B020411(020)

B. Tech. (Fourth Semester) Examination, April-May 2022

(AICTE Scheme)

(Civil Engg. Branch)

STRUCTURAL ANALYSIS-I

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *All questions are compulsory with internal choices among (b), (c) and (d).* Attempt 20 marks from each unit.

Unit-I

1. (a) Explain kinematic indeterminacy for rigid jointed and pin jointed frames.   4

(b) Find out external, static and kinematic indeterminacy of the given frames.　　8

Fig. 1

Fig. 2

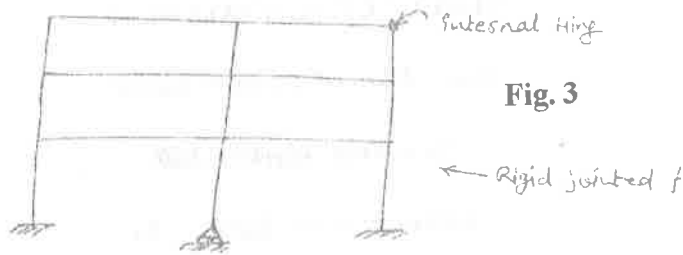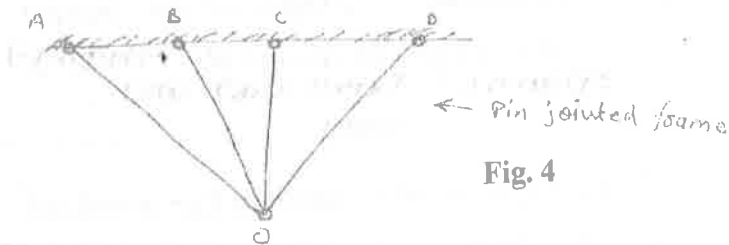(c) Find static and kinematic indeterminacy of the given frames :　　8

← Internal Hinge

Fig. 3

← Rigid jointed f

← Pin jointed frame

Fig. 4

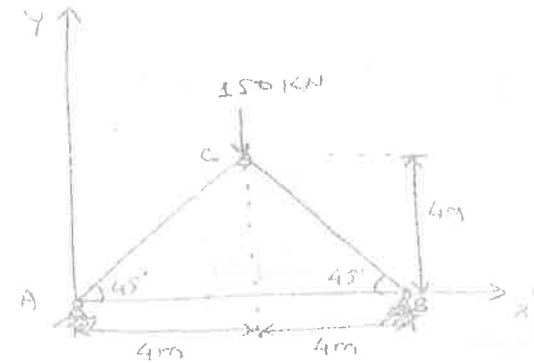(d) Find the forces in the truss given below using method of tension coefficient.　　8

Fig. 5

Unit-II

2. (a) Write the basics of conjugate beam method.　　4

(b) Determine the slopes at A and B and the deflection at C and D in the beam shown in figure. EI = Constant.　　16

Fig. 6

(c) Deterine the slope at A and the deflection at C in the beam shown in figure. EI = Constant.　16
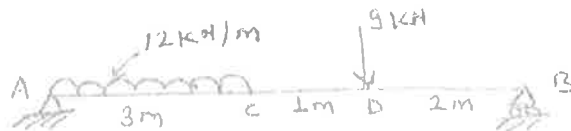

Fig. 7

Unit-III

3. (a) Explain :　4

   (i) Castigliano's first theorem

   (ii) Maxwell's reciprocal theorem

   (iii) Strain energy

   (iv) Betti's theorem

   (b) Determine the deflection and rotation at the free end of the cantilever beam as shown in figure. Use unit load method. Given $E = 2 \times 10^5$ N/mm^2 and $I = 12 \times 10^6$ mm^4.　16
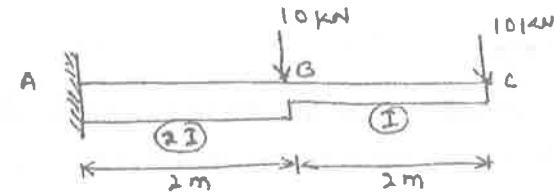
Fig. 8

(c) Using Castiglianco's first theorem. Determine the deflection and rotation of the overhanging end A of the beam loaded as shown in fig.9.　16
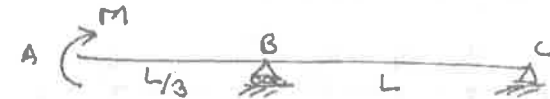

Fig. 9

Unit-IV

4. (a) What is an influence line diagram, and write its uses?　4

   (b) The following arrangement of axle loads is carried by a single bridge girder across a clear span of 30 m.

Axle load   5   5   10   10   10

Spacings   2·5   2·5   2·5   2·5

Draw the influence lines for shearing force and bending moment at a point 10 m from the left hand support and determine the maximum bending moment and maximum shear force at this point. The 5 kN load leads and the system may pass over the bridge from either side.   16

(c) Draw the influence line diagram for the forces in the members U_3L_4, U_3U_4 and U_3L_3 of the pin jointed frame shown in the figure.   16
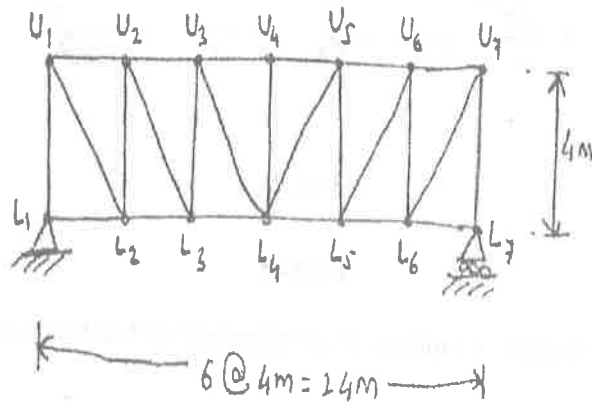

Fig. 10

Unit-V

5. (a) What is a stiffening girder and why is it used?   4

(b) A three hinged parabolic arch of span 40 m and rise 8 m carries a uniformly distributed load of 30 kN/m over the left half of the span. The hinges are provided at the supports and at centre of arch. Calculate reaction at support. Also calculate the bending moment, radial shear and normal thrust at a distance 10 m from the left support.   16

(c) A symmetrical three hinged circular arch has a span of 16 m and central rise to central hinge of 4·0 m. It carries a vertical load of 16 kN at 4·0 m from left end. Find :

   (i)   Magnitude of thrust at springing

   (ii)   Reactions at support

   (iii) Bending moment at 6·0 from left hand support. 16
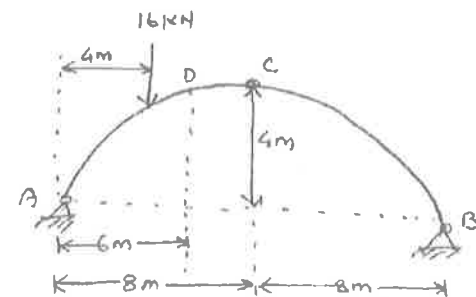

Fig. 11