M_{FBC} = \frac{-wl}{8} = \frac{-50 \times 8}{8} = -50 \text{ kNm.}$

$M_{FCB} = \frac{wl}{8} = \frac{50 \times 8}{8} = 50 \text{ kNm.}$

Step 3:

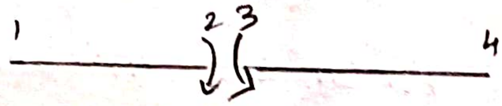
Form the element coordinate and Force $[P^o]$.



$$[P^o] = \begin{bmatrix} -13.33 \\ 13.33 \\ -50 \\ 50 \end{bmatrix}$$

Step 4:

Form β matrix.



$$[\beta] = \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}$$

$$[F^o] = [B]^T [P^o]$$

$$= \begin{bmatrix} 0 & 1 & 1 & 0 \end{bmatrix}_{1\times 4} \begin{bmatrix} -13.33 \\ 13.33 \\ -50 \\ 50 \end{bmatrix}_{4\times 1}$$

$$[F^o] = [-36.67]$$

Step 5:

Form the element stiffness matrix $[k_n]$

$$[k_1] = \begin{bmatrix} \frac{4EI}{l} & \frac{2EI}{l} \\ \frac{2EI}{l} & \frac{4EI}{l} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{4EI}{4} & \frac{2EI}{4} \\ \frac{2EI}{4} & \frac{4EI}{4} \end{bmatrix} k_1 = EI \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix}$$

$$[k_2] = \begin{bmatrix} \frac{4EI}{8} & \frac{2EI}{8} \\ \frac{2EI}{8} & \frac{4EI}{8} \end{bmatrix} \quad [k_2] = EI \begin{bmatrix} 0.5 & 0.25 \\ 0.25 & 0.5 \end{bmatrix}$$

$$[k_n] = EI \begin{bmatrix} 1 & 0.5 & 0 & 0 \\ 0.5 & 1 & 0 & 0 \\ 0 & 0 & 0.5 & 0.25 \\ 0 & 0 & 0.25 & 0.5 \end{bmatrix}$$

Step 6:

Form system stiffness Matrix $[K]$

$$[K] = [B]^T [k][B]$$

$$= \begin{bmatrix} 0 & 1 & 1 & 0 \end{bmatrix}_{1\times4} EI \begin{bmatrix} 1 & 0.5 & 0 & 0 \\ 0.5 & 1 & 0 & 0 \\ 0 & 0 & 0.5 & 0.25 \\ 0 & 0 & 0.25 & 0.5 \end{bmatrix}_{4\times4} \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}_{4\times1}$$

$$= EI \begin{bmatrix} 0.5 & 1 & 0.5 & 0.25 \end{bmatrix}_{1\times4} \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}_{4\times1}$$

$$= EI \begin{bmatrix} 1 + 0.5 \end{bmatrix}$$

$$= EI \; 1.5$$

Step 7:

Calculate Inverse stiffness Matrix $[K^{-1}]$

$$[k^{-1}]^{-1} = \frac{1}{1.5EI}$$

Step 8:

Calculate system displacement [U].

$$[U] = [K]^{-1}\{[F^f] - [F^0]\}$$

$$= \frac{1}{1.5EI}\{0 - (-36.67)\}$$

$$= 24.44EI$$

Step 9:

Calculate element displacement [δ]

$$[\delta] = [\beta][U]$$

$$[\delta] = \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}_{4\times 1} [24.44EI]_{1\times 1}$$

$$= EI\begin{bmatrix} 0 \\ 24.44 \\ 24.44 \\ 0 \end{bmatrix}$$

Step 10:

Calculate element force [P']

$$P' = [k][\delta]$$

$$= EI\begin{bmatrix} 1 & 0.5 & 0 & 0 \\ 0.5 & 1 & 0 & 0 \\ 0 & 0 & 0.5 & 0.25 \\ 0 & 0 & 0.25 & 0.5 \end{bmatrix}_{4\times 4} EI\begin{bmatrix} 0 \\ 24.44 \\ 24.44 \\ 0 \end{bmatrix}_{4\times 1} \quad 4\times 1$$

$$= EI\begin{bmatrix} 12.22 \\ 24.44 \\ 12.22 \\ 6.11 \end{bmatrix}$$

Step 11:

Calculate Final force $[P^f]$

$[P^f] = [P'] + [P^0]$

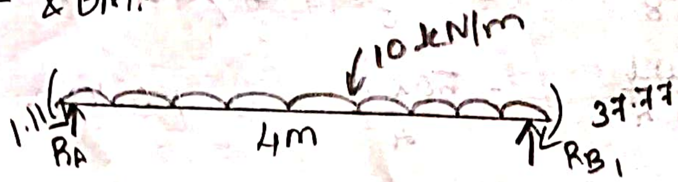
$$= EI \begin{bmatrix} 12.22 \\ 24.44 \\ 12.22 \\ 6.11 \end{bmatrix} + \begin{bmatrix} -13.33 \\ 13.33 \\ -50 \\ 50 \end{bmatrix}$$

$$= EI \begin{bmatrix} -1.11 \\ 37.77 \\ -37.78 \\ 56.11 \end{bmatrix}$$

Step 12:

SF & BM:

Span AB



$R_{B1} \times 4 - 1.11 + 37.77 = 10 \times 4 \times 4/2$

$4 R_{B1} + 36.66 = 80$

$4 R_{B1} = \frac{80 - 36.66}{34}$

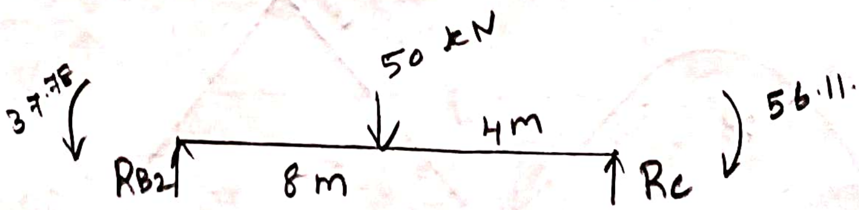
$R_{B1} = 10.83$ kN.

$R_A + R_{B1} = 10 \times 4$.

$R_A + 10.83 = 40$

$R_A = -29.17$ kN.

Span BC.



$$R_C \times 8 - 37.78 + 56.11 = 50 \times 8$$

$$8R_C + 18.33 = 400$$

$$R_C = \frac{400 - 18.33}{8}$$

$$R_C = 47.70 \text{ kN.}$$

$$R_{B2} + R_C = 50$$

$$R_{B2} + 47.70 = 50$$

$$R_{B2} = 50 - 47.70$$

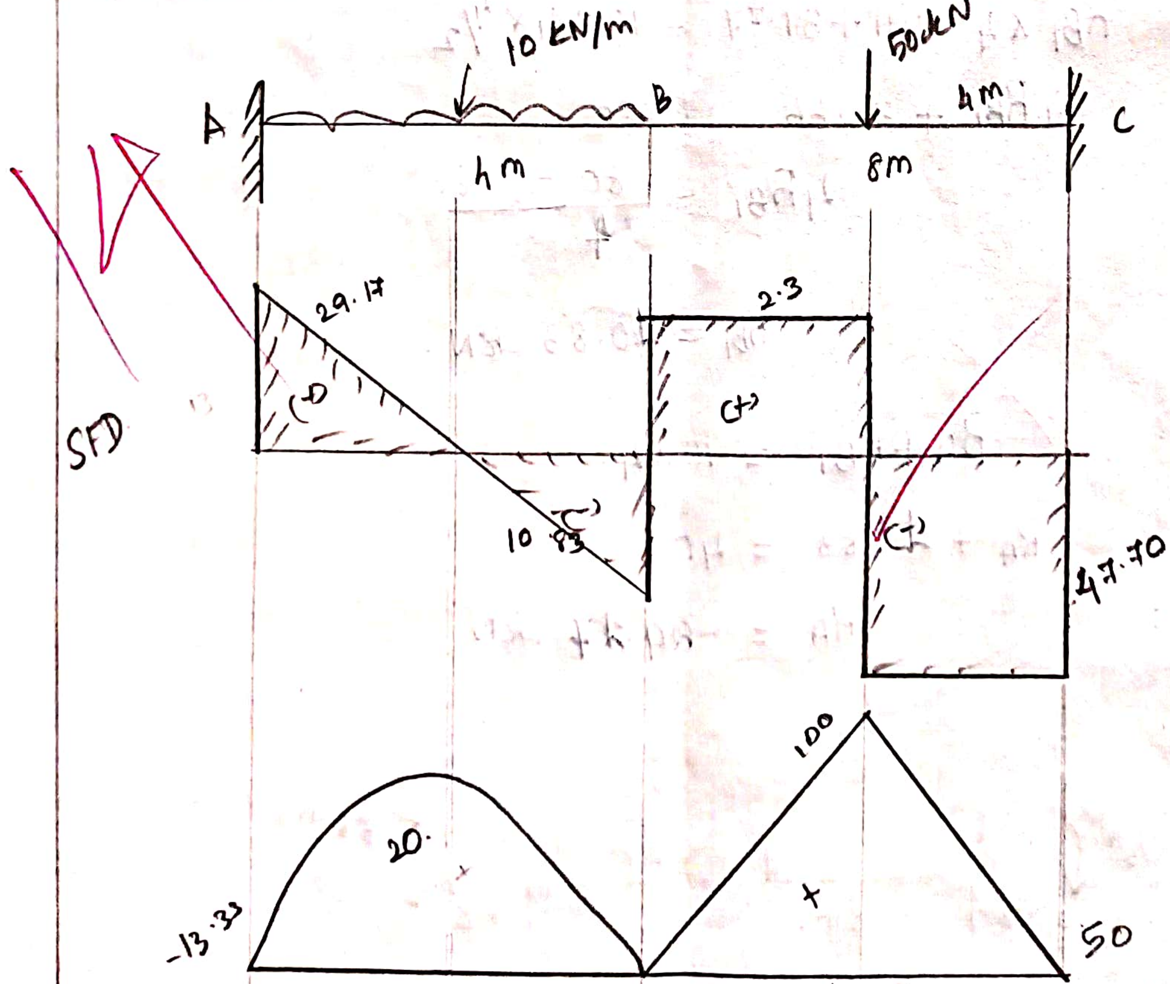
$$= 2.3 \text{ kN.}$$

BM:

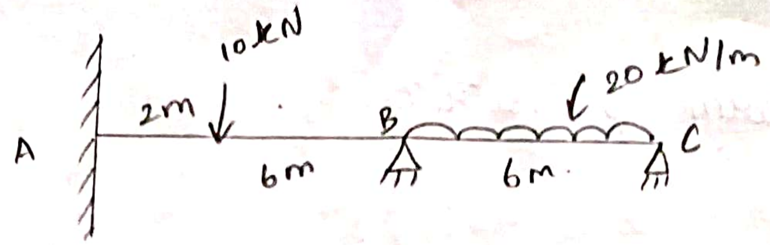
Span AB $= \frac{wl^2}{8} = \frac{10 \times 4^2}{8} = 20 \text{ kN.}$

Span BC $= \frac{wl}{4} = \frac{50 \times 8}{4} = 100 \text{ kN.}$

SFD & BMD.



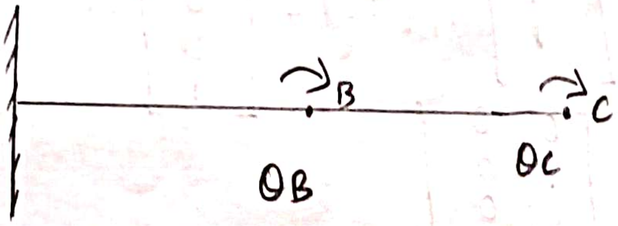
7.



Solu:

Step 1:

Calculate Kinematic Indeterminancy.



The structure is kinematic indeterminancy is 2 degree.

Considered θ_B and θ_C is system displacement.

Step 2:

Calculate FEM.

$$M_{FAB} = \frac{-wab^2}{l^2} = \frac{-10 \times 2 \times 4^2}{6^2} = -8.89 \text{ kNm.}$$

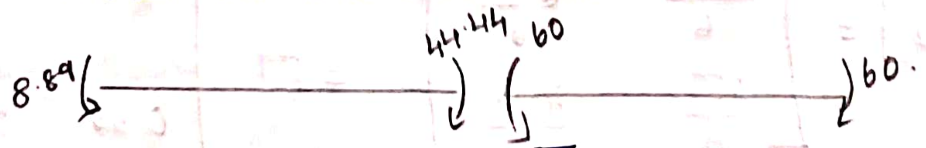
$$M_{FBA} = \frac{wa^2b}{l^2} = \frac{10 \times 2^2 \times 4}{6^2} = 4.44 \text{ kNm.}$$

$$M_{FBC} = \frac{-wl^2}{12} = \frac{-20 \times 6^2}{12} = -60 \text{ kNm.}$$

$$M_{FCB} = \frac{wl^2}{12} = \frac{20 \times 6^2}{12} = 60 \text{ kNm.}$$

Step 3:

Form the element coordinate and Force $[P^0]$.



$$[P^0] = \begin{bmatrix} -8.89 \\ 4.44 \\ -60 \\ 60 \end{bmatrix}$$

Step 4:

Form β matrix

$[B'] =$ 

$[B_2] =$ 

$$[B_1] = \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}, \quad [B_2] = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$[B] = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$[F^0] = [B]^T [P^0]$$

$$= \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -8.89 \\ 4.44 \\ -60 \\ 60 \end{bmatrix}$$

$$= \begin{bmatrix} -55.56 \\ 60 \end{bmatrix}$$

Step 5:

Form the element stiffness matrix $[k_n]$

$$[k_1] = \begin{bmatrix} \frac{4EI}{6} & \frac{2EI}{6} \\ \frac{2EI}{6} & \frac{4EI}{6} \end{bmatrix} = EI \begin{bmatrix} 0.66 & 0.33 \\ 0.33 & 0.66 \end{bmatrix}$$

$$[k_2] = \begin{bmatrix} \frac{4EI}{6} & \frac{2EI}{6} \\ \frac{2EI}{6} & \frac{4EI}{6} \end{bmatrix} = EI \begin{bmatrix} 0.66 & 0.33 \\ 0.33 & 0.66 \end{bmatrix}$$

$$[k_n] = EI \begin{bmatrix} 0.66 & 0.33 & 0 & 0 \\ 0.33 & 0.66 & 0 & 0 \\ 0 & 0 & 0.66 & 0.33 \\ 0 & 0 & 0.33 & 0.66 \end{bmatrix}$$

Step 6:

Form System Stiffness Matrix [K]

$$[K] = [\beta]^T [k] [\beta]$$

$$= \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}_{2\times4} \frac{1}{EI} \begin{bmatrix} 0.66 & 0.33 & 0 & 0 \\ 0.33 & 0.66 & 0 & 0 \\ 0 & 0 & 0.66 & 0.33 \\ 0 & 0 & 0.33 & 0.66 \end{bmatrix}_{4\times4} \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$= \frac{1}{EI} \begin{bmatrix} 0.33 & 0.66 & 0.66 & 0.33 \\ 0 & 0 & 0.33 & 0.66 \end{bmatrix}_{2\times4} \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}_{4\times2}$$

$$= \frac{1}{EI} \begin{bmatrix} 1.32 & 0.33 \\ 0.33 & 0.66 \end{bmatrix}$$

Step 7:

Calculate Inverse Stiffness Matrix $[K]^{-1}$

$$[k]^{-1} = \frac{1}{[0.87 - 0]} \frac{1}{EI} \begin{bmatrix} 0.66 & -0.33 \\ -0.33 & 1.32 \end{bmatrix}$$

$$= \frac{1}{0.87} \frac{1}{EI} \begin{bmatrix} 0.66 & -0.33 \\ -0.33 & 1.32 \end{bmatrix}$$

$$[k]^{-1} = \frac{1}{EI} \begin{bmatrix} 0.57 & -0.29 \\ -0.29 & 1.158 \end{bmatrix}$$

Step 8:

Calculate system displacement [U]

$$[U] = [K]^{-1}\{[F^f] - [f^0]\}$$

$$= \frac{1}{EI}\begin{bmatrix} 0.57 & -0.29 \\ -0.29 & 1.15 \end{bmatrix} \left\{ (0 - \begin{pmatrix} -55.56 \\ 60 \end{pmatrix}) \right\}$$

2×2 2×1

$$= \frac{1}{EI}\begin{bmatrix} 28.62 \\ -52.9 \end{bmatrix}$$

28.62

-31.67 + 60.29

16 10 -69

Step 9:

Calculate element displacement [δ]

$$[\delta] = [B][U]$$

$$= \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \frac{1}{EI}\begin{bmatrix} 28.62 \\ -52.9 \end{bmatrix}$$

4×2 2×1

$$= \frac{1}{EI}\begin{bmatrix} 0+0 \\ 28.62+0 \\ 28.62+0 \\ 0-52.9 \end{bmatrix}$$

$$= \frac{1}{EI}\begin{bmatrix} 0 \\ 28.62 \\ 28.62 \\ -52.9 \end{bmatrix}$$

Step 10:

Calculate element force [P']

Part-A :

1. Rigid frame:

* A of origid frame is a structural configuration consisting of frame the connecting b/w all the frame. fixed at particular angles that Do not change.

* Member can bending moment shear and axial load.

2. Primary structure

* Structure formed by removing the excess or redundant retaints from an indeterminate structure, statically determinate.

* Solving Indeterminate structure by flexibility matrix method.

3. Stiffness coefficient :

* Force developed at joint i due to unit displacement at joint j while other joints are fixed.

* Constant K.

* Unit Force per unit.

4. Rigidity of a structure.

* It does not bend or flex under an applied force.
* The opposite of rigidity is flexibility
* Rigidity of structural element.

5. Stiffness method

$$\{R\} = [K] \{r\}$$

where

K = structures stiffness Matrix

R = nodal loads through the structural equilibrium equation.

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

REVISION TEST-4

Class : III /CIVIL | Date & Session: 15.11.2023 (FN)

Max. Marks : 40 | Time: 90mins

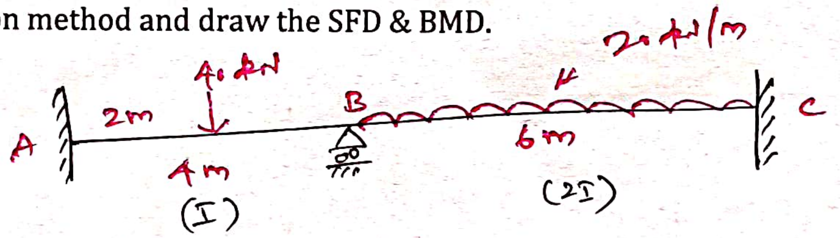
Answer all the questions

PART – A (5 x 2 = 10 Marks)

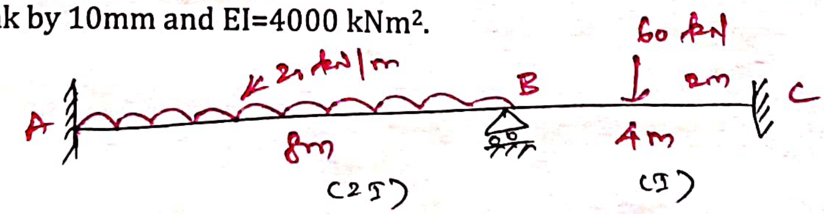
1. Write down the slope deflection equations.
2. What is a sway frame?
3. List the causes for sway in portal frames.
4. Mention the assumptions made in finding forces in a frame.
5. What are the uses of slope deflection method?

PART – B (2 x 15 = 30 Marks)

6. Analyze the two span continuous beam shown in the following figure by slope deflection method and draw the SFD & BMD.



7. Analyze the continuous beam shown in the figure by slope deflection method if joint B sink by 10mm and EI=4000 kNm^2.



STAFF INCHARGE

HOD/CIVIL

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Approved by AICTE, New Delhi
Affiliated to Anna University, Chennai.

B++ NAAC

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023 - 2024 (ODD SEM)

Format A

Assignment - I ✓ / II

Title : Individual activity is assigned to each student based on their learning ability. (Activity list enclosed)

Objective :
* To make the students learn about the ~~aaa~~ subject related questions
* To use latest apps / softwares like Quizalize and Hot potatoes.

Evaluation : Evaluation is based on the ... and presentation. (Evaluat...

Date of Completion : 05/09/2023

05/09/2023

STAFF INCHARGE SIGN

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ACCREDITED WITH GRADE B++ NAAC

DEPARTMENT OF CIVIL ENGINEERING

Sub. Code	: CE 3502	Branch / Year / Sem	: B.E CIVIL / III / V
Sub.Name	: Structural Analysis I	Batch	: 2021-2025
Staff Name	: Mr.K.Arun	Academic Year	: 2023-24 (ODD)

ASSIGNMENT: 1 - PCE ACTIVITY

EVALUATION SHEET

LEVEL-1 SLOW LEARNERS

L1-(Q1-Q4) QUIZ

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 20 Marks: 20 x 2	Total 40 Marks
1	6	MANIKKARAJ R	Determinate trusses	19 x 2	38
2	7	MATHANKUMAR S	Rigid frames	19 x 2	38
3	10	PASHAGAN G	Continuous beams	18 x 2	36
4	11	PRAGADISH M	Frames without sway	19 x 2	38

L1-(Q5-Q7) SEMINAR

S.No	Roll.No	Student Name	Seminar Topic	PPT : 15 Marks	Presentation: 20 Marks	Q&A : 05 Marks	Total 40 Marks
5	12	PRASANNA R	Lack of fit	15	20	03	38
6	13	SARAVANAN K	Sway conditions	15	19	04	38
7	21	SANJAIMANI M	Analysis of Trusses	14	19	04	37

LEVEL-2 AVERAGE LEARNERS

L2-(Q8-Q11) APPLICATION OF CONCEPTS

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 2 Marks: 2 x 20	Total 40 Marks
8	2	ANITHA B	Slope deflection method	2 x 20	40
9	3	ARULPANDIYAN A	Moment distribution method	2 x 20	40
10	4	ARUNKUMAR M	Tension coefficient method	2 x 20	40
11	5	MADHAN D S	Deflection of frames	2 x 20	40

L2-(Q12-Q14) CROSSWORD

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 20 Marks: 20 x 2	Total 40 Marks
12	14	SURYA.V	Determinate trusses	20X2	40
13	16	VENKATACHALAM D	Rigid frames	20X2	40
14	17	VIJAY S	Continuous beams	20X2	40

LEVEL-3 ADVANCED LEARNERS

L3-(Q15-Q18) POSTER PRESENTATION

S.No	Roll.No	Student Name	Poster Topic	Poster design : 20 Marks	Presentation: 15 Marks	Q&A : 05 Marks	Total 40 Marks
15	1	AKALYA J	Types of trusses	20	15	05	40
16	9	NAAVINIYAA G V	Types of beams	20	15	05	40
17	19	SINDHU G	Types of loads	20	15	05	40
18	20	SURUTHI A	Types of supports	20	15	05	40

L3-(Q19-Q21) GATE QUESTIONNAIRE

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 20 Marks: 20 x 2	Total 40 Marks
19	8	MOHAN S	Method of joints	20X2	40
20	15	TAMILARASAN T	Method of sections	20X2	40
21	18	MOHAMMED RIYAS J	Analysis of continuous beams	20X2	40

K. Arun 04/09/2023
COURSE INCHARGE
(K.ARUN, AP/CIVIL)

R. Saravanan 04/09/2023
HOD CIVIL
(Dr.R.SARAVANAN)

GO PREMIUM!

CE3502 - STRUCTURAL ANALYSIS I - PCE ACTIVITY

Quiz by Wincentre Classes

In Your Library

Feel free to use or edit the questions

includes Teacher and Student dashboards

Measure skills
from any curriculum

Tag the questions with any skills you have. Your dashboard will track each student's mastery of each skill.

- Share
- Lock quiz
- Make private
- Delete

Q 1/20 Score 0

Clapeyron's three moment theorem is used to solve

60

fixed beam	continuous beam
simply supported beam	cantilever

Q 2/20

Play as a student
to try out the quiz

Edit questions
to suit your class

20 questions

Verified

Hide answers

GO PREMIUM!

- ☒ Two hinged arch
- ☑ Double Overhanging beam
- ☒ Continuous beam
- ☒ Fixed beam

13

60 sec

Q. Which of the following material is not used in making trusses?

- ☒ Wood struts
- ☑ Concrete
- ☒ Metal Bars
- ☒ Channel

14

60 sec

Q. Which structure will perform better during earthquake?

- ☒ None of the above
- ☑ Statically indeterminate
- ☒ Statically determinate
- ☒ Depends upon magnitude of earthquake

15

60 sec

Q. Which of the following is carried by truss members?

- ☑ Axial load
- ☒ Bending load
- ☒ Flexural load
- ☒ Shear load

16

60 sec

Q. Which of the following methods for solving indeterminate structures are easiest for computational purposes?

- ☒ Method of consistent deformation
- ☑ Displacement method
- ☒ Force method
- ☒ Moment area method

17

60 sec

Q. The fixed support in a real beam becomes in the conjugate beam a

GO PREMIUM!

- ✗ 3

7

60 sec

Q. A single rolling load 8 KN rolls along a girder of 15 m span. The absolute maximum bending moment will be

- ✓ 30kNm
- ✗ 15kNm
- ✗ 60kNm
- ✗ 80kNm

8

60 sec

Q. The shape factor of rectangular section

- ✓ 1.5
- ✗ 1.65
- ✗ 2
- ✗ 2.5

9

60 sec

Q. In the theory of plastic bending of beams, the ratio of plastic moment to yield moment is :

- ✗ Plastic section modulus
- ✓ Shape factor
- ✗ Shear modulus
- ✗ Bulk modulus

10

60 sec

Q. In structural analysis using finite element method, the element stiffness matrix is

- ✗ Unsymmetric matrix
- ✗ Orthogonal matrix
- ✗ Diagonal matrix
- ✓ Symmetric matrix

11

60 sec

Q. Which of the following structural loads are not applied commonly to a building?

- ✓ Rain load
- ✗ Wind load
- ✗ Dead load
- ✗ Live load

KINGS COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

PCE ACTIVITY - SEMINAR

ANALYSIS OF TRUSSES

PRESENTATION BY
M.SANJAIMANI
III YR CIVIL
KCE

ANALYSIS OF TRUSSES

While analyzing a truss structure, a person needs to assume some things to keep things simple:

1.The joint is where the entire load is applied, and all other forces on the member are to be neglected.

2.The weight of a member is very insignificant to the amount of load that has been applied to it. Hence, it will not be considered in further calculations. However, some methods may take in account half of the weight of the member as acting on each individual joint of the member.

Truss Analysis

MAINLY THERE ARE ONLY TWO TYPES OF TRUSSES

(1)Perfect truss
(2)Imperfect truss
(a)Deficient truss
(b)Redundant truss

(1)PERFECT TRUSS:-

A pin jointed truss which has get just sufficient number of members to resist the load without under-going any deformation in shape is called a perfect truss.

Triangular frames is the simplest perfect truss and has three joints and three members.

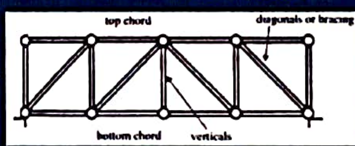
There is a mathematical formula by which we decide the given truss is perfect or imperfect

$m=2j-r$

m=number of members
J=number of joints
R=number of support reaction component

WHAT IS TRUSS?

- A truss is a structure comprising one or more triangular units constructed with straight members whose ends are connected at joints.
- If all the bars lie in a plane, the structure is a planar truss.
- The main parts of a planar truss.



(2)IMPERFECT TRUSS:-

A truss which doesn't satisfies the relation $m=2j-r$ is called an imperfect truss

Following are the two imperfect trusses.

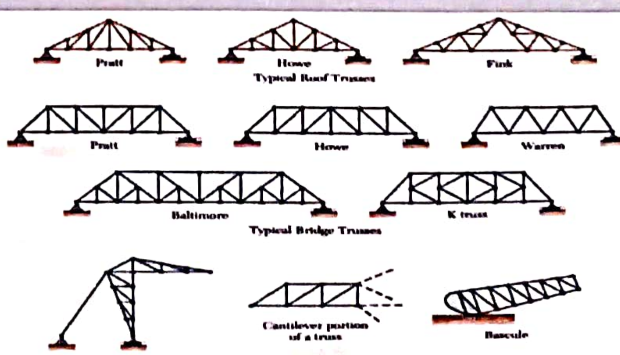
a)Imperfect deficient truss:-

A truss which satisfies the relation $m<2j-r$ is called a deficient truss . It is unstable and may collapse under external forces.

(b)Imperfect redundant truss:-

A truss which satisfies the relation $m>2j-r$ is called a redundant truss.it can't be completely analysed by static equilibrium condition , Therefore it is an indeterminate structure

There are many types of trusses available here, I am showing some common types of trusses.



SPECIAL CASE:-

In general we should not cut more than three members because we have three equations of equilibrium to find three unknown, but in exceptional cases we found that, there are many members are collinear. Then in this condition more than three member can cut. After which choose a centre through which some moment becomes zero and required unknown calculated.

Advantage of section method:-

In section method we do not have to analyse the entire truss if any intermediate member force is desired to be obtained. It can directly be obtained by selecting proper position of section, so it is less time consuming as compare to joint method.

=>Assumption for a perfect truss:-

(1)All the members of truss are straight and connected to each other at their ends by frictionless pins.
(2)All external forces are acting only at pins.
(3)All the members are assumed to be weightless.
(4)All the members of truss and external forces acting at pins lies in same plane.
(5)Static equilibrium condition is applicable for analysis of perfect truss.

i.e.,
summation of f in x=0
summation of f in y=0
Summation of f in z=0
Summation of moment at one point =0

APPLICATION:-

Trusses are usually designed to transmit forces over relatively long span. Common examples being bridge trusses, Roof trusses, Transmission tower etc... Truss is a building invent that allows the weight of a roof to be distributed to the outer walls for better support. Truss gives more support and allows the builders to use fewer materials to achieve any construction. It allows distribution of load. It increases the span of any construction like bridge or building.

Two force member concept:-

By the assumption of perfect truss, all the members of truss should have straight .Connected to each other at their ends by frictionless pins and no external force is acting in between their joint, identifies each truss member as a two force member which may be in tension or compression.
=> The two common techniques for computing the internal forces in a truss are the "Method of joints" and "Method of sections".

Truss Analysis Method of joints

Procedure for method of joints:-
(1)For simply supported truss, consider the F.B.D of entire truss. Applying condition of equilibrium and find support reaction
(2)Consider the F.B.D of joints from the truss at which not more than two member with unknown force exists.
(3)Assume the member to be in tension or compression by simple inspections and applying condition of equilibrium.to find the answers.
(4)The assumed sense can be verified from the obtained numerical results. A positive answer indicates that the sense is correct and vice versa.
(5)Select the new F.B.D of joints with not more than two unknowns in a member and repeat the points 3,4 and 5 for complete analysis,
(6)Finally calculate the answer in required member magnitude of force and their nature.

CONCLUSION:-

After study about truss, I conclude that concept of trusses are very useful in our real life, because concept of truss are help us to make bridge, roof, and tower etc... so trusses are very useful for us.it also have some disadvantage. In truss bridge, it takes up more space and can some-times become a distraction to drivers. It also have higher maintenance demand of all joint and fitting more calculation to determine that it will take the maximum load. Determination of forces in member is carry out by two process, method of joint & section. By this we conclude forces in each member and at each joint. Truss play a vital role in our surrounding i.e. everywhere like in bridge, building, roof top, etc.

Analysis in method of joints:-

While using the method of joints to calculate the forces in the member of truss, The equilibrium equation are applied to individual joints of the truss.
Consequently two independent equilibrium equations are available for each joints.
i.e. summation of f in x=0
summation of f in y=0

Special conditions

Identification of zero force member by inspections(without calculation)
(1)If any joint is identified without external force acting on it such that joint is formed by three members and two of them are collinear ,t hen the third non collinear member should be identified as zero force member.
(2)If any joint is formed by two non collinear members without any external force acting on it then both the members are identified as zero force members.

- (3)If any joint is formed such that only four forces are acting and are collinear in pairs then each collinear forces are equal.
- (4) If a given truss is symmetrical in geometry as well as in loading and support reactions are symmetrical then the forces in members on half side of symmetric is equal to the force in members on the other half.

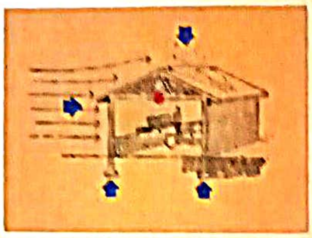
THANK YOU

Method of sections for trusses

Procedure for method of sections
(1)Consider the F.B.D of entire truss and find the support reactions applying equilibrium conditions.
(2)Select the cutting sections to cut the truss into two parts such that it should not cut more than three unknown members.
(3)Select the F.B.D of any one of the two parts considering all internal and external forces acting on that part.
4)Assume tension or compression in the cut members and applying equilibrium condition it's numerical values can be obtained. If the obtained values is negative ,do the required change in nature of force.
(5)Though three equations of equilibrium are available
i.e.,
summation of f in x=0
summation of f in y=0
Summation of moment at one point =0
Preferable use "summation of M=0" by selecting appropriate point for moment such that two known passes through that point. Moment of center may or ,may not lie on the F.B.D of truss.
(6)Do not consider the effect of uncut member in F.B.D.

LIVE LOADS

- Live Loads are not permanent and can change in magnitude.
- They include items found within a building



All the arrows indicate the live loads unless the red one

KINGS

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

PCE ACTIVITY - SEMINAR

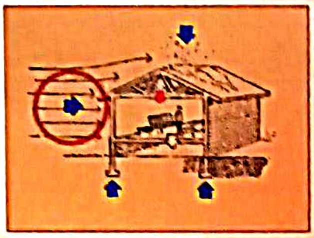
LACK OF FIT & TYPES OF LOADS

PRESENTATION BY
R.PRASANNA
III YR CIVIL
KCE

LIVE LOADS

WIND LOAD:-

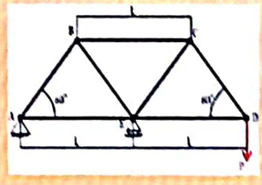
- The wind's relatively large projected areas can develop substantial forces in the structure.

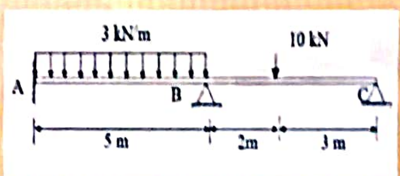


Wind load

LACK OF FIT

- Lack of fit is an occurence in trusses/beams in which there is a difference between the length of a member and the distance between the nodes it is supposed to fit.
- This happens because the connecting member is either too long or too short as compared to the distance between corresponding nodes.





LIVE LOADS

WIND LOAD:

A covered bridge destroyed by wind

INTRODUCTION

- What are the loads?

  -Simply, loads are some sort of force.

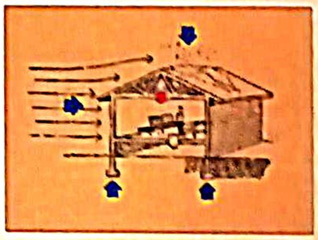
- Major types of loads:

  1.Dead loads. (red arrow)

  - Exerted by the weight of the element of the structure.

  2.Live loads. (rest arrow)

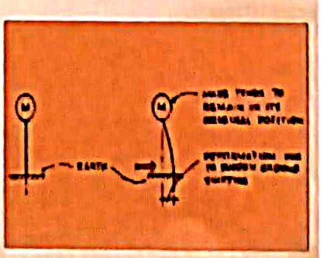
  - Exerted by any temporary force acting on the structure



LIVE LOADS

EARTHQUAKE LOADS:

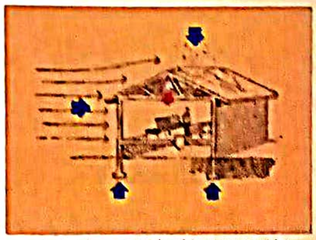
- Earthquake loads are another lateral live load.
- They are very complex, uncertain, and potentially more damaging than wind loads.



Mass tends to remain in its original position, deformation due to sudden ground moving take place at the base

DEAD LOADS

- Dead Loads are those loads which are considered to act permanently; they are "dead," stationary, and unable to be removed.
- The self-weight of the structural members normally provides the largest portion of the dead load of a building.



Exerted by the weight of the element of the structure

UNIFORMLY DISTRIBUTED LOAD

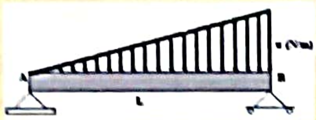
- Load uniformly distributed on certain length of a beam is called uniformly distributed load.
- It is written as u.d.l.
- It is shown by w.
- Unit of u.d.l. is kN/m or N/m.

LIVE LOADS

EARTHQUAKE LOADS:

- Buildings have been demolished by the earthquake loads, that happened because it have not been designed to deal with these loads. The earthquake was in Qamm in Iran.

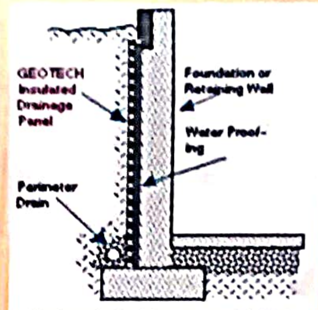
UNIFORMLY VARYING LOAD



- This type of load gradually increase or decrease on the length of the beam.
- It is also called triangular load.

HYDROSTATIC AND SOIL PRESSURE

- When building a wall, whether it is a basement wall or an outdoor retaining wall, it is necessary to make it strong enough to resist the pressure differential from the soil side to the open side.
- This pressure will consist of two elements:
  - Soil Pressure, which is a function of the soil depth and type.
  - Hydrostatic pressure, which will be simply the depth of the wall times the density of water

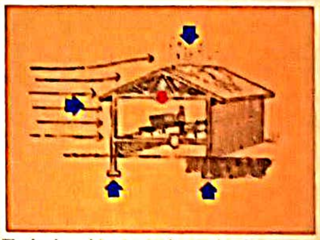


Hydrostatic Pressure Relief System

THANK YOU

LOAD COMBINATION

- Designing steel or concrete structures involves considering combinations of load; therefore, most structural engineers are quite familiar with assessing the probability of various load combinations.
- As an example, it is unlikely that any bridge will need to resist full design vehicle load, design wind load, and the structure's self-weight simultaneously.

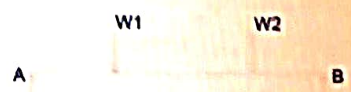


The load combination is clear in this figure, we can see the dead load and the live load including its kinds like weight of furniture and people, wind load and snow loads.

POINT LOAD OR CONCENTRATED LOAD

- The load concentrated at one point is called point load.
- Unit of point load is N or kN.

  e.g. 20kN,100N etc.



W1 and W2 are point loads.

APPLICATION OF CONCEPTS

Tension Co-efficient Method

CE 3502 - Structural Analysis

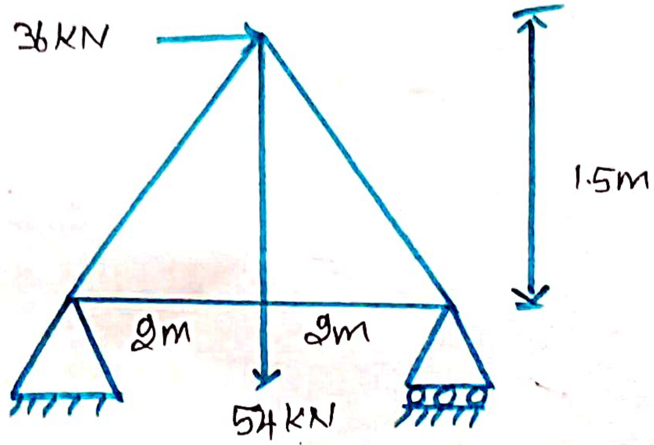
40

20/08/2023

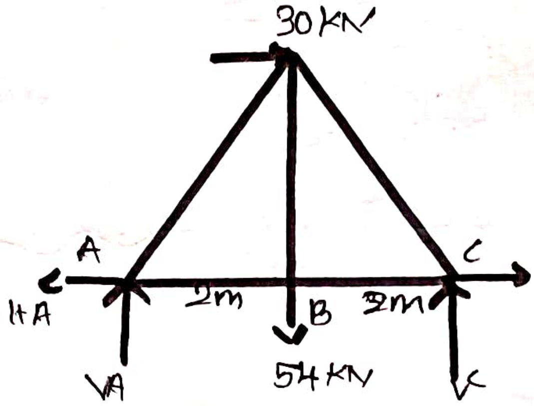
ASSIGNMENT NO: 1

NAME : M. Arun Kumar
class : III \ civil
SubJect : Structural Analysis-1
Sub code : CE 3502
Roll NO : 21CE04
DATE : 04\09\2023

① using tension co-efficient method, analysis the plane truss show in the fig. and find the forces in the members.



Step 1 :-



$\Sigma M = 0$

$\Rightarrow$ Taking moment about A,

$\Rightarrow 54 \times 2 + 36 \times 1.5 - V_C \times 4\,m = 0$

$\Rightarrow V_C = 40.5\,KN$

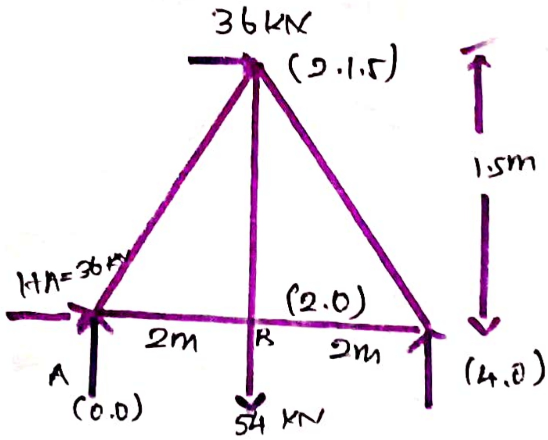
$\Sigma F_y = 0$

$\Rightarrow V_A + V_C = 54 \Rightarrow V_A = 13.5\,KN$

$\Sigma F_x = 0 \Rightarrow -H_A + 36 = 0 \Rightarrow H_A = 36\,KN$

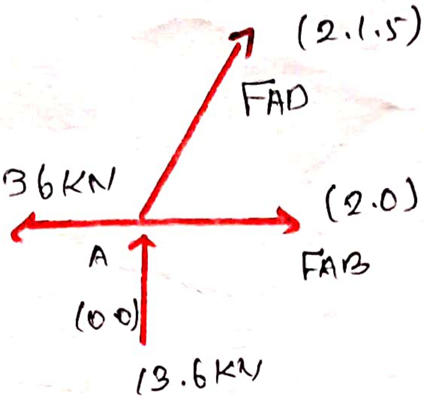
Step 2 :-

let A is origin.



Calculation of tension co-efficient :-

Consider Joint A,



$\Sigma F_x = 0 = \Sigma t_{ij} \cdot x_{ij} + x_i = 0$

$\Rightarrow t_{AB} \cdot x_{AB} + t_{AD} \cdot x_{AD} - 36 = 0$

$\Rightarrow 2t_{AB} + 2 \cdot t_{AD} = 36$

$\Rightarrow t_{AB} + t_{AD} = 18 \longrightarrow (1)$

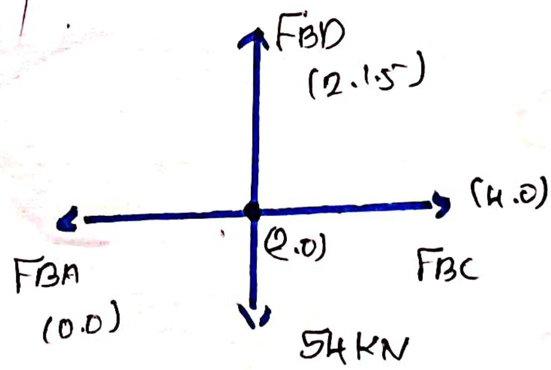
$\Sigma F_y = 0 \Rightarrow \Sigma t_{ij} \cdot y_{ij} + y_i = 0$

$\Rightarrow t_{AD} \cdot y_{AD} + y_i = 0$

$\Rightarrow t_{AB} \cdot 1.5 + 13.6 = 0 \Rightarrow t_{AD} = -13.6/1.5 = -9$ kN/m

$t_{AB} = 27$ kN/m

Consider Joint B:-



$\Sigma F_x = 0$

$\Rightarrow x_{BC} + t_{BC} + x_{BA} \cdot t_{BA} = 0$

$\Rightarrow (4-2)\, t_{BC} + (0-2)\, t_{BA} = 0$

$\Rightarrow 2t_{BC} - 2t_{BA} = 0$

$\Rightarrow t_{BC} = t_{BA} = 27$ kN/m

$\Sigma F_y = 0 \Rightarrow t_{BD} \cdot x_{BD} - 54 = 0$

$\Rightarrow t_{BD} \times 1.5 - 54 = 0 \Rightarrow t_{BD} = 36$ kN/m

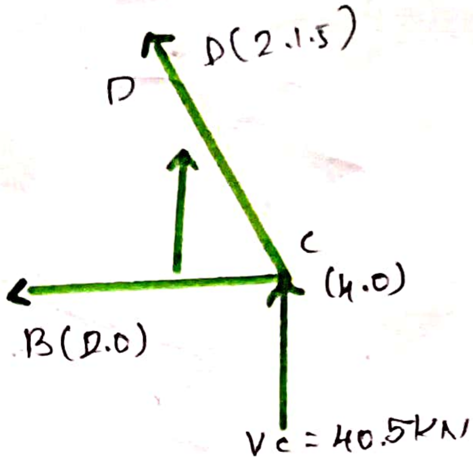
Consider Joint C :-

$\Sigma F_y = 0$

$\Rightarrow f_{CD} - y_{CD} + 40.5 = 0$

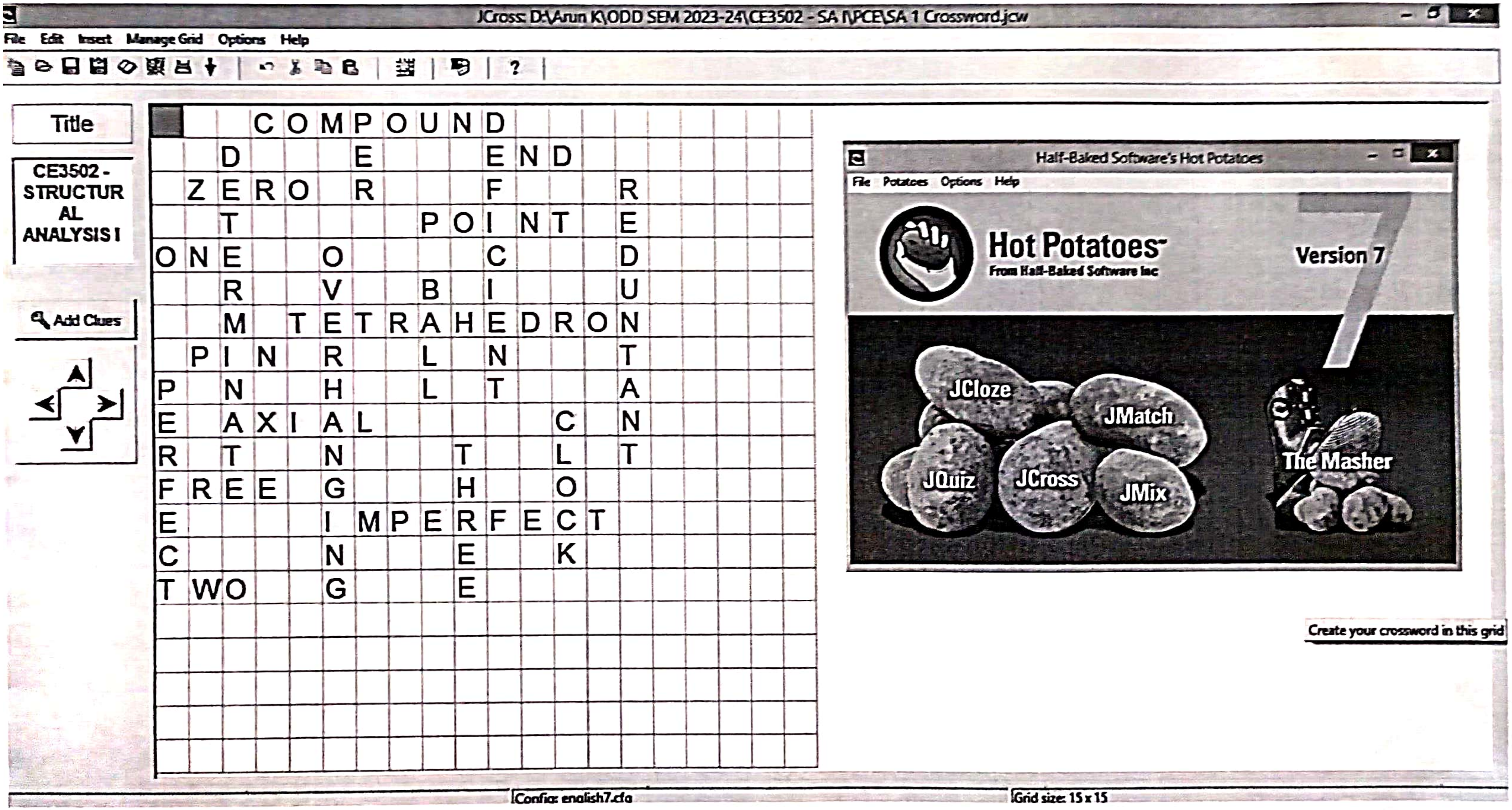
$\Rightarrow 1.5 \, f_{CD} + 40.5 = 0$

$\Rightarrow f_{CD} = 27 \, kN/m$



Force in members by tension coefficient method :-

Member	f_{ij}	L_{ij}	$T_{ij} = f_{ij} \times L_{ij}$	Nature
AB	27	2	54 kN	Tension
BC	27	2	54 kN	"
CD	27	$\sqrt{2^2 + 1.5^2} = 2.5$	67.5 kN	"
BA	-9	2.5	-22.5 kN	compression
BD	36	1.5	54 kN	Tension.


JCross: D:\Arun K\ODD SEM 2023-24\CE3502 - SA I\PCE\SA 1 Crossword.jcw
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CE3502 - STRUCTURAL ANALYSIS I
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E AXIAL C N
R T N T L T
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E IMPERFECT
C N E K
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V. Surya.

KINGS COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

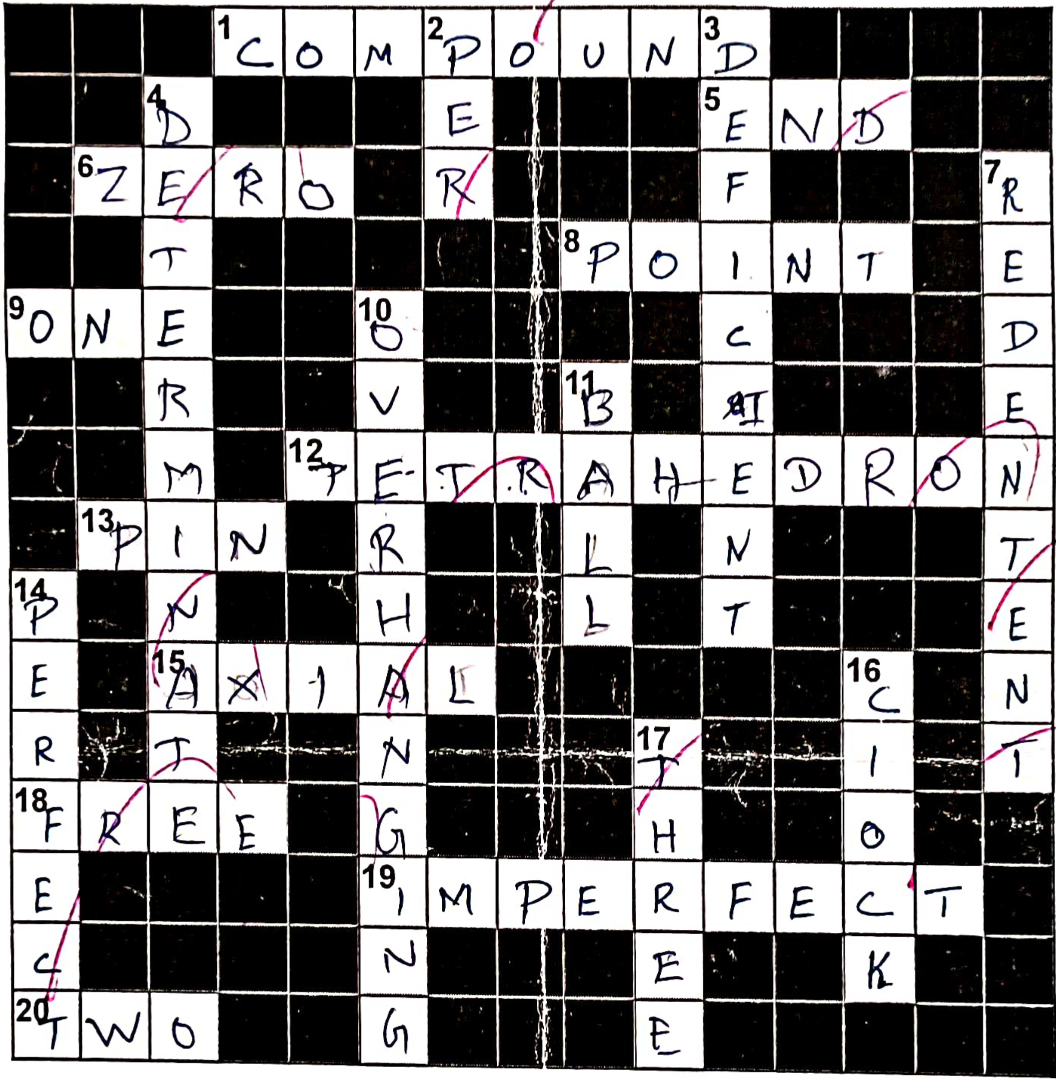
ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 - STRUCTURAL ANALYSIS I - PCE ACTIVITY

STUDENT NAME : SURYA.V

ROLL No : 21CE14

Crossword



24/08/2023

Across:

1 A truss formed by joining two or more simple trusses is called ________ Truss

5 Fixed ______ moments are required for solving slope deflection equations

6 Moment at a hinge will be equal to ____________

8 Concentrated load is also known as ___________ load

9 The degree of freedom of space roller joint is _____

12 __________ is the simplest element of a space truss.

13 Hinge support is also known as _____ support.

15 Truss members carry ________ load

18 In a beam, slope value will be ____________ at the free end.

19 If "n" is not equal to 2j-3, then the frame is called as ____________ frame.

20 In general ____ equilibrium equations are needed to solve each joint of a truss.

Down:

2 For UDI, loads are measured in load ___________ length

3 If n < 2j-3, then the frame is called as ____________ frame.

4 If the equilibrium conditions are enough to analyze a structure, then it is said to be statically ________________

7 If n > 2j-3, then the frame is called as ____________ frame.

10 If a beam extends beyond its support, then it is called as __________ beam.

11 The type of joints used in space truss are _______ and Socket Joint.

14 If n = 2j-3, then the frame is called as ____________ frame.

16 ____-_____wise moments are positive.

17 The number of independent equations to be satisfied for static equilibrium of a plane structure is _________

DEPARTMENT OF CIVIL ENGINEERING

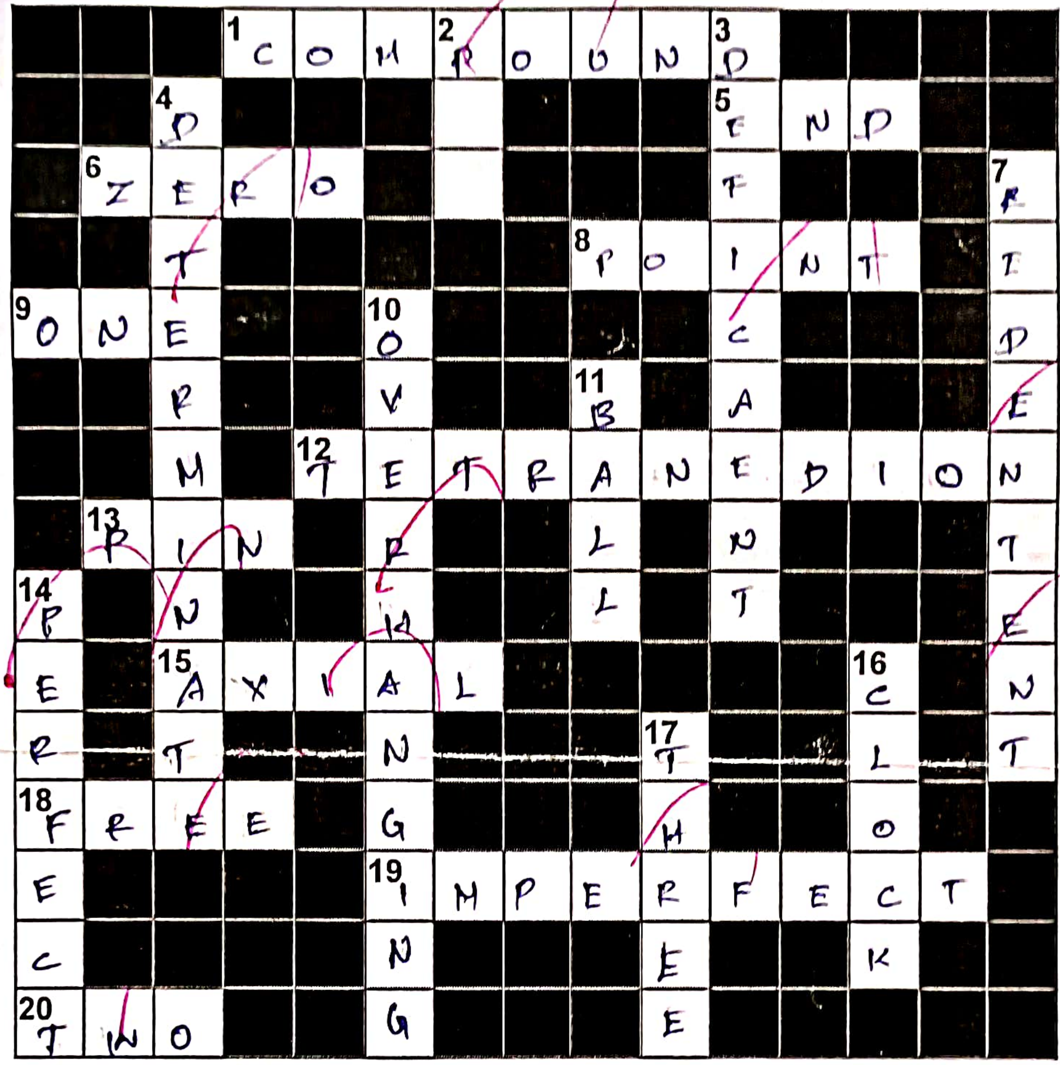
ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 - STRUCTURAL ANALYSIS I - PCE ACTIVITY

STUDENT NAME : D. Venkatachalam.

ROLL No : 921121103018

Crossword



10

Across:

1 A truss formed by joining two or more simple trusses is called _________ Truss

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Verified

Vijay

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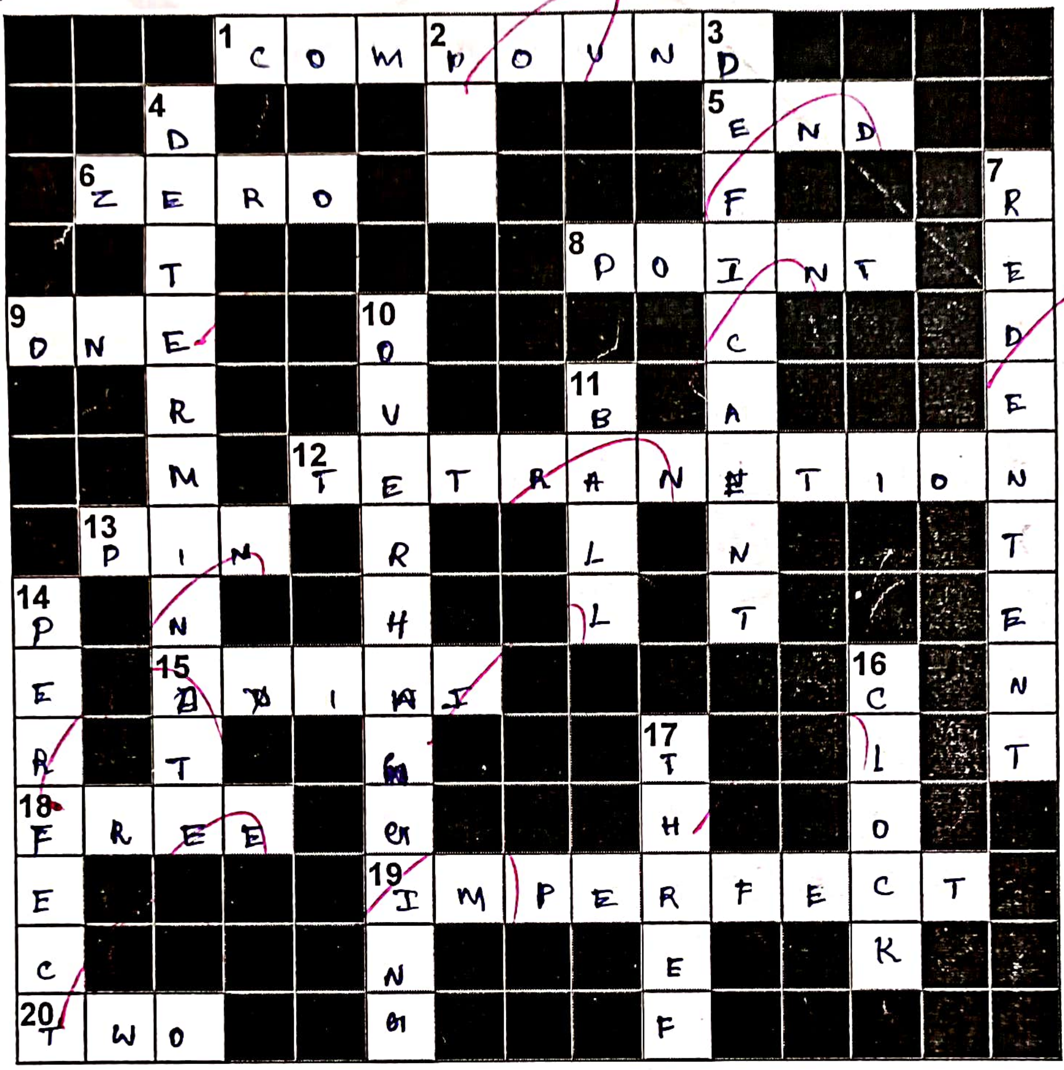
ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 - STRUCTURAL ANALYSIS I - PCE ACTIVITY

STUDENT NAME : VIJAY S

ROLL No : 21CE17

Crossword



Across:

1. A truss formed by joining two or more simple trusses is called ________ Truss
5. Fixed ______ moments are required for solving slope deflection equations
6. Moment at a hinge will be equal to ____________
8. Concentrated load is also known as __________ load
9. The degree of freedom of space roller joint is _____
12. __________ is the simplest element of a space truss.
13. Hinge support is also known as _____ support.
15. Truss members carry ________ load
18. In a beam, slope value will be ___________ at the free end.
19. If "n" is not equal to 2j-3, then the frame is called as ____________ frame.
20. In general ____ equilibrium equations are needed to solve each joint of a truss.

Down:

2. For UDI, loads are measured in load ___________ length
3. If n < 2j-3, then the frame is called as ____________ frame.
4. If the equilibrium conditions are enough to analyze a structure, then it is said to be statically ___________________
7. If n > 2j-3, then the frame is called as ____________ frame.
10. If a beam extends beyond its support, then it is called as __________ beam.
11. The type of joints used in space truss are _______ and Socket Joint.
14. If n = 2j-3, then the frame is called as ____________ frame.
16. ___________wise moments are positive.
17. The number of independent equations to be satisfied for static equilibrium of a plane structure is _________

ASSINGNMENT-1

STRUCTURAL ANALYSIS-1

SUBMITTED BY:

A. SURUTHI

821121103303

III - CIVIL

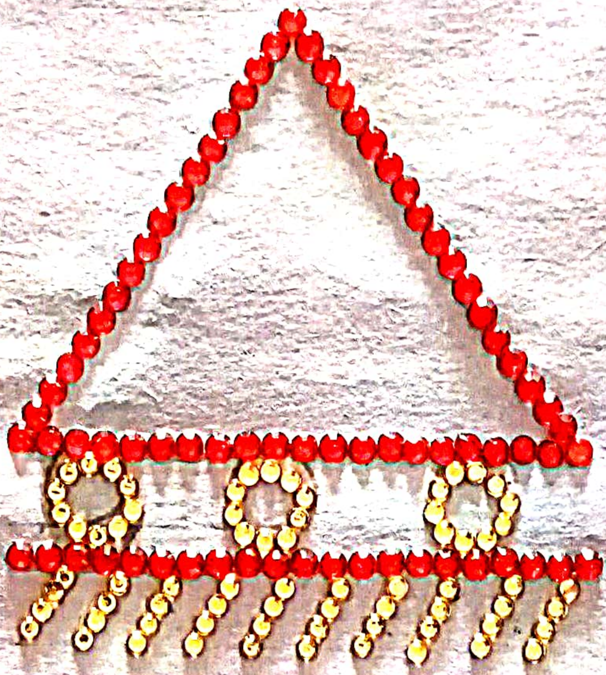
CE 3502 - SA-I

POSTER PRESENTATION

TOPIC

TYPES OF SUPPORTS

1. ROLLER SUPPORT

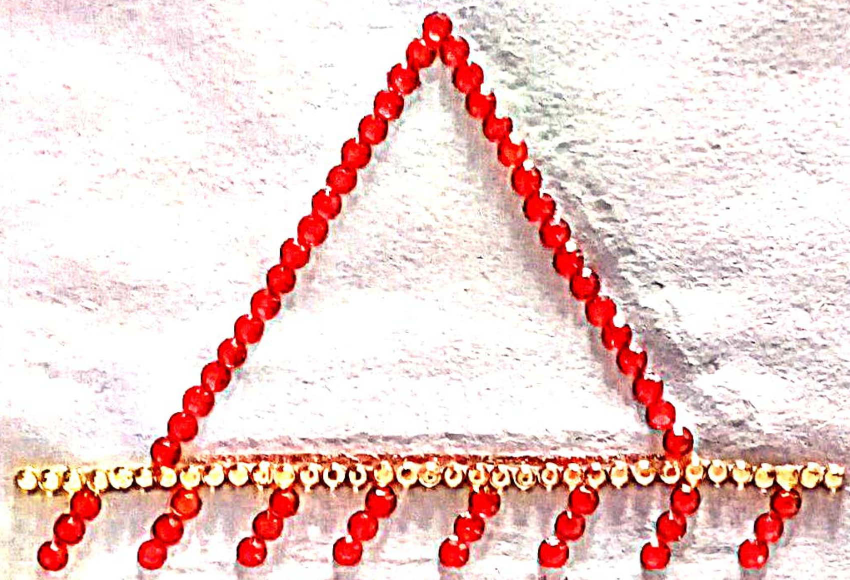


* A roller support allows rotation about any axis and translation (horizontal movement) in any direction parallel to the surface on which it rests.

* It restrains the structure from movement in a vertical direction.

* The idealized representation of a roller and its reaction are also shown.

2. HINGED SUPPORT



* If the beam is supported on hinge or pin then such a support is called as Hinged or pinned support

* In hinged support the beam cannot move in any direction.

* In hinged beam the reaction may be vertical (V_A), Horizontal (H_A) or inclined (R) depending upon the type of loading.

3. FIXED SUPPORT

* If the end of the beam is fixed or built-in, then such a support is called as fixed support.

* In fixed support the reaction may be vertical (V_A). Horizontal (H_A) or Inclined (R) and in addition there will be a moment (M_A) acting at fixed ea end as shown.

* It has three reaction.

ASSIGNMENT-I

GATE QUESTIONS

40

28/08/2023

Verified

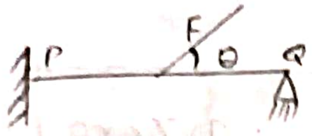
J. MOHAMED RIYAS

III[rd] YEAR CIVIL

CE3502

STRUCTURAL ANALYSIS-I

1) consider a beam PQ fixed at P hinged at Q and subjected to a load F as shown in figure (not drawn to scale). The static and kinematic degrees of indeterminacy, respectively are



a) 2 and 1

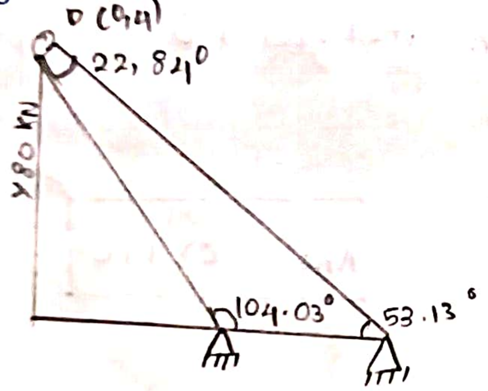
b) 2 and 0

c) 1 and 2

D) 2 and 2

Ans : A, 2 and 1

2) Mathematically idealization of crane has three bars with their vertices arranged as shown in figure with a load 80 KN hanging vertically. The coordinates of the vertices are given in parenthesis. The force in the member QR, FQR will be



a) 30KN compressive

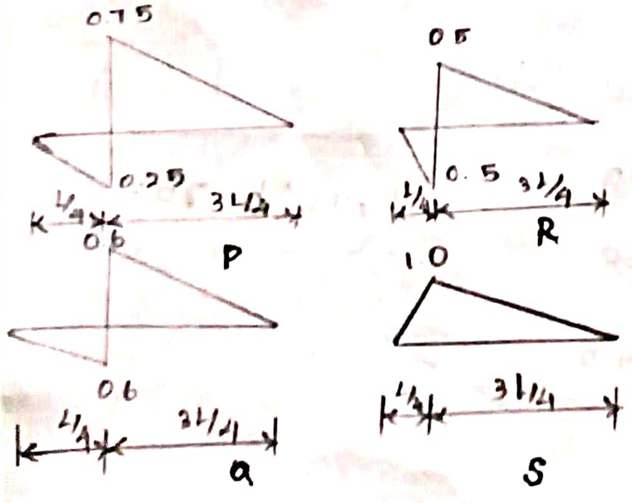
b) 30KN Tensile.

c) 50KN compressive.

D) 50KN Tensile.

Ans : 30KN compressive

IN beam of lenght L, four possible influence line diagram for shear force at a section located at a distance of L/4 from the left end support are shown below. The correct influence line diagram is:



a) P

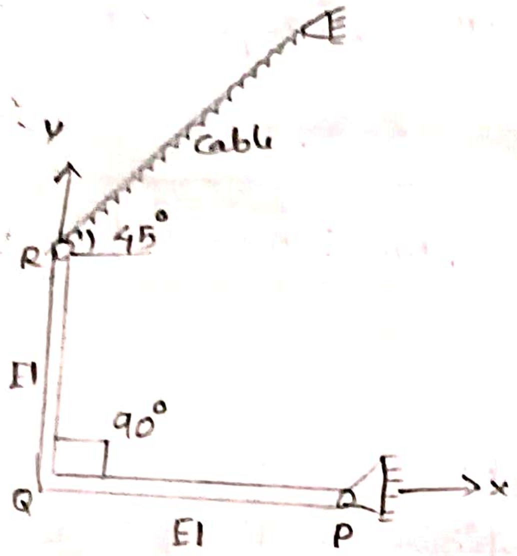
b) Q

c) R

d) S

Ans : a) P

4) The degree of static indeterminacy of a rigid jointed frame PQR supported as shown in the figure is.



a) zero

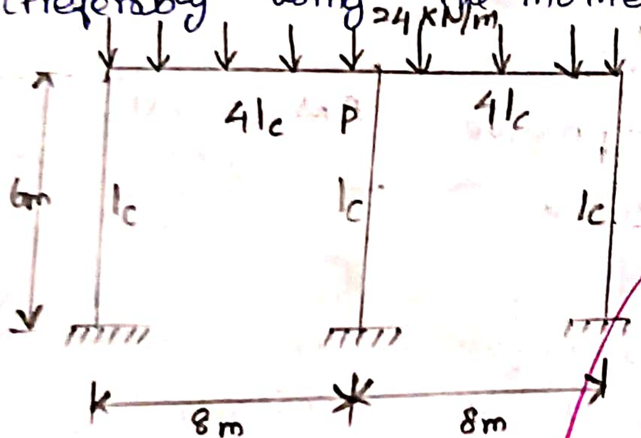
b) one

c) Two

d) unstable

Ans : a) Zero

5) Consider the symmetry of a rigid frame as shown below the magnitude of the bending moment (in KNm) at P (Preferably using the moment distribution method) is



a) 170

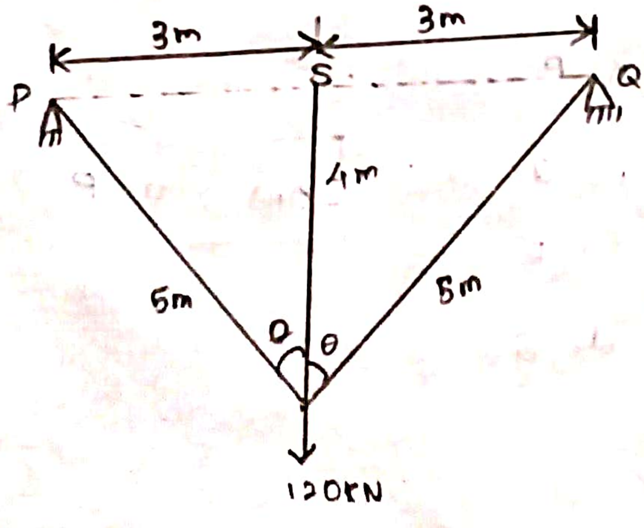
b) 172

c) 176

d) 178

Ans : c) 176

6) The tension (in KNm) in 10m long cable shown in figure neglecting its-self-weight is.



a) 120

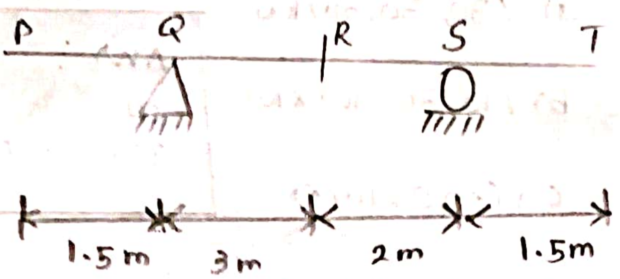
b) 75

c) 60

d) 45

Ans : b 75

7) Distributed loads (s) of 50 KN/m may occupy any position (s) (either continuously or in patches) on the girder PQRST as shown in the figure (NOT drawn to the scale)



a) 22.50

b) 56.25

c) 93.75

D) 150.00

Ans: b) 56.25

8) A rigid weightless platform PQRS shown is can slide freely. vertical direction. The platform is held in position by the weightless member OJ and four weightless frictionless rollers point O and J are pin connection. A block 90KN rests on the platform.

a) 90

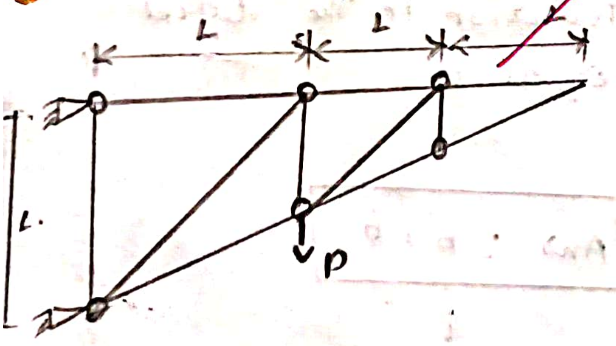
b) 120

c) 150

D) 180

Ans : b) 120

9) Consider the planar truss shown as figure. action load of The P is



a) 6

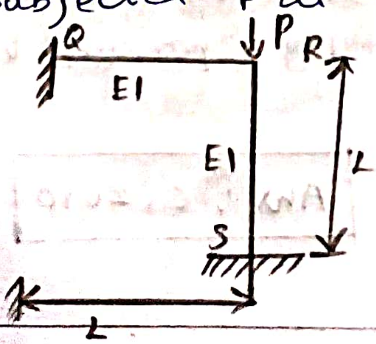
b) 7

c) 8

D) 9

Ans : c) 8

10) The rigid-joined planed frame QRS shown in the figure. is subjected P at the joint R load



a) 0.1

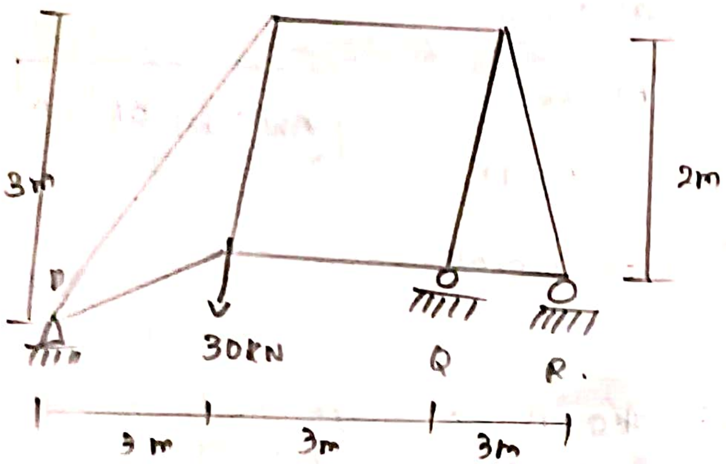
b) 7.5

c) 3.0

D) 48.0

Ans : b ; 7.5

11) Consider the pin jointed plane truss shown in the figure let RP, RQ and RR denote the vertical reaction (upward positive) applied by the support at P, Q and R respectively on the truss



a) (30,-30,30) KN

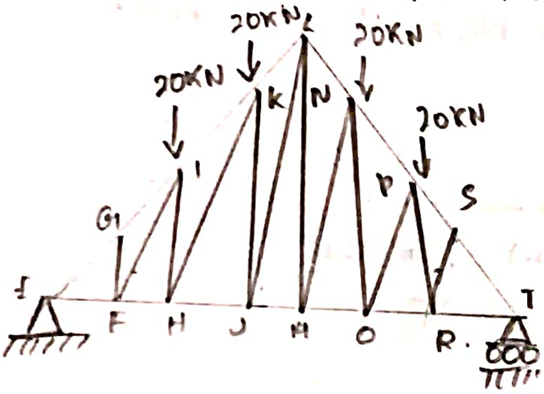
b) (10,30,-10) KN)

c) (20,0,10) KN

d) (0,60,-30) KN

Ans : a) 30,-30,30

12) A plane truss is which one of the option contain only zero forces members in the truss?



a) FG, FI, HI, RS

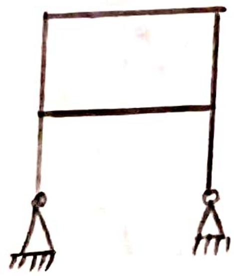
b) FI, FG, RS, PR

c) FI, HI, PR, RS

D) FG, FH, HI, RS

Ans : b) FI, FG, RS, PR

13) If the axial and shear deformation in different members of the frame are assumed to be negligible the reduction in the degree of kinematical indeterminacy would be equal to



a) 5

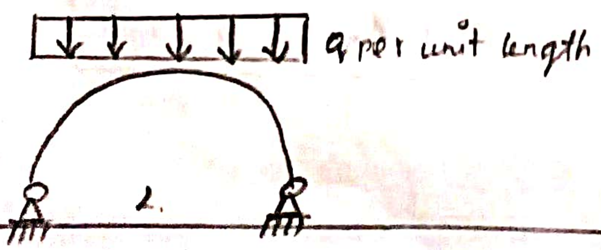
b) 6

c) 7

D) 8

Ans : b, 6

14) The figure shown a two-hinged parabolic arch L span subjected uniformly distributed load of intensity q per unit length



a) $qL^2/8$

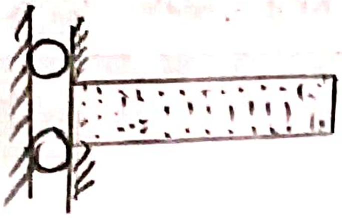
b) $qL^2/12$

c) zero

d) $qL^2/10$

Ans : c, zero

15) A guided support as shown in figure below is respectly by three springs (horizontal, vertical and rotational) with stiffness k_x, k_y and K_θ respectively.



a) ∞, 0, ∞

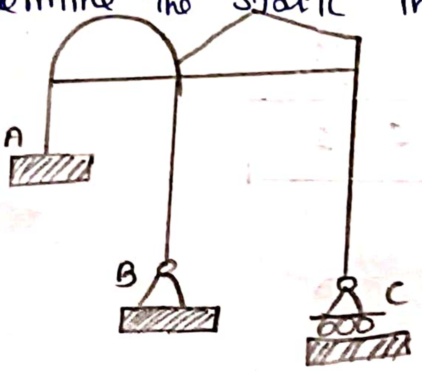
b) ∞, ∞, ∞

c) 0, ∞, ∞

d) ∞, ∞, 0

Ans : a) ∞, 0, ∞

16 Determine the static indeterminacy of structure shown in figure



a) 9

b) 8

c) 12

d) 6

Ans : a) 9

17) If there are m unknown member forces, r unknown reaction component and j number of joints Then degree of static indeterminacy of a pin-jointed plane frame is given by

a) m + r - 3j

b) m - r + 2j

c) m + r - 2j

d) m + r + 2j.

Ans : c) m + r - 2j

18) Which of the following is an example for statically determine structure.

a) Two hinged beam.

b) Cantilever beam

c) Fixed beam

D) Continuous beam

Ans : b) Cantilever beam

19) Slope = area of BMD/EI is the relation given by:

a) Mohr's first theorem
b) Mohr's Second Theorem
c) Castigiliano Theorem
D) Macualy's Theorem

Ans : a, Mohr's first Theorem

20, Degree of Kinematic indeterminancy of given beam is

a) 0
b) 3
c) 2
d) 1

Ans c., 2

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NAAC B++

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023 - 2024 (ODD SEM)

Format A

Assignment - I / II ✓

Title : Individual activity is assigned to each Student based on their learning ability. (Activity list enclosed)

Objective : * To make the Students learn about the Subject related Questions
* To use latest apps/softwares like Hot potatoes and Quizalize

Evaluation : Evaluation is based on the Questionaries and presentation (Evaluation sheet enclosed)

Date of Completion : 05/10/2023

05/10/2023

STAFF INCHARGE SIGN

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B++ NAAC

DEPARTMENT OF CIVIL ENGINEERING

Sub. Code : CE 3502
Sub.Name : Structural Analysis I
Staff Name : Mr.K.Arun

Branch / Year / Sem : B.E CIVIL / III / V
Batch : 2021-2025
Academic Year : 2023-24 (ODD)

ASSIGNMENT: 2 - PCE ACTIVITY

EVALUATION SHEET

LEVEL-1 SLOW LEARNERS

L1-(Q1-Q4) SEMINAR

S.No	Roll.No	Student Name	Seminar Topic	PPT : 15 Marks	Presentation: 20 Marks	Q&A : 05 Marks	Total 40 Marks
1	6	MANIKKARAJ R	Formation of flexibility matrices	15	18	03	36
2	7	MATHANKUMAR S	Formation of stiffness matrices	15	20	04	39
3	10	PASHAGAN G	Primary structures	15	18	03	36
4	11	PRAGADISH M	Restrained structures	15	18	04	37

L1-(Q5-Q7) QUIZ

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 20 Marks: 20 x 2	Total 40 Marks
5	12	PRASANNA R	Rigid jointed plane frames	19 x 2	38
6	13	SARAVANAN K	Indeterminate frames	19x2	38
7	21	SANJAIMANI M	Matrix method	18x2	36

LEVEL-2 AVERAGE LEARNERS

L2-(Q8-Q11) CROSSWORD

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 20 Marks: 20 x 2	Total 40 Marks
8	2	ANITHA B	Symmetric frames	20x2	40
9	3	ARULPANDIYAN A	Skew symmetric loadings	20x2	40
10	4	ARUNKUMAR M	Lack of fit	20x2	40
11	5	MADHAN D S	Pin jointed plane frames	19x2	38

L2-(Q12-Q14) APPLICATION OF CONCEPTS

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 2 Marks: 2 x 20	Total 40 Marks
12	14	SURYA.V	Carryover factor	20x2	40
13	16	VENKATACHALAM D	Sway conditions	20x2	40
14	17	VIJAY S	Symmetric loadings	20x2	40

LEVEL-3 ADVANCED LEARNERS

L3-(Q15-Q18) GATE QUESTIONNAIRE

S.No	Roll.No	Student Name	Topic Name	No. of Ques: 20 Marks: 20 x 2	Total 40 Marks
15	1	AKALYA J	Stiffness method	20x2	40
16	9	NAAVINIYAA G V	Flexibility method	20x2	40
17	19	SINDHU G	Analysis of trusses	20x2	40
18	20	SURUTHI A	Frames with sway and without sway conditions	20x2	40

L3-(Q19-Q21) POSTER PRESENTATION

S.No	Roll.No	Student Name	Poster Topic	Poster design : 20 Marks	Presentation: 15 Marks	Q&A : 05 Marks	Total 40 Marks
19	8	MOHAN S	Compatibility conditions	20	15	05	40
20	15	TAMILARASAN T	Equilibrium conditions	20	15	05	40
21	18	MOHAMMED RIYAS J	Distribution and carryover factors	20	15	05	40

05/10/2023
COURSE INCHARGE
(K.ARUN, AP/CIVIL)

R. Saravanan 05/10/2023
HOD CIVIL
(Dr.R.SARAVANAN)

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DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

PCE ACTIVITY - SEMINAR

STIFFNESS MATRIX

PRESENTATION BY
S.MATHAN KUMAR
III YR CIVIL
KCE

Topic: Analysis of Beam Stiffness Method

Outline

- Introduction
- Procedure
- Properties
- Types of supports

KINGS COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 – STRUCTURAL ANALYSIS I

PCE ACTIVITY - SEMINAR

TYPES OF STRUCTURES

PRESENTATION BY
G.PASHAGAN
III YR CIVIL
KCE

'YPES OF STRUCTURES AND LOADS

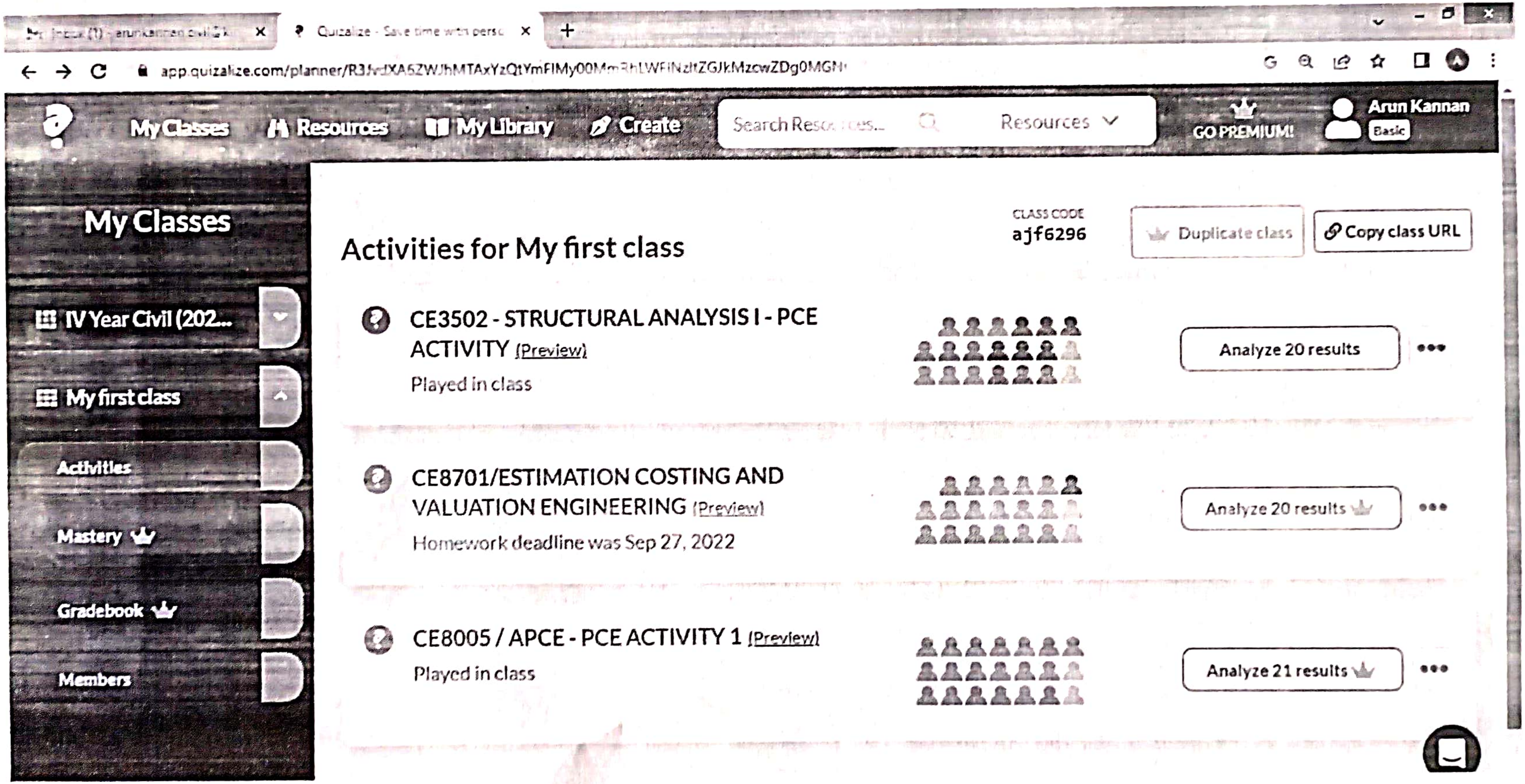
The results of this analysis then can be used to redesign the structure accounting for a more accurate determination of the weight of the members and their size. Structural design, therefore, follows a series of successive approximations in which every cycle requires a structural analysis. In this book, the structural analysis is applied to civil engineering structures; however, the method of analysis described can also be used for structures related to other fields of engineering.

'YPES OF STRUCTURES AND LOADS - :lassification of Structures

It is important for a structural engineer to recognize the various type: of elements composing a structure and to be able to classify structures as to their form and function. We will introduce some of these aspects now and expand on them at appropriate points throughout the text.

'YPES OF STRUCTURES AND LOADS

A *structure* refers to a system of connected parts used to support a load. Important examples related to civil engineering include buildings, bridges, and towers; and in other branches of engineering, ship and aircraft frames, tanks, pressure vessels, mechanical systems and electrical supporting structures are important.



Inbox (1) - arunkannan.civil@k...
Quizalize - Save time with persc...
app.quizalize.com/planner/R3JvdXA5ZWJhMTAxYzQtYmFlMy00Mm RhLWFiNzltZGJkMzcwZDg0MGN
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Resources
My Library
Create
Search Resources...
Resources
GO PREMIUM!
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Basic
My Classes
IV Year Civil (202...
My first class
Activities
Mastery
Gradebook
Members
Activities for My first class
CLASS CODE
ajf6296
Duplicate class
Copy class URL
CE3502 - STRUCTURAL ANALYSIS I - PCE ACTIVITY (Preview)
Played in class
Analyze 20 results
CE8701/ESTIMATION COSTING AND VALUATION ENGINEERING (Preview)
Homework deadline was Sep 27, 2022
Analyze 20 results
CE8005 / APCE - PCE ACTIVITY 1 (Preview)
Played in class
Analyze 21 results

KINGS

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC YEAR 2023-2024 (ODD SEM)

CE3502 - STRUCTURAL ANALYSIS I - PCE ACTIVITY

STUDENT NAME : B. ANITHA

ROLL No : 21102

Crossword

			1 C	O	M	2 P	O	U	N	3 D				
		4 D				E				5 E	N	D		
	6 Z	E	R	O		R				F				7 R
		T						8 P	O	I	N	T		E
9 O	N	E			10 O					C				D
		R			V			11 B		I				U
		M		12 T	E	T	R	A	H	E	D	R	O	N
	13 P	I	N		R			L		N				T
14 P		N			H			L		T				A
E		15 A	X	I	A	L						16 C		N
R		T			N				17 F			L		T
18 F	R	E	E		G				O			O		
E					19 I	M	P	E	R	F	E	C	T	
C					N				C			K		
20 T	W	O			G				E					

40

22/09/23

Across:

1. A truss formed by joining two or more simple trusses is called ________ Truss
5. Fixed ______ moments are required for solving slope deflection equations
6. Moment at a hinge will be equal to ____________
8. Concentrated load is also known as __________ load
9. The degree of freedom of space roller joint is _____
12. __________ is the simplest element of a space truss.
13. Hinge support is also known as _____ support.
15. Truss members carry ________ load
18. In a beam, slope value will be ____________ at the free end.
19. If "n" is not equal to 2j-3, then the frame is called as ____________ frame.
20. In general ____ equilibrium equations are needed to solve each joint of a truss.

Down:

2. For UDI, loads are measured in load __________ length
3. If n < 2j-3, then the frame is called as ____________ frame.
4. If the equilibrium conditions are enough to analyze a structure, then it is said to be statically ________________
7. If n > 2j-3, then the frame is called as ____________ frame.
10. If a beam extends beyond its support, then it is called as __________ beam.
11. The type of joints used in space truss are _______ and Socket Joint.
14. If n = 2j-3, then the frame is called as ____________ frame.
16. __________wise moments are positive.
17. The number of independent equations to be satisfied for static equilibrium of a plane structure is ________

ASSIGNMENT - 2
GATE QUESTIONS

(A) Good

05/10/2023

G.V. NAAVINIYAA
III - Yr CIVIL ENGG
CE 3502 - STRUCTURAL ANALYSIS

1. Flexibility matrix method of a analysis is basically

1. Force method

2. Displacement method

3. Equilibrium method

4. None of the above

2. Castigliano's theorem represents which one of the following methods?

1. Equilibrium

2. Flexibility

3. Displacement

4. Force

3. which of the following is the force method?

a) column analogy method

b) Flexibility matrix method

c) compatibility equation

d) stiffness matrix method

1. a and b

3. a, b and c

2. a, b, d

4. all of these

4. Castigliano's theorem 2 falls under ___ method.

1. stiffness
2. force
3. moment of distribution
4. displacement

5. Force method is also called as ___ as per structural analysis.

1. slope deflection method
2. Kani's method
3. Moment distribution method
4. column analogy method

6. In column analogy method, the area of an analogous column for a fixed beam of span L and flexural rigidity EI is taken as

1. L/EI
2. L/2EI
3. L/4EI
4. L/8EI

7. A beam of span 5m, fixed at A and B, carries a point load of 50 kN at 2 m from 'A'. The fixed end moments at the supports 'A' and 'B' respectively, are

1. 24 kNm clockwise and 36 kNm clockwise
2. 24 kNm anticlockwise and 36 kNm anticlockwise.
3. 36 kNm clockwise and 24 kNm anticlockwise
4. 36 kNm anticlockwise and 24 kNm clockwise.

8. which of the following methods of structural analysis is a force method?

1. slope deflection method
2. column analogy method
3. moment distribution method
4. None of the above

9. The theorem of three moments cannot be applied to

1. continuous beams with over hangs
2. Trusses and frames
3. single span fixed beams

10. Flexibility matrix method of a analysis is

1. Displacement method
2. Equilibrium method
3. Force method

11. Which one of the following method is not classified as a force method?

1. The theorem of three moments
2. The Moments distribution method
3. The method of consistent deformation
4. Castigliano's Theorem

12. A rigid cantilever frame ABC is loaded and supported as shown in the figure below. The horizontal displacement of point C is

1. $\frac{2Ph^3}{3EI}$

2. $\frac{Ph^2(2h+L)}{2EI}$

3. $\frac{Ph^3}{3EI}$

4. $\frac{Ph^2(h+L)}{3EI}$

13. In column analogy method, the area of an analogous column for a fixed beam of span length L and flexural rigidity is

1. $0.25L/(EI)$

2. $0.5L/(EI)$

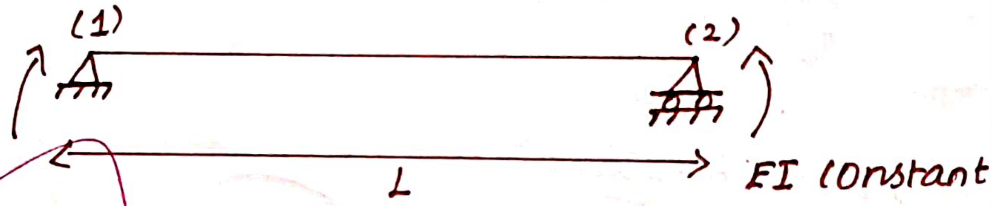
3. $0.75L/(EI)$

4. $L/(EI)$

14. Force method in structural analysis always ensures

1. compatibility of deformation
2. Equilibrium of forces
3. kinematically admissible strains

15. The flexibility matrix for the simply supported beam with reference to the coordinates, as shown below, is



1. $\frac{L}{6EI}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

2. $\frac{L}{3EI}\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

3. $\frac{L}{6EI}\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

4. $\frac{L}{3EI}\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

16. In stiffness matrix method of structure analysis, the quantity taken as reduntant is

1. Deflection

2. Rotation

3. Both (A) and (B)

4. None of the above

17. For stable structures, one of the important properties of flexibility and stiffness matrices is that the element on the main diagonal.

i) of a stiffness matrix must be negative

ii) of a stiffness matrix must be positive

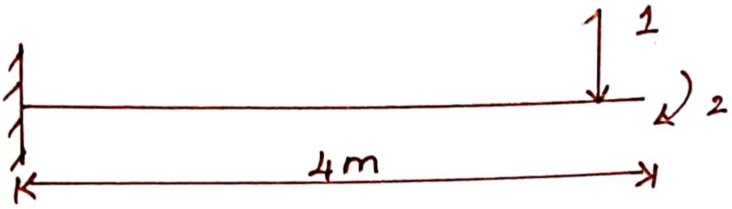
iii) of a flexibility matrix must be positive

1. (i) and (ii)

2. (i) and (iv)

3. (ii) and (iii)

18. The flexibility matrix of the beam shown below is



1. $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{8}{EI} & \frac{16}{EI} \end{bmatrix}$

2. $\begin{bmatrix} \frac{64}{3EI} & \frac{-8}{EI} \\ \frac{-8}{EI} & \frac{4}{EI} \end{bmatrix}$

3. $\begin{bmatrix} \frac{64}{3EI} & \frac{8}{EI} \\ \frac{8}{EI} & \frac{4}{EI} \end{bmatrix}$

19. The stiffness coefficients k_{ij} indicate

1. Deformation at j due to a unit force at i
2. Force at i due to a unit deformation at j
3. Deformation at i due to a unit force at j

20. The stiffness matrix of a beam is given as $K = \begin{bmatrix} 12 & 4 \\ 4 & 5 \end{bmatrix}$ calulate the flexibility matrix. Flexibility matrix will be

1. $\frac{K}{44} \begin{bmatrix} 12 & 4 \\ 4 & 5 \end{bmatrix}$

2. $\frac{1}{44} \begin{bmatrix} 12 & -4 \\ -4 & 5 \end{bmatrix}$

3. $\frac{K}{44} \begin{bmatrix} 12 & -4 \\ -4 & 5 \end{bmatrix}$

4. $\frac{1}{44} \begin{bmatrix} 5 & -4 \\ -4 & 12 \end{bmatrix}$

STRUCTURAL ANALAYSIS - I

DISTRIBUTION AND CARRY OVER FACTOR

ASSIGNMENT NO :- 2

05/10/2023

NAME :- J. MOHAMMED RIYAS

CLASS :- 3rd YEAR CIVIL

SUB :- SA-I

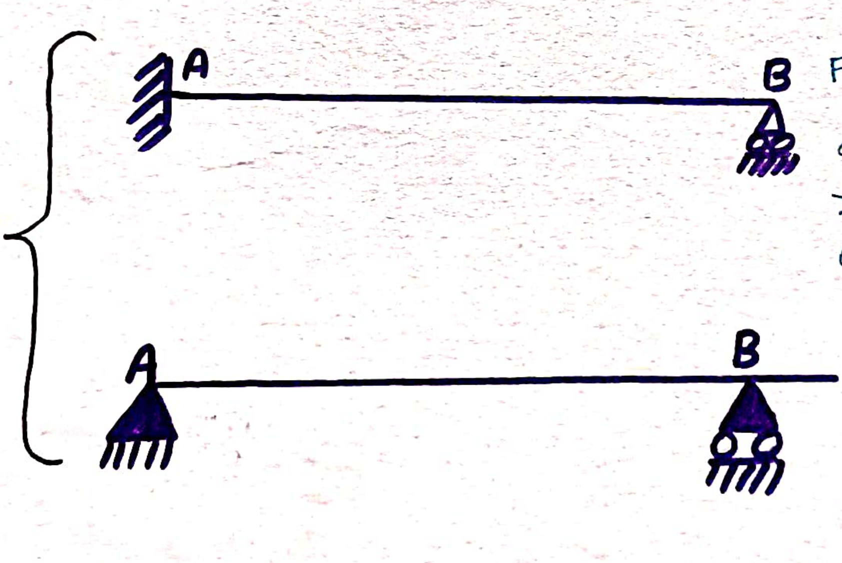
SUB CODE :- CE 3502

DATE :- 05/10/2023

Distribution Factor :-

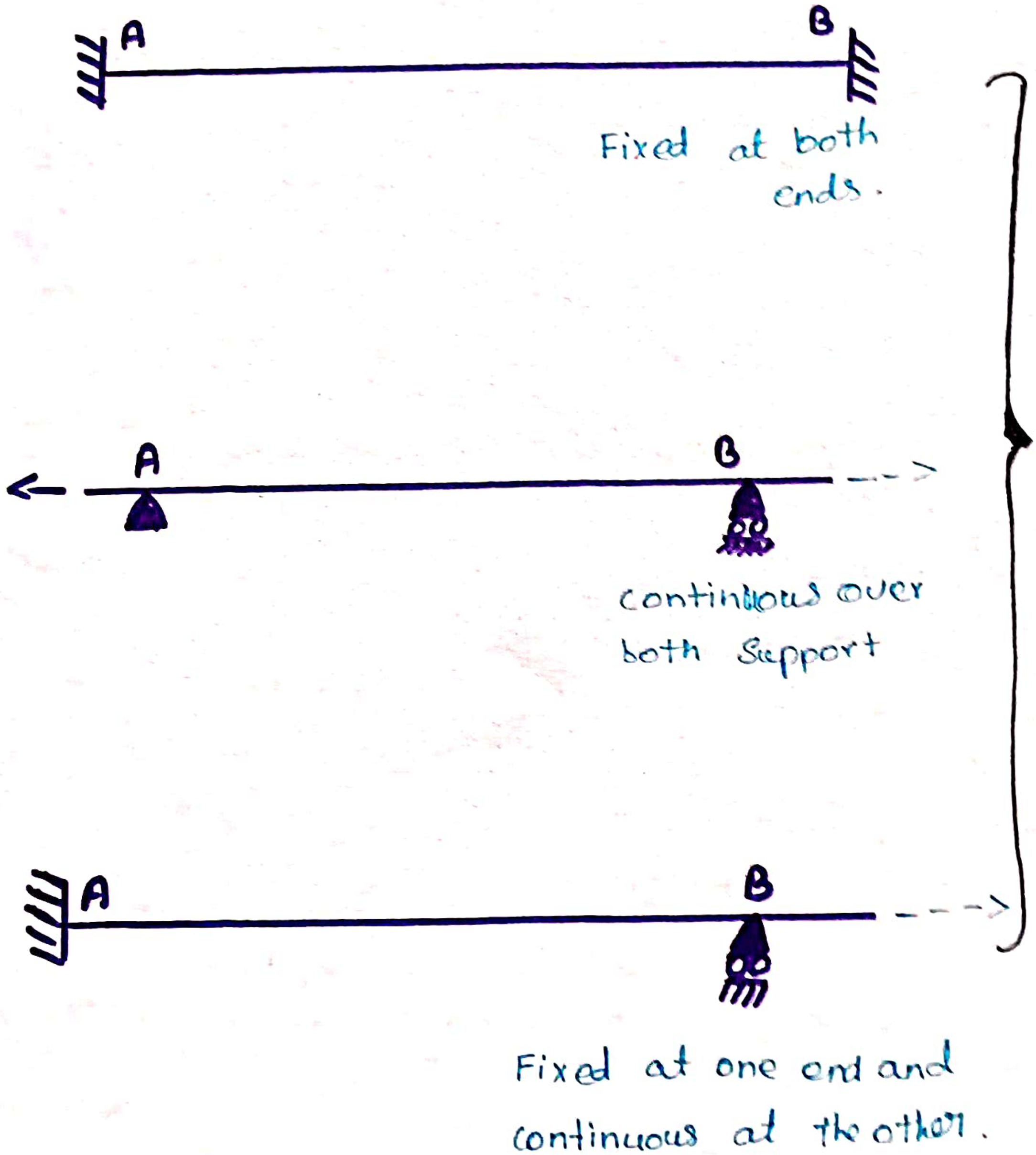
The (DF) for a member at a joint is the ratio of the stiffness (or relative stiffness) of the member to the total stiffness (or total relative stiffness) of all the members meeting at a joint

$K_{AB} = \frac{3EI}{L}.$



Fixed at one end and pinned at the other without continuity.

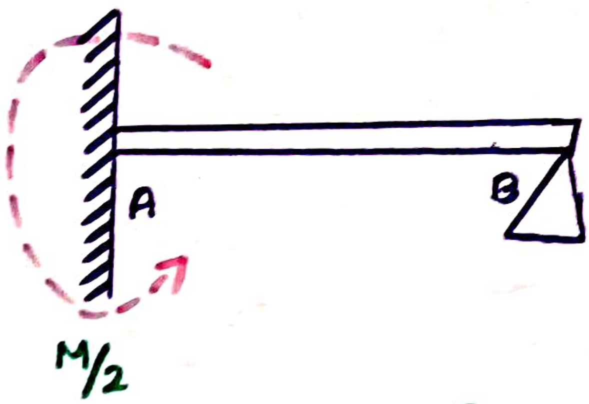
Pinned at one end and continuous at the other



$$K_{AB} = \frac{4EI}{L}.$$

Carry Over Factor :-

It is the Ratio of Moment Transferred to the for end and moment applied to the other end of the beam. Distribution factor. This the factor by which moment at the junction of beam is distribution to a beam.



Carry over factor = $\frac{M_{AB}}{M_{BA}}$

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-2024 (ODD SEMESTER)

CLASS : III YR CIVIL **SEM: V**

NPTEL VIDEO SESSION REPORT

TITLE : Analysis of determinate trusses

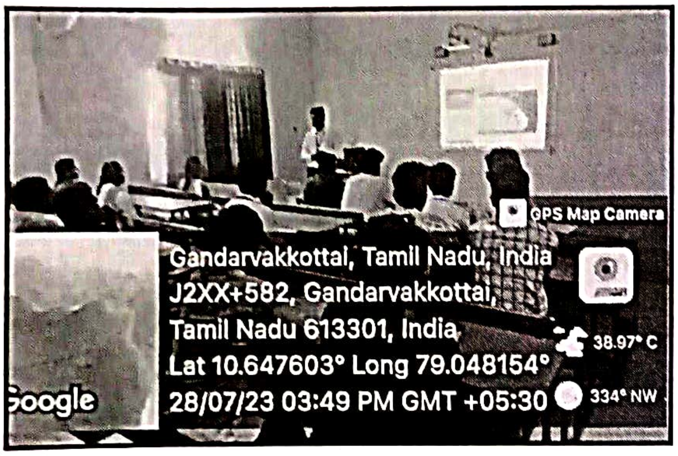
OBJECTIVE : To make the students understand the about the analysis of determinate trusses using method of joints.

METHODOLOGY : Video

URL : https://archive.nptel.ac.in/courses/105/105/105105166/

COVERAGE :

- Identify the determinate and indeterminate trusses.
- Analyse a determinate truss using method of joints.
- Concepts and step by step procedure for solving a determinate truss using method of joints.



NPTEL Session on "Analysis of determinate trusses" by Prof. Dr.Amit shaw, IIT Kharagpur

OUTCOME:

- Determinate and indeterminate structures were detailed.
- Students got an exposure about the analysis of determinate trus method of joints.
- They also learned about the analysis of truss using method of sections.

EVALUATION : QUIZ

DATE OF COMPLETION : 28.07.2023

30/07/2023
COURSE IN-CHARGE

30/07/2023
HOD/CIVIL

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NAAC B++

DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-2024 (ODD SEMESTER)

CLASS : III YR CIVIL **SEM: V**

NPTEL Session on "*Analysis of determinate trusses*"
Mark Statement

R.NO	REG.NO	NAME	QUIZ (10)
1.	821121103001	AKALYA J	10
2.	821121103002	ANITHA B	10
3.	821121103003	ARULPANDIYAN A	09
4.	821121103004	ARUNKUMAR M	09
5.	821121103006	MADHAN D S	08
6.	821121103007	MANIKKARAJ R	08
7.	821121103008	MATHANKUMAR S	09
8.	821121103009	MOHAN S	10
9.	821121103010	NAAVINIYAA G V	10
10.	821121103012	PASHAGAN G (VOC)	08
11.	821121103013	PRAGADISH M	08
12.	821121103014	PRASANNA R	09
13.	821121103015	SARAVANAN K	08
14.	821121103016	SURYA.V	10
15.	821121103017	TAMILARASAN T	10
16.	821121103018	VENKATACHALAM D	09
17.	821121103019	VIJAY S	10
18.	821121103301	MOHAMMED RIYAS J	10
19.	821121103302	SINDHU G	10
20.	821121103303	SURUTHI A	10
21.	821121103701	SANJAIMANI M	08

30/07/2023 30/07/2023

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-2024 (ODD SEMESTER)

CLASS: III YR CIVIL **SEM: V**

CONTENT BEYOND SYLLABUS SESSION EXECUTION DETAILS

Subject Code / Title : CE3502 STRUCTURAL ANALYSIS I
Course Incharge : Mr.K.Arun, AP/CIVIL
Date of Execution : 16.10.2023
CBS Topic : Analysis of beams using strain energy method.

Objective :

- To know about the strain energy.
- To learn about the analysis of beams.
- To gain knowledge about analysis of beams by strain energy method.

CBS Session on **"Analysis of beams using strain energy method."**

EVALUATION : Based on problem solving

OUTCOME :

- Students learned about the strain energy.
- They got an idea about the different types of analysis of beams.
- Students got exposure about the analysis of beams using strain energy me

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DEPARTMENT OF CIVIL ENGINEERING
ACADEMIC YEAR 2023-2024 (ODD SEMESTER)

CLASS: III YR CIVIL **SEM: V**

CBS Session on "Analysis of beams using strain energy method."

Mark Statement

R.NO	REG.NO	NAME	Write up (10)
1.	821121103001	AKALYA J	10
2.	821121103002	ANITHA B	10
3.	821121103003	ARULPANDIYAN A	09
4.	821121103004	ARUNKUMAR M	08
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7.	821121103008	MATHANKUMAR S	08
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19.	821121103302	SINDHU G	10
20.	821121103303	SURUTHI A	10
21.	821121103701	SANJAIMANI M	08

17/10/2023 — **COURSE IN-CHARGE**

17/10/2023 — **HOD/CIVIL**

ACADEMIC YEAR 2023-2024 (ODD SEM)

CONTENT BEYOND THE SYLLABUS

CE3502 – STRUCTURAL ANALYSIS I

ANALYSIS OF BEAMS USING STRAIN ENERGY METHOD

16.10.2023

PRESENTATION BY
ARUN.K
AP/CIVIL

Strain Energy

- In mechanics, Energy is defined as the capacity to do work.
- In solid deformable bodies, the stresses multiplied by the respective areas are the forces and the deformation are the distances.
- The product of the force and deformations is the internal work done in a body by externally applied forces.
- The internal work done is stored in the body as the internal elastic energy of deformation or the elastic strain energy.

Conservation of energy, work and strain

- Conservation of energy is one of the basic law of physics and in a closed system consisting of a structure and the applied force must obeys this law.

$W = E_s + E_l$

W = Work Performed

E_s = Energy stored in the body

E_l = Energy loss

- Now in a structure, work is performed by the external load moving through a distance and the energy is stored due to elastic deformation of the members.
- If the structure is static there is no kinetic energy in the system with no energy loss due to heat, permanent set etc. The equation reduces to

$W = E_s$

E_s = Elastic strain energy also denoted by "U"

Hence for a conservational structural system

$W = U$

Strain energy/unit volume = $u = 1/2 \times \sigma \times \varepsilon$

Total Strain energy = $U = ½ \int \sigma \times \varepsilon \times dv$

where, σ = stress, ε = strain

Real work and Complimentary work

- Work = Force × Displacement
- The work done as the force F moves through a distance $d\Delta$

$\Delta W = F \times d\Delta$

Total work done = $W = \int F \times d\Delta$

- If force "F" is three dimensional with components F_x, F_y and F_z

Total work done $W = \int F_x \times d\Delta_x + \int F_y \times d\Delta_y + \int F_z \times d\Delta_z$

This work is known as Real work as shown in Fig. 1.

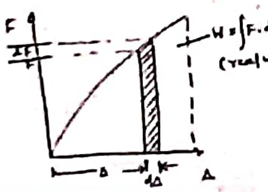


Fig 1

Q1. Determine the deflection at the free end of the over hanging beam shown in Figure by unit load method.

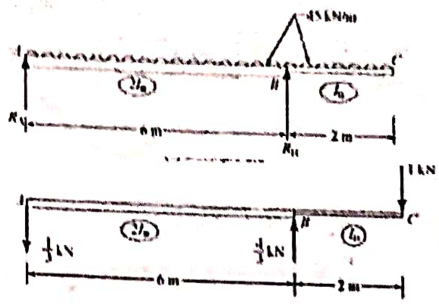


Figure 1: Beam with unit load at 'C'

- Find out the reactions due to external forces, taking moment about A

$$\Sigma M_A = 0, \text{ gives}$$
$$R_B \times 6 = 45 \times 8 \times 4$$
$$R_B = 240 \text{ kN}$$
$$\Sigma F = 0, \text{ gives}$$
$$R_A = 45 \times 8 - 240 = 120 \text{ kN}$$

- Find out the reactions, when unit load acting at 'C'

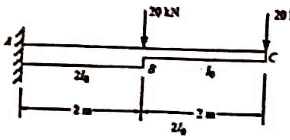
$$R_B = \frac{1 \times 8}{6} = 1.333 \text{ kN}$$
$$R_A = 0.333 \text{ kN} \downarrow$$

- Taking sagging moment as positive and hogging moment as negative, find out the expressions for moments in various portions of the beam due to external loading and unit force where the deflection is to be determined in a Tabular form.

Portion	AB	BC
Origin	A	C
Limit	0 – 6	0 – 2
M	$120x - \frac{1}{2} \times 45x^2$	$-\frac{1}{2} \times 45x^2$
m	$-0.333x$	$-x$
I	$2I_o$	I_o

$$\Delta_C = \int_0^6 \frac{(120x - 22.5x^2)(-0.333x)dx}{E2I_o} + \int_0^2 \frac{(-22.5x^2)(-x)dx}{EI_o}$$
$$= \int_0^6 \frac{(-20x^2 + 3.7x^3)dx}{EI_o} + \frac{1}{EI_o}\int_0^2 22.5x^3 dx$$
$$= \frac{1}{EI_o}\left[-\frac{20x^3}{3} + \frac{3.75x^4}{4}\right]_0^6 + \frac{1}{EI_o}\left[\frac{22.5x^4}{4}\right]_0^2$$
$$= \frac{1}{EI_o}\left[-\frac{20 \times 6^3}{3} + \frac{3.75 \times 6^4}{4} + \frac{22.5 \times 2^4}{4}\right]$$
$$= -\frac{135}{EI_o}$$
$$= \frac{135}{EI_o}, \text{ upward}$$

Q2. Determine the deflection and rotation at the free end of the cantilever beam shown in Figure by unit load method. Given $E = 200000$ N/mm² and $I = 12 \times 10^6$ mm⁴



- Find out the deflection and rotation at the free end of the cantilever beam, apply unit load for deflection and unit moment for rotation at the free end of the beam as shown in Figure.

Figure 1: Beam with unit vertical load at 'C'

Figure 2: Beam with unit moment at 'C'

- The bending moment expressions can be calculated by
- M for external given load, m_1 for unit vertical load at 'C' and m_2 for unit moment at 'C' for various portion of cantilever beam and tabulated below.

Portion	CB	BA
Origin	C	B
Limit	0 – 2	0 – 2
M	$-20x$	$-[20(2 + x) + 20x]$
m_1	$-x$	$-(x + 2)$
m_2	-1	-1
I	I_o	$2I_o$

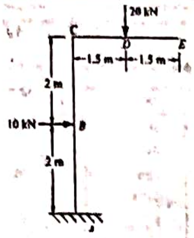
Vertical deflection at 'C' = $\Delta = \int_0^L \frac{Mm_1}{EI}dx$

$$= \int_0^2 \frac{(-20x)(-x)}{EI_o}dx + \int_0^2 \frac{[20(2+x)+20x](x+2)}{E2I_o}dx$$
$$= \int_0^2 \frac{20x^2}{EI_o}dx + \int_0^2 \frac{(40x+40)(x+2)}{2EI_o}dx$$
$$= \left[\frac{20}{3}\frac{x^3}{EI_o}\right]_0^2 + \frac{1}{2EI_o}\left[\frac{40x^3}{3} + \frac{120x^2}{2} + 80x\right]_0^2$$
$$= \frac{53.333}{EI_o} + \frac{1}{EI_o}[253.333]$$
$$= \frac{306.67}{EI_o}$$

Rotation at 'C' = $\theta_c = \int_0^L \frac{Mm_2}{EI} = \int_0^2 \frac{(20x)}{EI_o}dx + \int_0^2 \frac{(40x+40)1}{E2I_o}dx$

$$= \left[\frac{20}{EI_o}\frac{x^2}{2}\right]_0^2 + \frac{1}{EI_o}\left[\frac{40x^2}{2} + 40x\right]_0^2$$
$$= \frac{40}{EI_o} + \frac{160}{2EI_o}$$
$$= \frac{120}{EI_o}$$

Q3. Determine the vertical and horizontal deflection at the free end of the bent shown in Figure by unit load method. Assume uniform flexural rigidity EI throughout.



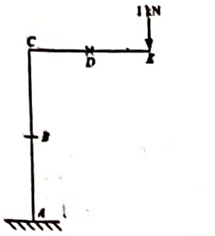


Figure 1: Frame with unit vertical load at 'E'

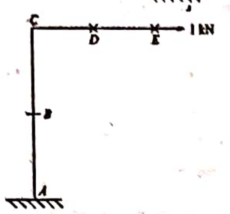


Figure 2: Frame with unit horizontal load at 'E'

- Find out the expressions in Tabular form for moment 'M' due to external loads, m_1 due to the unit vertical load present at the free end (Figure 1) and m_2 due to the unit horizontal load present at the free end (Figure 2) of the bent.

Portion	ED	DC	CB	BA
Origin	E	D	C	B
Limit	0 – 1.5	0 – 1.5	0 –2	0 – 2
M	0	$-20x$	–30	$-30-10x$
m_1	x	$-(1.5+x)$	–3	–3
m_2	0	0	$-x$	$-(x+2)$
Flexural Rigidity	EI	EI	EI	EI

Note: Moment carrying tension on dotted side is taken as positive

Vertical deflection at 'E' = Δ_{EV}

$$EI\Delta_{EV} = \int M m_1\,dx$$

$$= 0+\int_0^{1.5} 20x(1.5+x)dx+\int_0^2 90dx+\int_0^2 (90+30x)dx$$

$$= \int_0^{1.5}\left(30x+20x^2\right)dx+\int_0^2 90dx+\int_0^2 (90+30x)dx$$

$$= \left[\frac{30x^2}{2}+\frac{20x^3}{3}\right]_0^{1.5}+[90x]_0^2+\left[90x+\frac{30x^2}{2}\right]_0^2$$

$$= 56.25+180+240$$

$$= 476.25$$

$$\Delta_{EV} = \frac{476.25}{EI}$$

Horizontal Deflection at 'E' = Δ_{EH}

$$EI\Delta_{EH} = \int M m_2\,dx$$

$$= 0+0+\int_0^2 30x\,dx+\int_0^2 (30+10x)(x+2)dx$$

$$= \left[15x^2\right]_0^2+\int_0^2\left(10x^2+50x+60\right)dx$$

$$= 60+\left[\frac{10x^3}{3}+50\times\frac{x^2}{2}+60x\right]_0^2$$

$$= 306.67$$

$$\Delta_{EH} = \frac{306.67}{EI}$$

THANK YOU

REVIEW SHEET

After Completion of syllabus
Faculty experience in handling / covering syllabus
Unit I : This unit deals with analysis of trusses by method of joints and method of sections. Deflection can be learned.
Unit II : Analysis of beams by slope deflection method. Sway of frames and supports settlements are learnt in this unit
Unit III : This unit covers the analysis of beams and frames by moment distribution method. Steps are easy to solve the problems.
Unit IV : Flexibility method involves matrix equations which is difficult for the students.
Unit V : Stiffness matrices includes more steps to solve and students feel difficult to solve the problems.
Difficulties (if any) Unit IV and V involves more steps to solve matrices, Hence time consuming.
Feedback on University Question Paper Part - A - 8 Questions were asked in CAT I & CAT II Part - B - Expected Questions and already practiced in internal Exams. Part - C - 16 (a) is easy, FAQ 16 (b) involves more steps, little complicated
05/01/2024 **SIGNATURE OF STAFF** R. Saravanan 05/01/2024. **HOD/CIVIL**

123

Reg. No. : [| | | | | | | | | | |]

Question Paper Code : 20517

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Civil Engineering

CE 3502 – STRUCTURAL ANALYSIS I

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

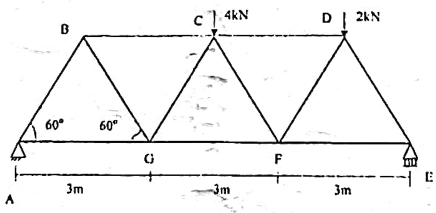
Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the different methods of analysis of truss?
2. Write the generalized formula for finding the deflection at the joint of the truss.
3. Give the slope deflection equation for the beam with end span is pin supported.
4. State the conditions when sway occurs in frames.
5. Define carry over factor.
6. Define distribution factor.
7. Write the generalized formula for flexibility method.
8. State the steps to be done to get the solution by flexibility method.
9. Write the generalized formula for stiffness method.
10. What is meant by degree of kinematic indeterminancy?

PART B — (5 × 13 = 65 marks)

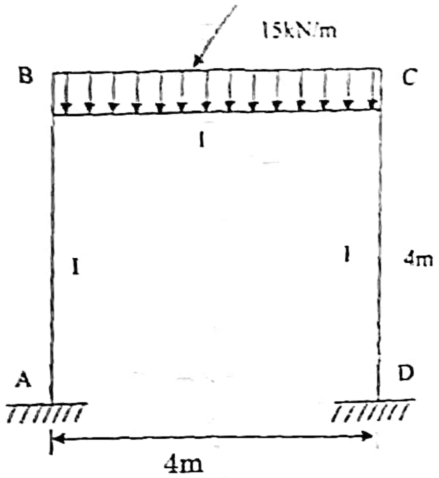
11. (a) Find the forces in the members AB, AG and BG by method of joints.



Or

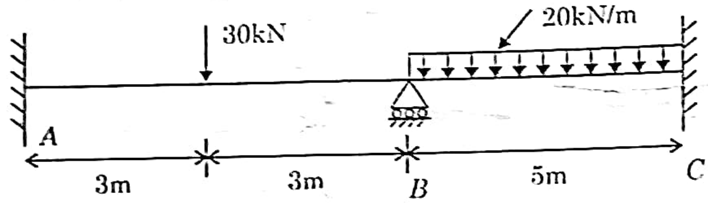
(b) Find the forces in the members CD and CF and FD shown in question 11.(a) by method of tension coefficient.

12. (a) Analysis the frame shown in figure given by slope deflection method and draw bending moment diagram.

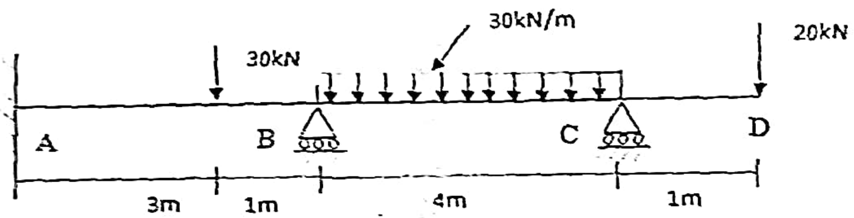


Or

(b) Analyse the continuous beam ABC shown in figure given below by slope deflection method. Take EI constant.

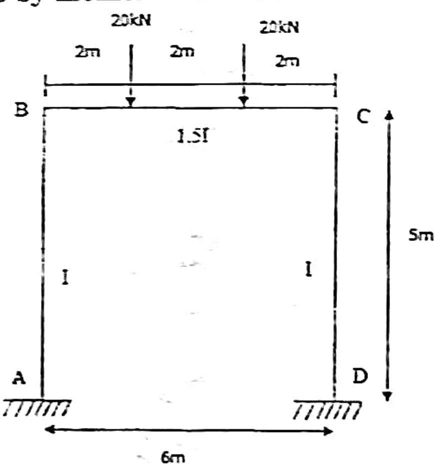


13. (a) Analyse the beam by moment distribution method.

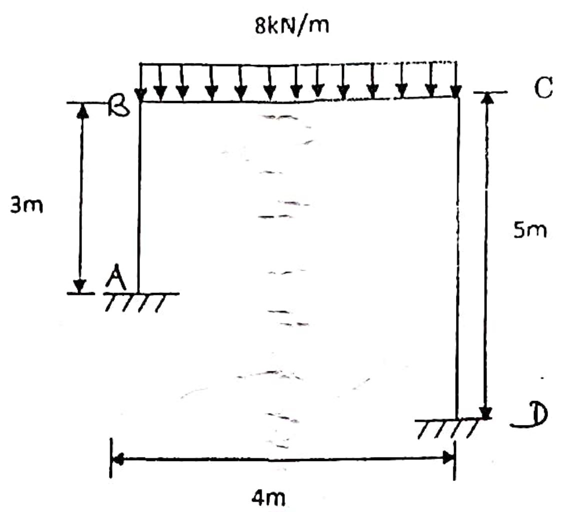


Or

(b) Analyse the frame by moment distribution method.

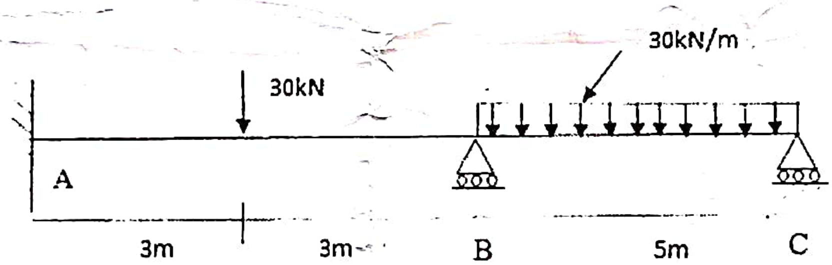


14. (a) Determine the support reactions on the frame by flexibility method.

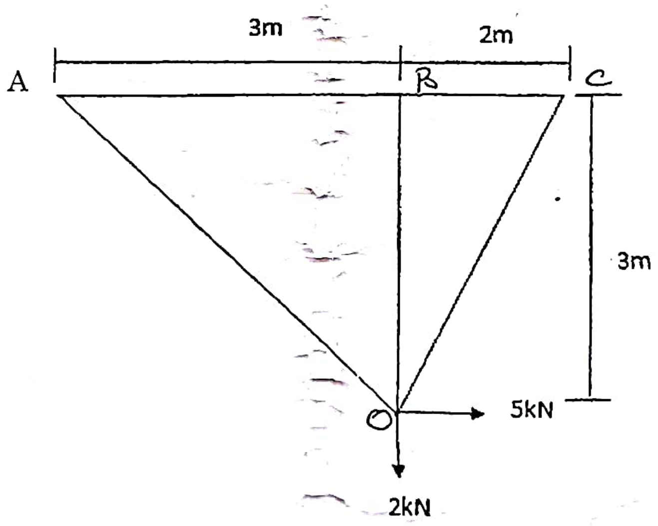


Or

(b) Analyze the continuous beam shown in figure by flexibility method.

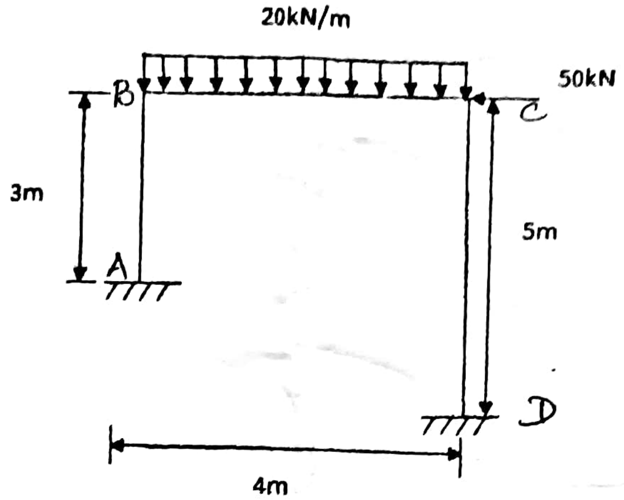


15. (a) Analyse the truss by stiffness method.



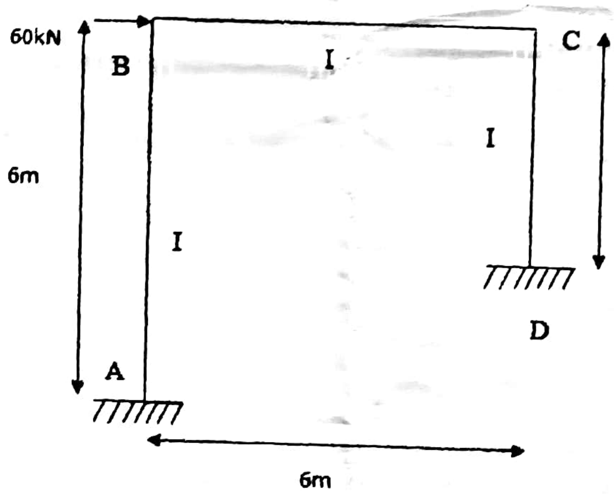
Or

(b) Analyse the frame by stiffness method.



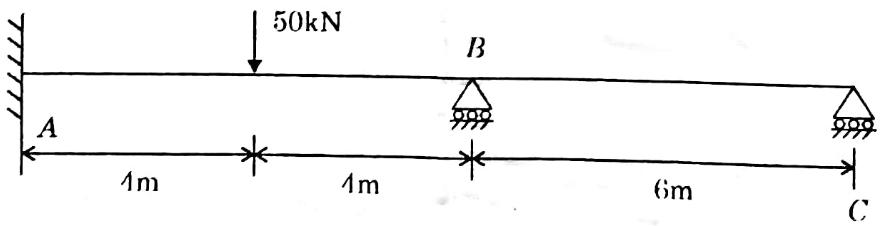
PART C — (1 × 15 = 15 marks)

16. (a) Analyze the frame shown in figure by moment distribution method.



Or

(b) Analyse the continuous beam ABC shown in figure given below, if support B sinks by 10 mm by flexibility matrix method. Take $EI = 6000\,kNm^2$.



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TEST REPORT -ODD SEMESTER 2023-2024

Department	CIVIL ENGINEERING	Year/Section	III CIVIL
Name of the subject & Code	CE3502 - STRUCTURAL ANALYSIS I	Name of the Staff	K. ARUN

Test	Date	No.of.Students							Reason for poor performance	Corrective action	Signature of staff	Signature of HOD	PRINCIPAL
		Total	Appeared	Absent	Passed	Pass %	60-80	81-100					
Assessment Test -1	16/9/23	21	15	06	05	33.3%	1	-	More absenteeism during classes and Exams	Assignments given	[signature] 22/09/23	[signature] 22/09/23	J. [signature] 22/9/23
Assessment Test -2	31/10/23	21	21	0	04	19%	1	-	Problem oriented subject. Students feel difficult to solve problems in time	more tutorial Problems given for practice. Coaching classes will be conducted	[signature] 03/11/23	[signature] 06/11/2023	J. [signature] 6/11/23
Model Exam	-	-	-	-	-	-	-	-	-	-	-	-	-
AU Exam	05/01/24	21	21	-	11	52.4%	6	-	Frequently absent students were failed in exams	1 Student applied for revaluation	[signature] 23/04/24	[signature] 23/04/24	

Note: - Report should be retained by HOD concerned