

Reg. No. _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2017

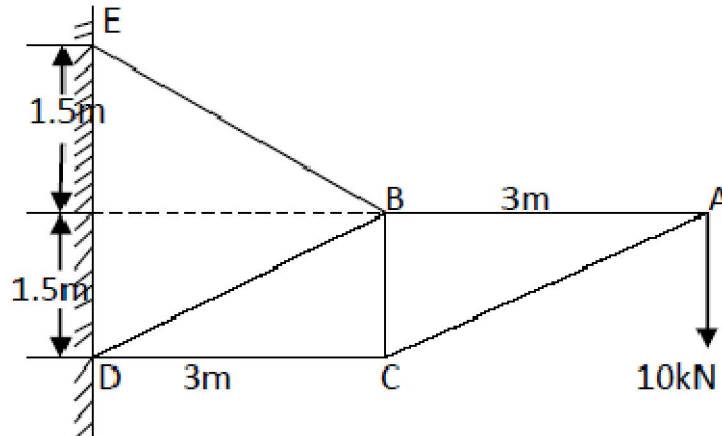
Course Code: **CE202**Course Name: **STRUCTURAL ANALYSIS – I (CE)**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer any TWO questions. 15 marks each.*

1. a) Enumerate the methods of analysing a determinate truss and illustrate along with sketches, the significance of the methods. (7)
- b) Using Castigliano's theorem, determine the deflection under the load. A simply supported beam of span 'L' carries a concentrated load P at a distance 'a' from left hand support. Assume uniform flexural rigidity. (8)
2. a) Elucidate Maxwell's theorem of reciprocal deflection and Betti's theorem. (5)
- b) Differentiate static and kinematic indeterminacies with one example each. (5)
- c) Demonstrate unit load method as applied to the analysis of a rigid frame. (5)
3. Analyse the pin jointed frame and tabulate the results.

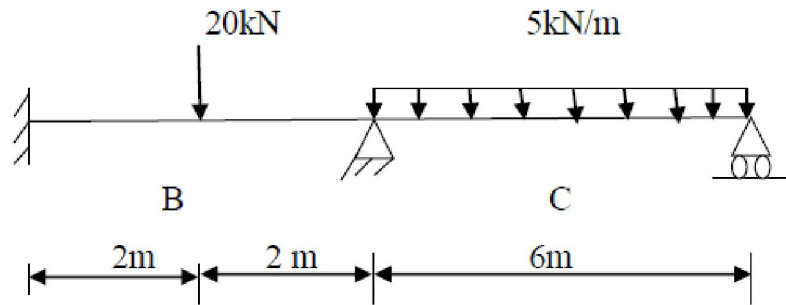


(15)

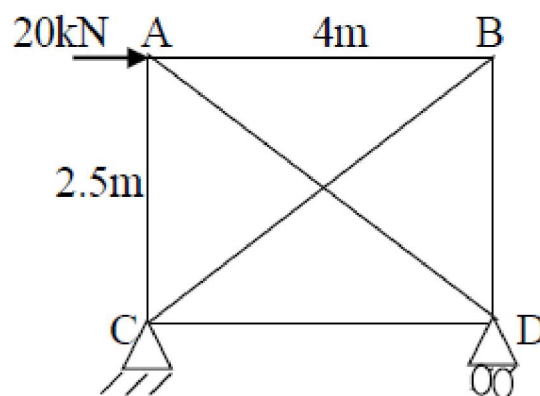
PART B*Answer any TWO questions. 15 marks each.*

4. Determine the reaction components in the beam shown using Consistent deformation method. EI is constant throughout.

(15)

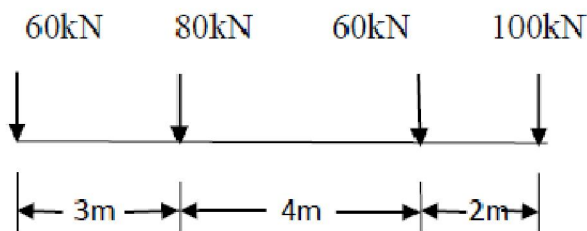


5. Compute the forces in the members. Given for all members, cross-sectional area = 1000 mm^2 , Young's modulus = 200 kN/mm^2 .



(15)

6. A load system as shown crosses a girder of span 25m from right to left with 60kN load leading. Find the max. BM at 15m from left end. Also find the absolute maximum BM and state where it occurs.



(15)

PART C

Answer any TWO questions. 20 marks each.

7. a) Justify that an arch is more economical compared to a SS beam of same span carrying the same load. (6)

- b) A 3 hinged parabolic arch has a horizontal span of 36m with a central rise of 5m. A udl of 1kN/m acts at right half of the span. Calculate the magnitude and position of maximum positive BM in the arch. Also calculate the BM, NT and RS at left quarter point. (14)
8. a) A bridge cable is suspended from towers 80 m apart and carries a load of 30 kN/m on the entire span. If the maximum sag is 8 m, calculate the maximum tension in the cable. If the cable is supported by saddles which are stayed by wires inclined at 30° to the horizontal, determine the forces acting on the towers. If the same inclination of back stay passes over pulley, determine the forces on the towers. Height of the tower is 10m. (14)
- b) Illustrate Eddy's theorem in arches. (6)
9. a) A 3 hinged semi-circular arch ACB of uniform section and radius 'r' carries a udl of w/m run over the whole span. Find the position and magnitude of maximum bending moment. Draw the BMD. (14)
- b) For a cable carrying concentrated loads, estimate the maximum and minimum tensions and their locations. (6)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: CE202
Course Name: STRUCTURAL ANALYSIS – I (CE)

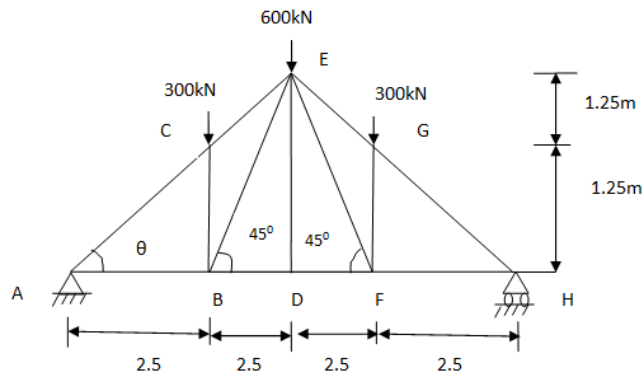
Max. Marks: 100

Duration: 3 Hours

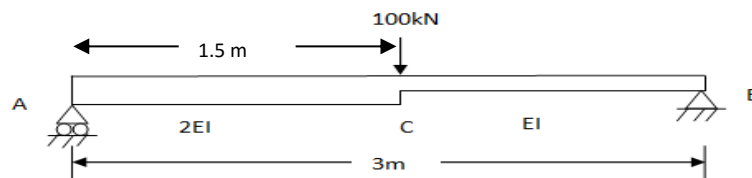
PART A

Answer any two full questions. Each question carries 15 marks.

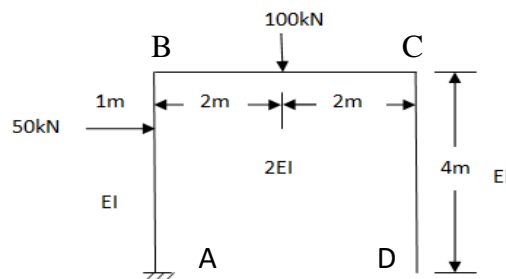
- 1 a) Explain the method of sections. (5)
- b) Analyse the pin jointed truss as shown by the method of joints. (10)



- 2 a) Explain Maxwell's law of reciprocal deflection. (5)
- b) Find the deflection at C of the beam as shown in figure by strain energy method. (10)



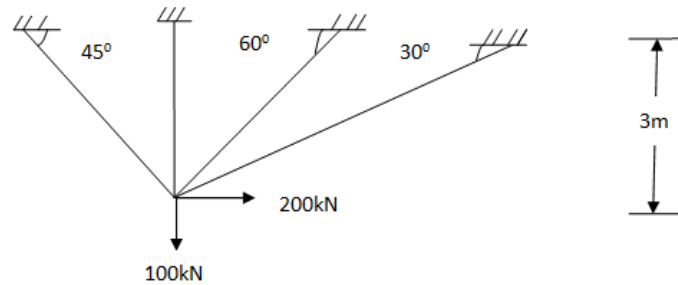
- 3 a) Differentiate between static and kinematic indeterminacy with examples. (5)
- b) Find the vertical deflection at the free end of the frame loaded as shown by unit load method. (10)



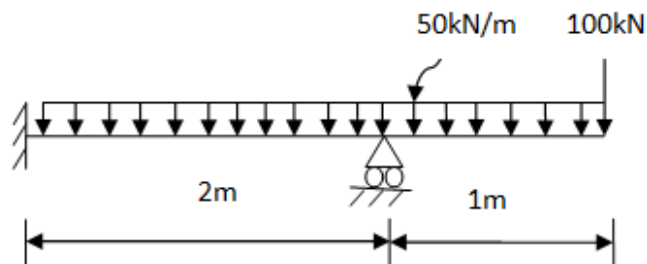
PART B

Answer any two full questions. Each question carries 15 marks.

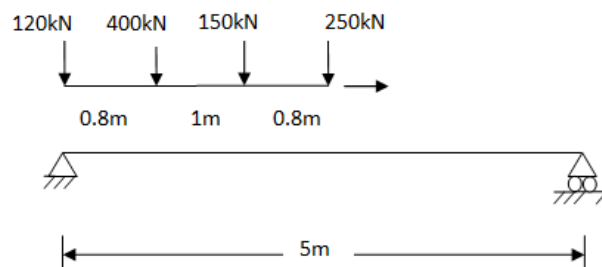
- 4 a) How will you account the effect of lack of fit and temperature changes in the analysis of trusses? (5)
- b) Analyse the single jointed truss as shown in figure by the method of consistent deformation. AE is constant for all the members. (10)



- 5 a) What do you mean by influence line diagram? What are the uses of influence line diagrams? (5)
- b) Analyse the propped cantilever by consistent deformation method. EI constant. (10)



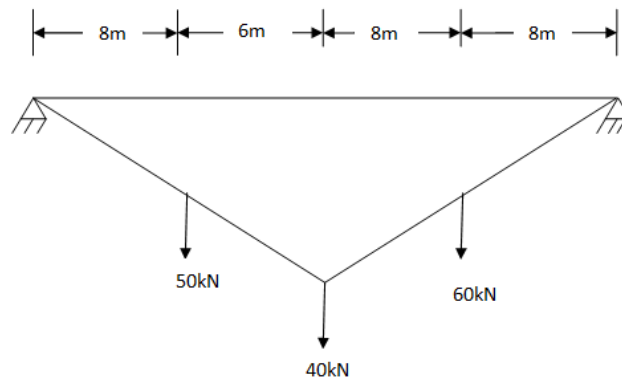
- 6 a) Draw the influence line diagram for shear force at any section of an overhanging beam of span 'L' with equal overhang on each side. (3)
- b) For the simply supported beam AB of span 5m subjected to a train of concentrated loads moving from left to right as shown in Figure. Using influence lines find the absolute maximum bending moment and the equivalent uniformly distributed load. (12)

**PART C**

Answer any two full questions. Each question carries 20 marks

- 7 a) Write sheet notes on suspension bridges. (3)
- b) Show that a cable subjected to uniformly distributed load w /unit horizontal length the shape of the cable is a parabolic. (5)

- c) A light cable is supported at two points 30m apart which are at the same level. The cable supports three concentrated loads as shown. The deflection at first point is 1m. Determine the tension in the different segments and total length of the cable. (12)



- 8 a) State Eddy's theorem. (3)
- b) What are the advantages of arches? (5)
- c) Draw the bending moment diagram for a three-hinged symmetric parabolic arch of span 50m rise 10m subjected to a concentrated load of 50 kN acting at 8m from left support and a uniformly distributed load of 25 kN/m acting over the right half portion. (12)
- 9 a) Show that the parabolic shape is a funicular shape for a three-hinged arch subjected to UDL for the entire span. (6)
- b) Draw the influence lines for horizontal thrust 'H', Moment at any section and radial shear for a three-hinged arch of span L and rise 'h'. (14)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CE202

Course Name: STRUCTURAL ANALYSIS – I (CE)

Max. Marks: 100

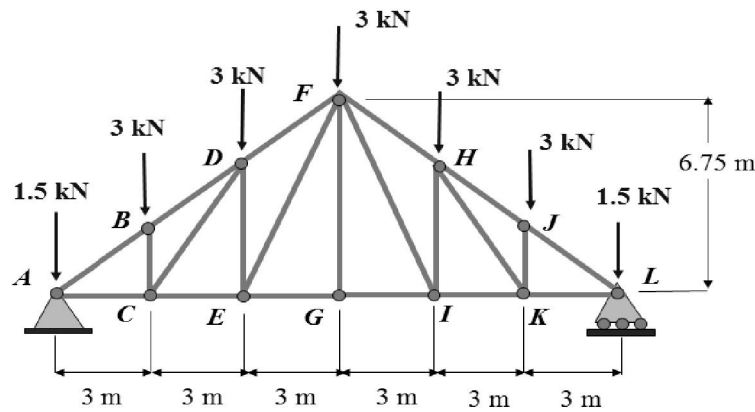
Duration: 3 Hours

PART A

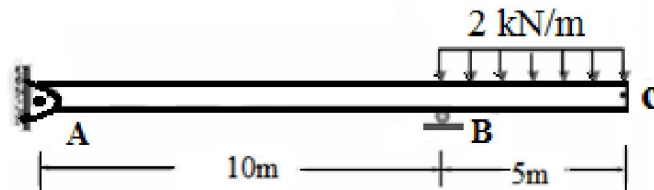
Answer any two full questions, each carries 15 marks.

Marks

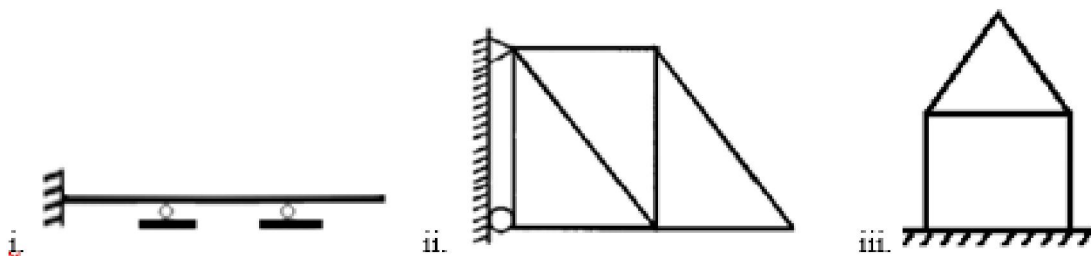
- 1 a) State the assumptions made in the analysis of plane trusses. (3)
- b) A Pratt roof truss is loaded as shown. Using the method of sections, determine the forces in members *FH* and *GI*. (12)



- 2 a) Obtain the expression for strain energy due to bending in a flexural member. (3)
- b) Determine the vertical deflection at C using unit load method. Assume EI constant. (12)



- 3 a) State and prove Maxwell's law of reciprocal deflections. (6)
- b) Determine the static and kinematic indeterminacies of the structures shown. (9)

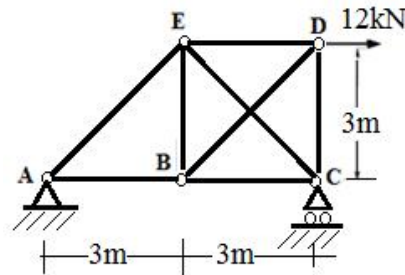


PART B

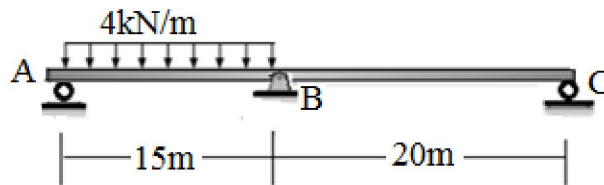
Answer any two full questions, each carries 15 marks.

- 4 Determine the force in the member BE. Axial rigidity AE of all members is (15)

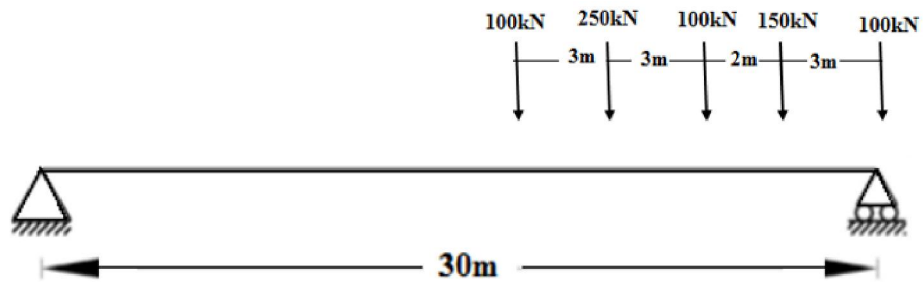
constant.



- 5 Analyse the beam shown using consistent deformation method and draw the SFD (15) and BMD



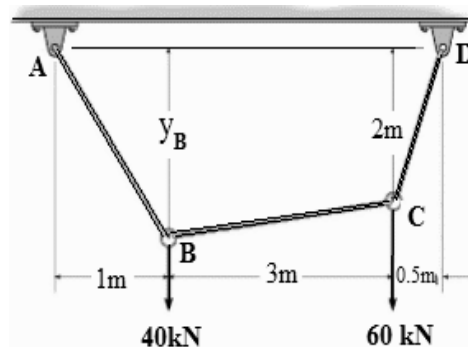
- 6 Compute the absolute maximum bending moment for the beam having span of 30 m (15) and loaded with a series of concentrated loads moving across the span as shown in Figure.



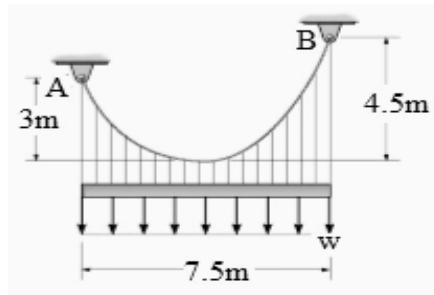
PART C

Answer any two full questions, each carries 20 marks.

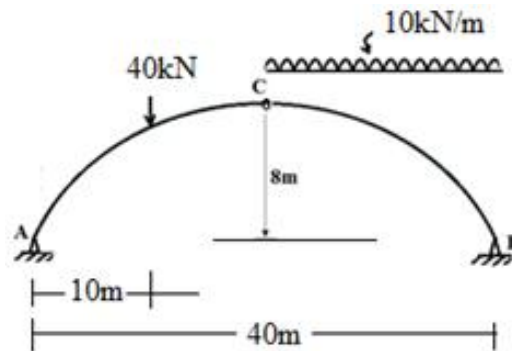
- 7 a) Cable ABCD supports the loading shown. Determine the maximum tension in the cable and sag of point B. (10)



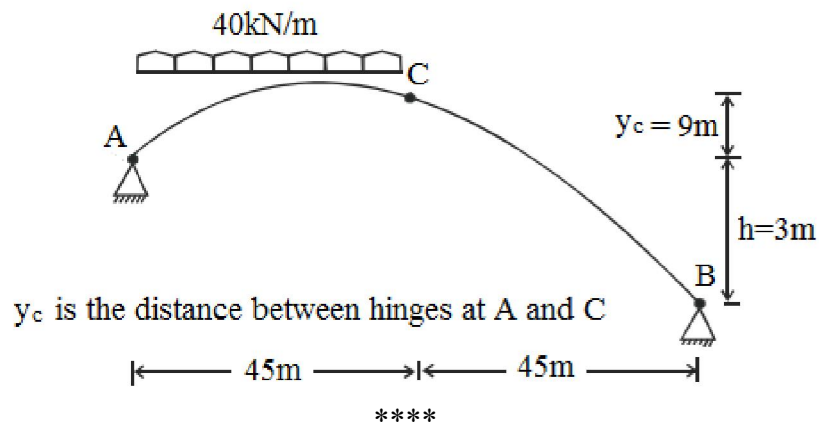
- b) The cable supports the uniform load of $w=8\text{kN/m}$. Determine the tension in the cable at each support A and B. (10)



- 8 a) A three-hinged parabolic arch is loaded as shown in figure. Calculate the location and magnitude of maximum bending moment in the arch. Draw bending moment diagram. (15)



- b) State Eddy's theorem. (5)
- 9 a) A three-hinged symmetric parabolic arch has a horizontal span L and central rise h . It is subjected to a uniformly distributed load of w per unit length along the span. Show that the shear force and bending moment at any section normal to the profile of arch is zero. Find also the normal thrust at this section. (6)
- b) Analyse the three-hinged parabolic loaded arch with supports at different levels as shown. (14)



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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE202
Course Name: STRUCTURAL ANALYSIS – I (CE)

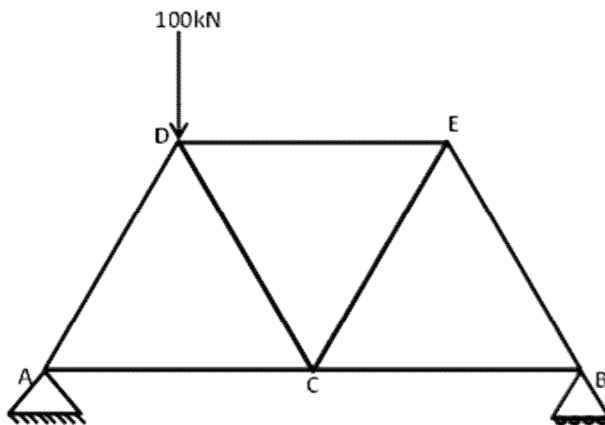
Max. Marks: 100

Duration: 3 Hours

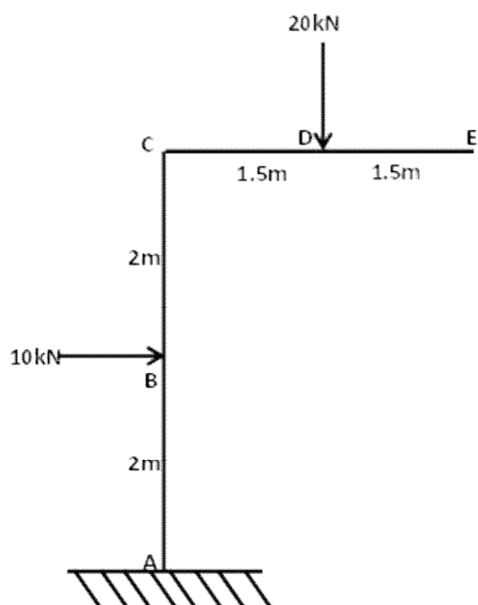
PART A

Answer any two full questions. Each question carries 15 marks.

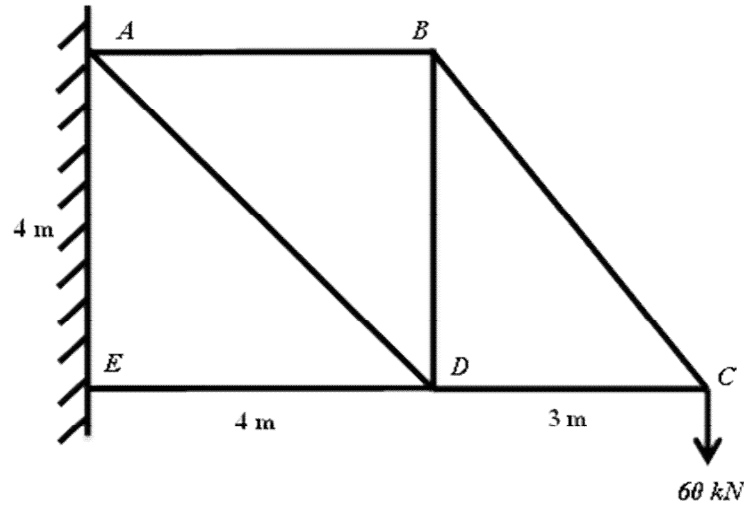
- 1 a) Briefly explain Castigliano's first and second theorems. 5
 b) Analyse the pin-jointed truss given below. All members have the same length and cross sectional area. Tabulate the results. 10



- 2 a) Discuss Maxwell's theorem of reciprocal deflection as applied to structural systems. 5
 b) Determine the horizontal and vertical deflection at point E of the frame shown in figure. Assume uniform flexural rigidity EI. 10



- 3 a) Distinguish between force and displacement method of analysis. 5
 b) Determine the vertical deflection of point D in the pin-jointed truss shown below. The cross sectional area of members AD and AE are 1500 mm^2 while those of other members are 1000 mm^2 . Take modulus of elasticity E as 200

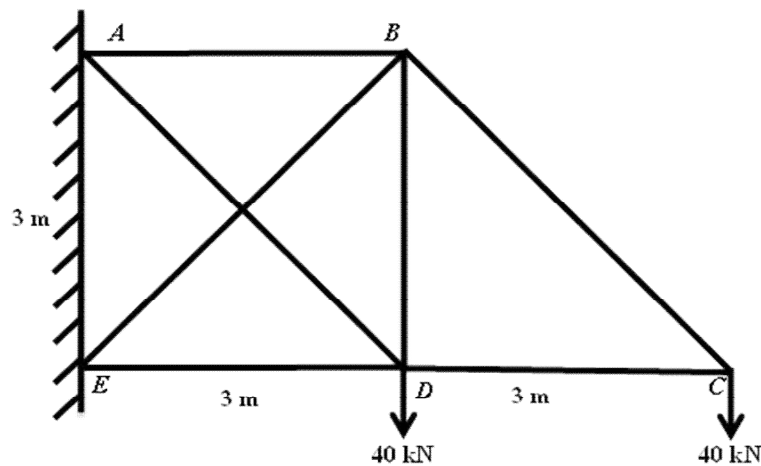


kN/mm^2 .

PART B

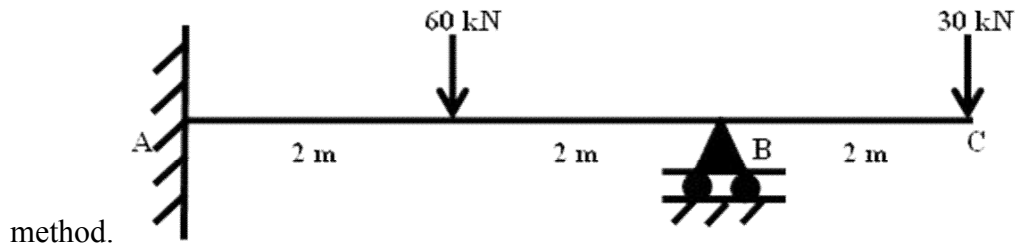
Answer any two full questions. Each question carries 15 marks.

- 4 a) Describe the steps involved in analysis of indeterminate beams subjected to support settlement. 5
 b) Find the member forces in the pin-jointed truss shown in figure. Tabulate the 10

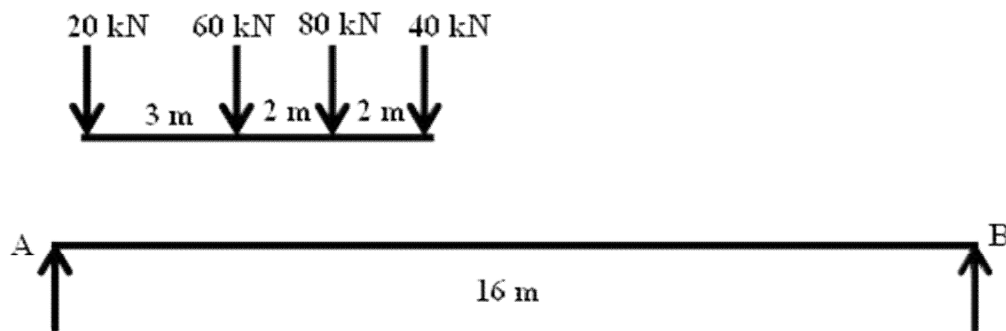


results.

- 5 a) Describe the steps involved in analysis of indeterminate beams by consistent deformation method. 5
 b) Analyse the beam shown in figure using consistent deformation 10



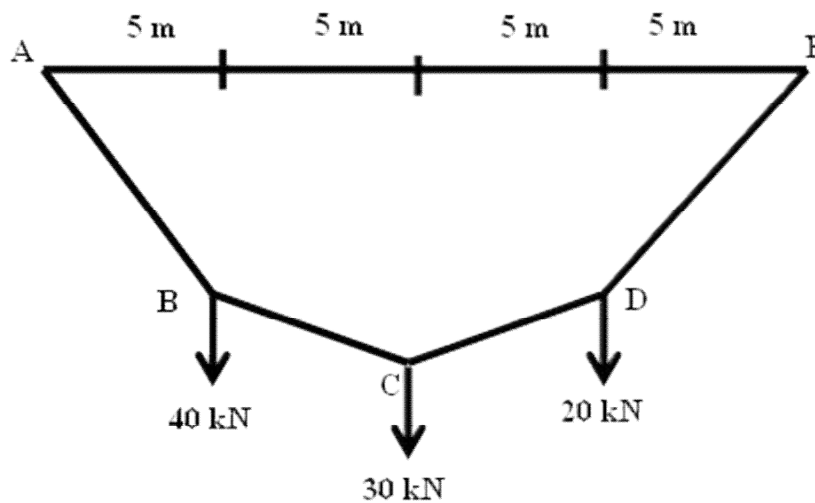
- 6 a) Construct ILD for BM at fixed support for a cantilever beam of span 'l'. 5
- b) A train of concentrated loads moves from left to right on a simply supported girder of span 16 m as shown in figure. Determine the absolute maximum shear force and bending moment developed in the beam. 10



PART C

Answer any two full questions. Each question carries 20 marks

- 7 a) With neat sketch, explain the functions of major components of a suspension bridge. 6
- b) A light cable is supported at two points 20 m apart which are at the same level. The cable supports three concentrated loads as shown in figure. The deflection at first point is found to be 0.8m. Determine the tension in the different segments and the total length of the cable. 14



- 8 a) With neat sketch, discuss the profile/shape of cable subjected to uniformly distributed load 'w' per unit horizontal length. 5
- b) A bridge cable is suspended from towers A and B, 80 m apart and carries a load 30 kN/m on the entire span. If the maximum sag is 8m at point C, calculate the maximum tension in the cable. If the cable is supported by saddles which are stayed by wires inclined at 30 degrees to the horizontal, determine the forces acting on the towers. If the same inclination of back stay passes over pulley, determine the forces on the towers. 15
- 9 a) With neat sketches, explain the different types of arches. 6
- b) A three- hinged circular arch hinged at the springing points A and B and crown point C, has a span of 40 m and a central rise of 8m. It carries a uniformly distributed load 20kN/m over the left-half of the span together with a concentrated load of 100 kN at the right quarter span point. Find the reactions at the supports, normal thrust, radial shear and bending moment at a section D 10 m from the left support. 14

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: CE202
Course Name: STRUCTURAL ANALYSIS – I (CE)

Max. Marks: 100

Duration: 3 Hours

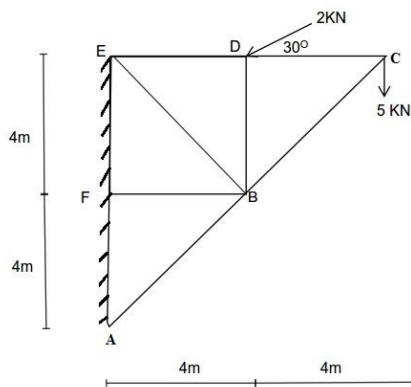
PART A

Answer any two full questions. Each question carries 15 marks.

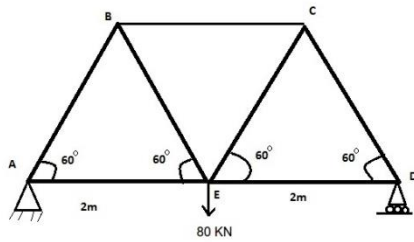
Answer any two full questions, each carries 15 marks.

Marks

- | | | |
|---|---|----|
| 1 | a) Distinguish between method of joints and method of sections used in the analysis of pin jointed framed structures. | 5 |
| | b) Analyse the truss shown in figure by method of sections | 10 |



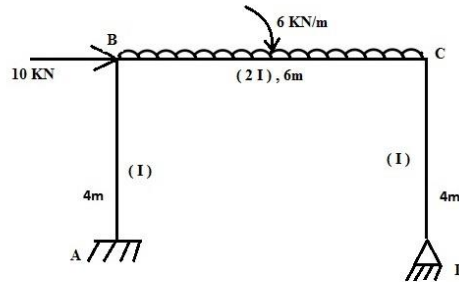
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|---|--|----|
| 2 | a) Derive an expression for strain energy due to bending of a beam subjected to general loading | 4 |
| | b) Explain Castigliano's theorems with the help of sketches | 4 |
| | c) State Betti's theorem | 4 |
| | d) Explain the Principle of least work | 3 |
| 3 | a) Describe static and kinematic indeterminacies with the help of examples | 5 |
| | b) Determine the vertical displacement of joint E of truss shown in figure by unit load method. Given, for all members cross sectional area = 1000mm ² , Young's modulus = 200 kN/mm ² | 10 |



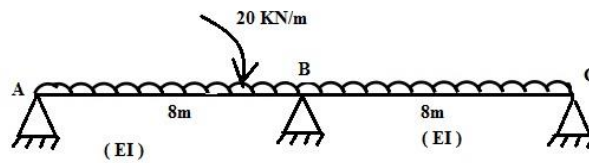
PART B

Answer any two full questions, each carries 15 marks.

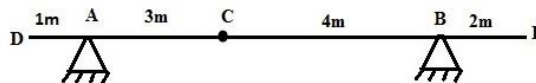
- 4 a) Describe the steps involved in the analysis of indeterminate beams subjected to support settlement 5
 b) Analyse the frame shown in figure using consistent deformation method. Draw the bending moment diagram. 10



- 5 a) Analyse the beam shown in figure by strain energy method and draw the bending moment diagram. 9

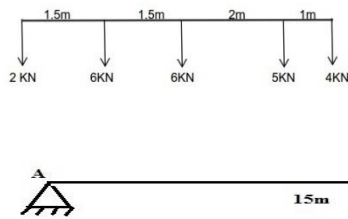


- b) Draw the influence lines for shear force and bending moment at a point C of the beam shown in figure 6



- 6 a) What are influence lines? What are its advantages? 3
 b) A train of concentrated loads moves from left to right on a simply supported girder of span 15 m, and 4kN load leading as shown in figure. Determine the 12

maximum shear force and the maximum bending moment at a section 4m from left support.



PART C

Answer any two full questions, each carries 20 marks.

- 7 a) With the help of a sketch, explain the various steps involved in the analysis of a loaded cable 8
loaded cable
- b) A light cable is supported at two points 20m apart which are at the same level. 12
The cable supports three concentrated loads of magnitudes 20 kN, 30 kN and 25 kN at points 1,2 and 3 respectively. The points 1,2 and 3 are at distances 5m, 10m,15 m respectively from the left support. The deflection at first point is found to be 0.8m. Determine the tension in the different segments and total length of the cable.
- 8 a) Explain with the help of sketches, the different types of arches. 8
- b) A flexible suspension cable of weight 0.75 N/m hangs between two vertical walls 12
60m apart, the left hand end being attached to the wall at point 10m below the right hand end. A concentrated load of 100 N is attached to the cable in such a manner that the point of attachment of the load is 20m horizontally from the left hand wall and 5m below the left hand support. Show that the maximum resultant cable tension is at the right hand end and find its value. The cable weight may be taken as uniformly distributed horizontally.
- 9 a) State Eddy's theorem 5
- b) A parabolic three hinged arch carries a udl of 30 kN/m on the left half of the 15
span. It has a span of 16 m and a central rise of 3 m. Determine the resultant reactions at the supports. Find the bending moment, normal thrust and radial shear at a section 2m from left support.

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER- 2019

Course Code: CE202
Course Name: STRUCTURAL ANALYSIS – I

Max. Marks: 100

Duration: 3 Hours

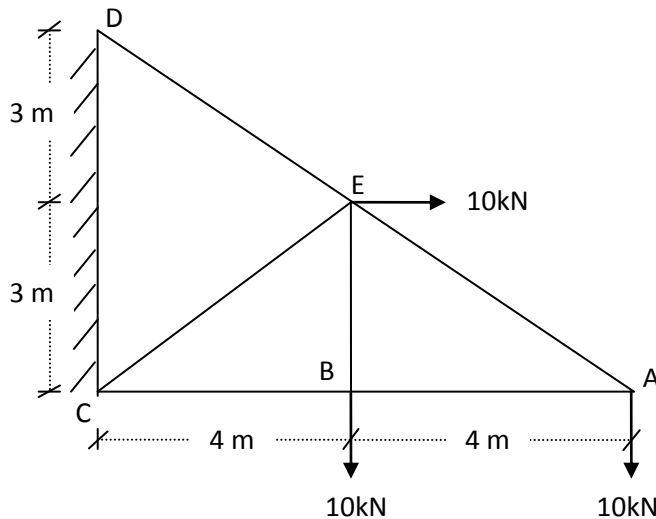
PART A

Answer any two full questions. Each question carries 15 marks.

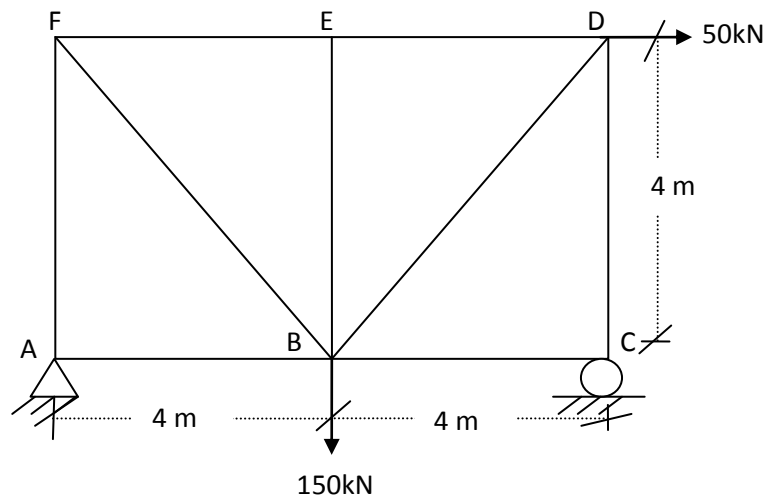
Answer any two full questions, each carries 15 marks.

Marks

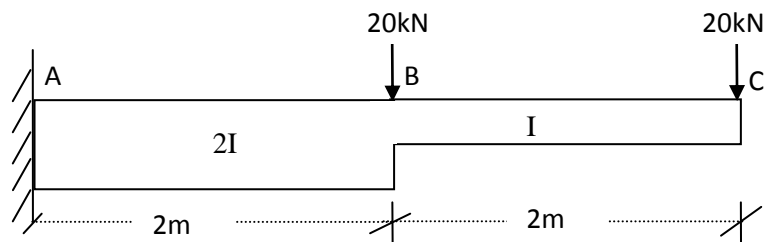
- 1 a) Analyse the plane truss by method of joints and tabulate the forces in all the members. (12)



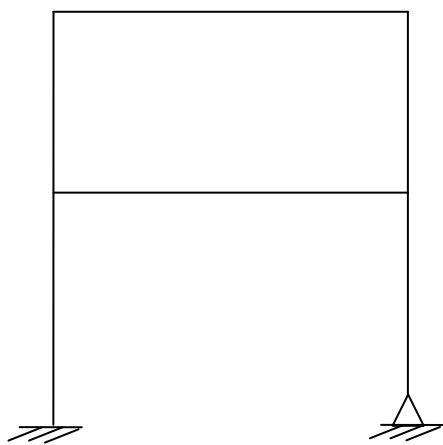
- b) Explain the 'method of sections' for the analysis of truss. (3)
- 2 a) State Maxwell's law of reciprocal deflections. (3)
- b) Determine the vertical deflection at B using unit load method. Cross sectional area of all horizontal members: 50 sq.cm, vertical members and inclined members: 25 sq.cm. $E = 200\text{GPa}$. (12)



- 3 a) Derive the expression for strain energy due to bending moment. (3)
- b) Determine the deflection at the free end of the cantilever using strain energy method. Given $E = 200 \text{ GPa}$, $I = 6.67 \times 10^7 \text{ mm}^4$ (10)



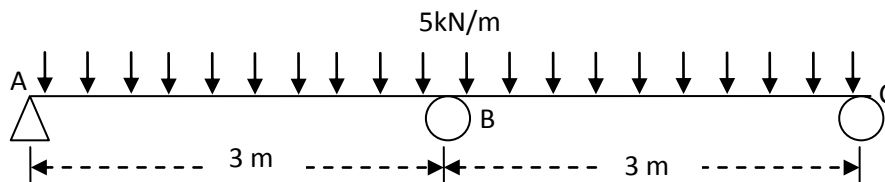
- c) Determine degree of static and kinematic indeterminacy in the structure shown in fig. Assume all members are axially rigid. (2)



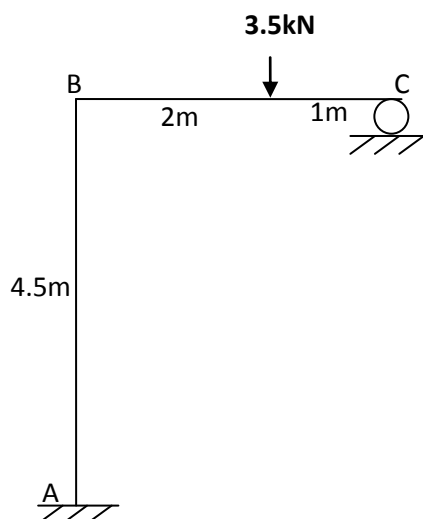
PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Explain the effect of temperature change in any member of an indeterminate truss. (5)
- b) Determine the support reactions of the beam shown in fig. using the method of consistent deformation. (10)

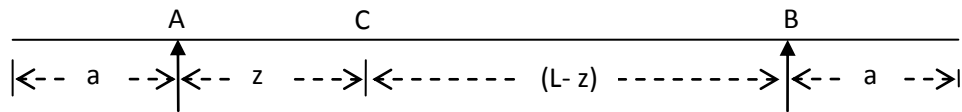


- 5 a) Three wheel loads, each of magnitude W , are traversing a simply supported beam from left to right. If the distance between consecutive wheel loads is a and span of the beam is $2l$, determine the maximum bending moment at mid-span of the beam. Given, $a = l/4$ (8)
- b) A UDL 2 kN/m of length 1.5 m is traversing a simply supported beam of span 8m. Determine i) the maximum support reaction ii) Maximum shear force at a section 2m from left support. In both the cases, indicate the position of the UDL on the span. (7)
- 6 a) Analyse the frame shown in figure using strain energy method. (10)



- b) For the overhanging beam AB shown in fig., draw influence line diagram for the following : (5)
- i) Shear force at C ii) BM at C iii) Support reaction at A iv) Support

reaction at B.



PART C

Answer any two full questions, each carries 20 marks.

- 7 a) A cable is suspended between two supports 120m apart, at the same level. It carries a UDL of 25kN/m over the entire span. The dip of the cable is 10m. Find
 i) the length of the cable ii) tension in the cable at the support iii) lowest tension in the cable. (12)
- b) Explain the various components of a suspension bridge with the help of a neat figure. (8)
- 8 a) A 3-hinged parabolic arch has a span of 18m and a rise of 6m. The arch is hinged at the springing A and B and at the crown C. It carries a UDL of 20kN/m over the left half of the span and a point load of 100kN at 4.5m from the right support B. Find the bending moment, normal thrust and radial shear at a section 3m from left end. (15)
- b) Draw the influence line diagram for bending moment at any section of a three hinged arch. (5)
- 9 a) A cable is suspended between two supports 120m apart, at the same level. It carries two concentrated loads each of 5kN at points 30m and 90m from left support. The length of the cable is 160m. Determine i) the support reactions ii) tension in various portions of the cable. (10)
- b) A 3-hinged semi-circular arch of radius R carries a UDL of w / unit run over the whole span. Find i) horizontal thrust at each support ii) location and magnitude of maximum bending moment. (10)

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: CE202**Course Name: STRUCTURAL ANALYSIS – I (CE)**

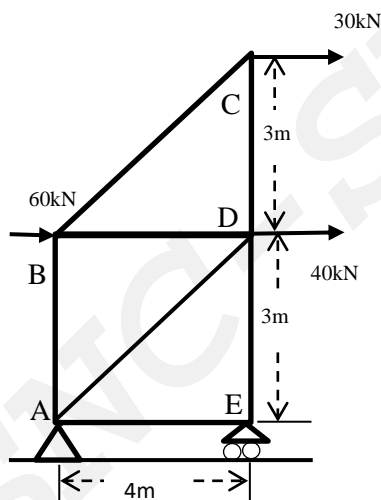
Max. Marks: 100

Duration: 3 Hours

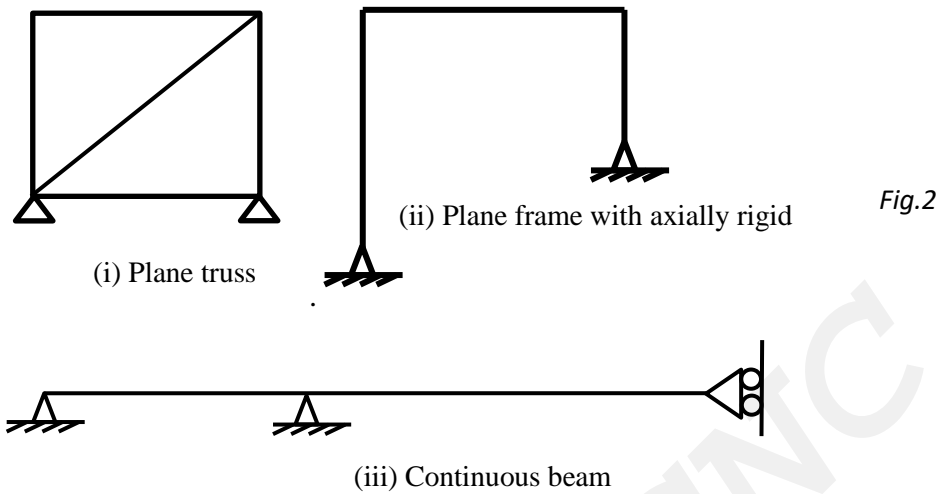
*Answer any two full questions from each part. Assume any missing data suitably.***PART A***Answer any two full questions, each carries 15 marks.*

Marks

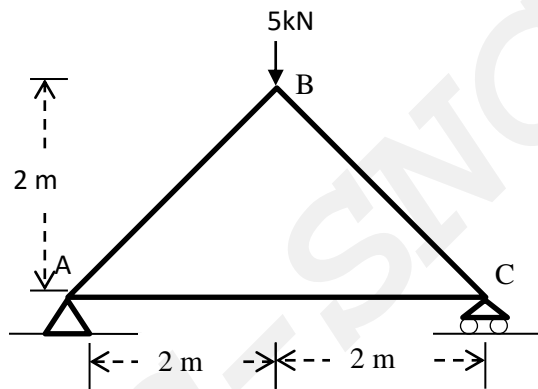
- 1 a) Differentiate the 'method of sections' and 'method of joints' for the analysis of truss. 5
- b) Analyse the truss shown in *Fig.1* and tabulate the member forces. 10

*Fig.1*

- 2 a) State Castigliano's first theorem and derive the relation between strain energy and displacement. 9
- b) Determine the static indeterminacy and kinematic indeterminacy of the structures shown in *Fig.2*. 6



- 3 a) For the pin jointed plane truss given in Fig.3, determine the vertical deflection at B by unit load method. Given $E = 200 \text{ GPa}$. Cross section of horizontal member is 150 sq.mm and of inclined members is 200 sq.mm . 12

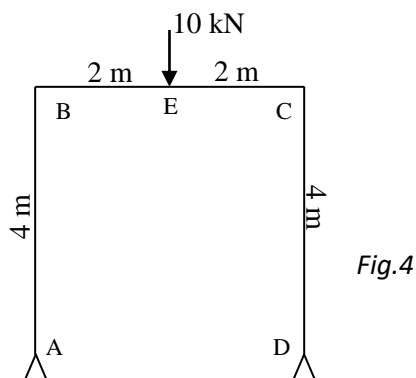


- b) With an example, explain the effect of lack of fit in a statically determinate truss. 3

PART B

Answer any two full questions, each carries 15 marks.

- 4 Analyse the frame in Fig.4 by strain energy method and calculate all support reactions. 15



- 5 a) Using the method of consistent deformation, determine the reaction at the prop in a propped cantilever shown in Fig.5. 10

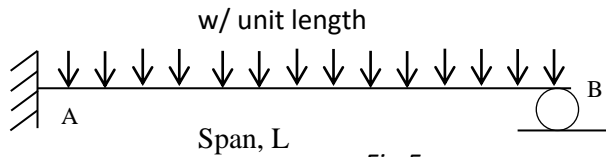


Fig.5

- b) Draw Influence line diagrams of the support reactions at A and B for the beam shown in Fig.6. 5

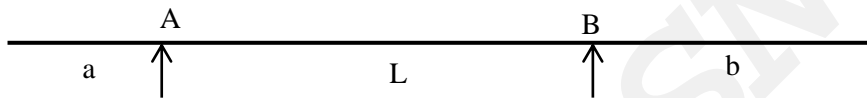


Fig.6

- 6 A UDL 60kN/m, 8m long crosses a girder of 30m span. Calculate the maximum shear force and bending moment at a section 12m from left support. Also find the absolute maximum bending moment in the beam. 15

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) A light cable is supporting a load of w per unit run on the horizontal span L . Ends of the cable are supported at points which are at the same level. If h is the dip, calculate reactions at the supports. 7
- b) A cable AD of span 7 meter is supporting two concentrated loads 10kN, 20kN at points B and C which are 2m and 5m from left support. Support A and D are at the same level. Dip of point C is 2.2 m. Calculate the support reactions and dip of point B. Also calculate the tension in the cable in different segments. 13
- 8 a) A three-hinged parabolic arch of span 20m and a rise 4m carries a uniformly distributed load of 20kN per meter over the left half of the span. Find the maximum bending moment in the arch. 12
- b) A 3-hinged semicircular arch of radius R carries a uniformly distributed load of w per unit run over the whole span. Find the location and magnitude of the maximum bending moment for the arch. 8
- 9 a) A cable of span 100 meter hangs between two supports at the same level. It carries a UDL of 25kN/m over the entire span. Determine the reactions on the 10

top of the supporting tower where the cable passes over a frictionless pulley.
Given: dip of the cable: 12m and the anchor cable makes an angle 30° with the horizontal.

- b) A three hinged parabolic arch has a span of L and a rise of h . Draw the 10
influence line diagram for the following.
i) Horizontal thrust, ii) Bending moment at a point 'a' distance from the left
support.
