BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO2022)

CLASS: B.TECH. **SEMESTER: III**
BRANCH: CIVIL **SESSION: MO/2022**

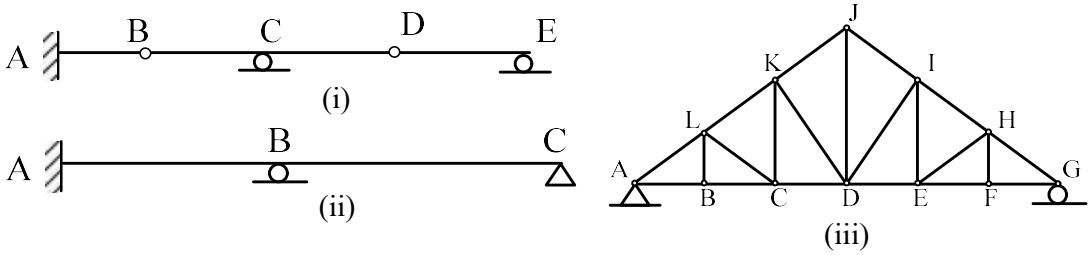
SUBJECT: CE202 STRUCTURAL ANALYSIS -I

TIME: 03 HOURS **FULL MARKS: 50**

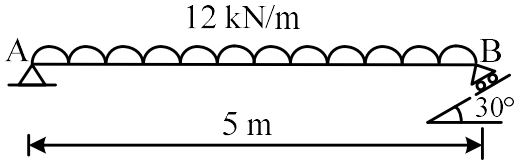
INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.

Q.1(a) Define the degree of freedom. In two-dimension how many degrees of freedom a hinge support has? [2] CO1 K1

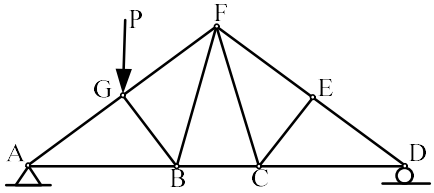
Q.1(b) Classify each of the following structures as statically determinate or indeterminate. If statically indeterminate, report the number of the degree of indeterminacy. [3] CO1 K2



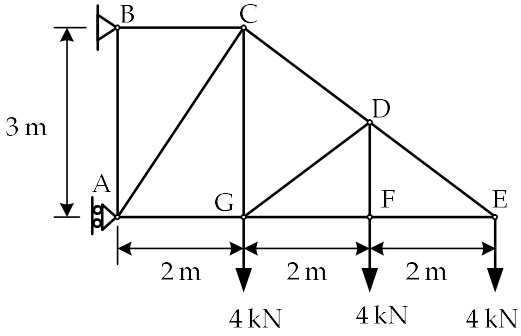
Q.1(c) A beam AB of span 5 m is hinged at A. Point B has an inclined roller support, as shown in the given figure. The inclination of the roller support with the horizontal is 30°. The beam when subjected to a uniformly distributed load of 12 kN/m over the entire span of the beam. Determine the reactions at the both supports. [5] CO1 K4



Q.2(a) Use method of joints to find out the zero-force member in the following truss, when there is a vertically downward load at joint 'G' [2] CO2 K3

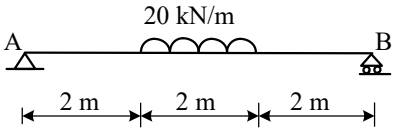


Q.2(b) Find the forces (with their nature) in the members FG, GD and CD of the truss loaded as shown in the following figure [3] CO2 K3

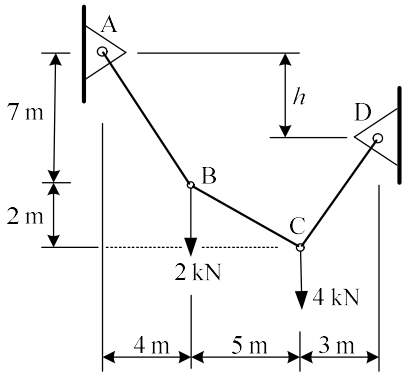


PTO

Q.2(c) Draw the Shear Force and Bending Moment diagrams for a simply supported beam as shown in the following figure. [5] CO2 K4

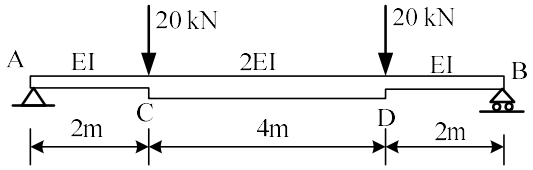


Q.3(a) Determine the tension in each segment of the cable shown in the figure. Also Calculate the vertical distance h. [5] CO3 K3



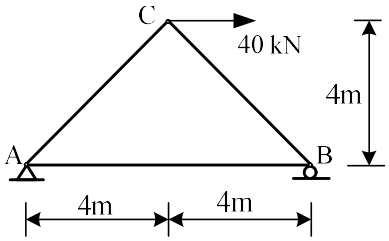
Q.3(b) A three hinged parabolic arch has a span of 20 m. The central rise of the arch is 4m. It is loaded with a point load of 4 kN at a point on the arch 4 m horizontally from the right-hand hinge. Calculate a) reactions at all the hinges, b) bending moment at 4m from the left hinge. [5] CO3 K3

Q.4(a) A simply supported beam AB has a span of 8 m. Two-point loads of 20 kN each act on point C, 2 m from the left support and at point D, 2 m from the right support and at point D. Variation of the flexural rigidity (EI) are as shown the given figure. Using moment area theorem calculate mid-point deflection of the beam. Take I=6 $\times 10^8$ mm^4 and E=2 $\times 10^5$ N/mm^2. [5] CO5 K4



Q.4(b) A horizontal simply supported beam AB is 12m long. Draw the influence line diagram (ILD) bending moment for point C, 3 m from support A. Using the ILD find the maximum positive bending moment at C due to a uniformly distributed load of intensity 2 kN/m and length 5m. [5] CO4 K3

Q.5(a) Determine the vertical displacement of joint C of the truss shown in the figure using unit load method. Each member has cross-sectional area (A)=500 mm^2 and Modulus of Elasticity (E)=200 GPa. [5] CO5 K3



Q.5(b) A horizontal cantilever beam AB of length 'L' is subjected to uniformly distributed load of intensity 'w' over its entire span. Point A is fixed support and point B is free end. The beam has constant flexural rigidity (EI). Using the Castigliano's theorem find out the deflection and rotation at the free end of the beam. [5] CO5 K3