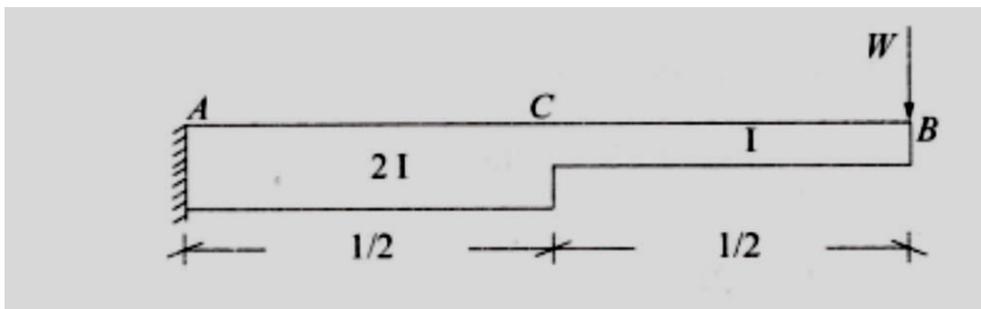


B.TECH.**THEORY EXAMINATION (SEM-IV) 2016-17****STRUCTURAL ANALYSIS-I****Time : 3 Hours****Max. Marks : 100****Note : Be precise in your answer. In case of numerical problem assume data wherever not provided.****SECTION – A**

1. **Attempt the following:** **10 x 2 = 20**
- Give an example of a structure where it is externally as well as internally indeterminate?
 - Which method of analysis is suitable, if static indeterminacy is more than kinematic indeterminacy?
 - What are the uses of influence lines?
 - Distinguish between influence line diagram and bending moment diagram.
 - Classify the arches based on materials, shapes and structural systems?
 - Why arches are preferred than beams?
 - Write the formulae for area the centroid of the curve defined by $y = kx^n$.
 - What is the advantage of conjugate beam method over other method?
 - State Castigliano's first theorem?
 - Write the equation in term of strain energy, which is sufficient to determine the stress in case of propped cantilever beams?

SECTION – B

2. **Attempt any five parts of the following questions:** **5 x 10 = 50**
- A simply supported beam has a span of 25m. Draw the influence line for shearing force at a section 10m from one end and using this diagram determine the maximum shearing force due to the passage of a point load 5kN followed immediately by uniformly distributed load of 2.4kN/m^2 extending over a length of 5m?
 - An uniformly distributed load of 40kN/m and of length 3 metres transverse across the span of simply supported length of 18 metres. Compute the maximum bending moment at 4m from the left support and absolute bending moment.
 - A three hinged parabolic arch hinged at the supports and at the crown has a span of 24m and a central rise of 4m. It carries concentrated load of 50kN at 18m from the left support and udl of 30kN/m over the left portion. Determine the normal thrust, radial shear at a section 6 metre from the left hand support.
 - Find the slope and deflection at the free end of a cantilever shown in figure by moment area method. Moment area of AC is twice the inertia of BC.



- A beam ABCDE is 12m long and supports a load of 100kN at C, simply supported at A and E. Portions $AB=BC=CD=DE=3\text{M}$. Moment of inertia is I in the portion AB and DE

and $2I$ in the portion BD . Determine the deflections at B and C by using conjugate beam method.

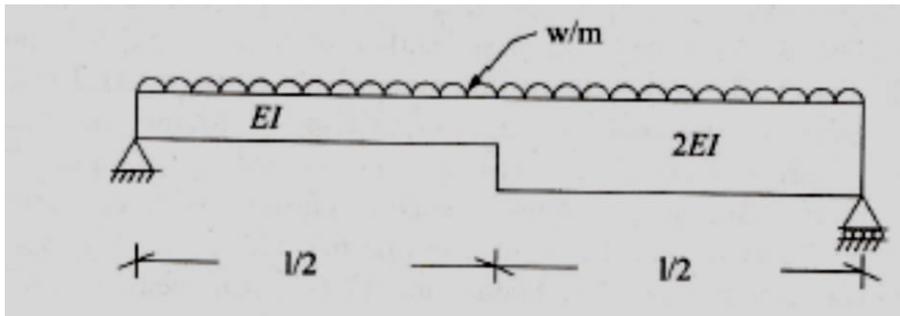
- (f) A cantilever beam is of span 2m and is subjected to a concentrated load of 20kN at the free end. The cross section of the beam is $100 \times 200\text{mm}$ and $E=30\text{kN/mm}^2$. Calculate the slope and deflection of the beam at midspan. Use unit load method.
- (g) State and prove that the Castigliano's theorem.
- (h) (i) Define fatigue
(ii) What is the polar moment of inertia?
(iii) What is unsymmetrical bending?
(iv) What are the reasons for unsymmetrical bending occurring in the beams?

SECTION – C

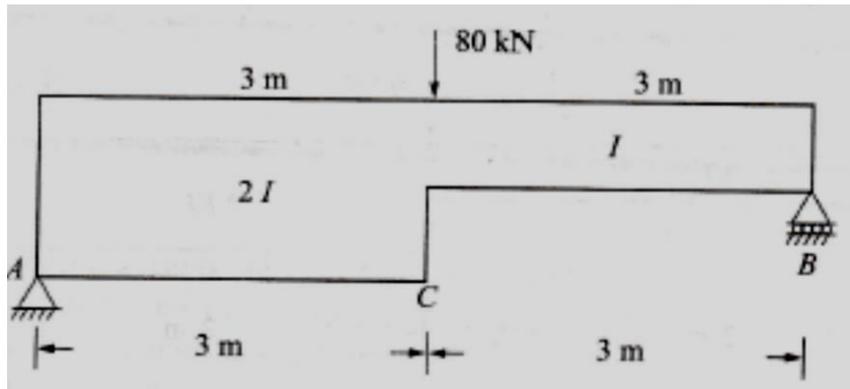
Attempt any two of the following questions:

2 x 15 = 30

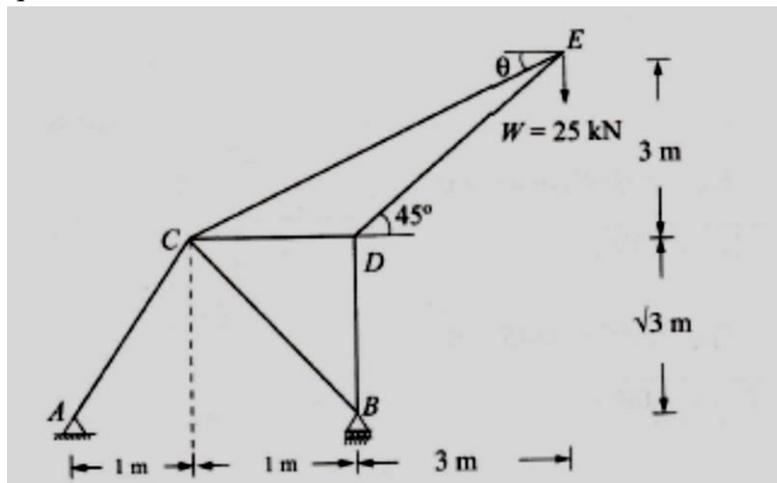
3. (a) A simply supported beam with variable moment of inertia supports a uniformly distributed load of $w \text{ kN/m}$. Estimate the maximum deflection in a beam.



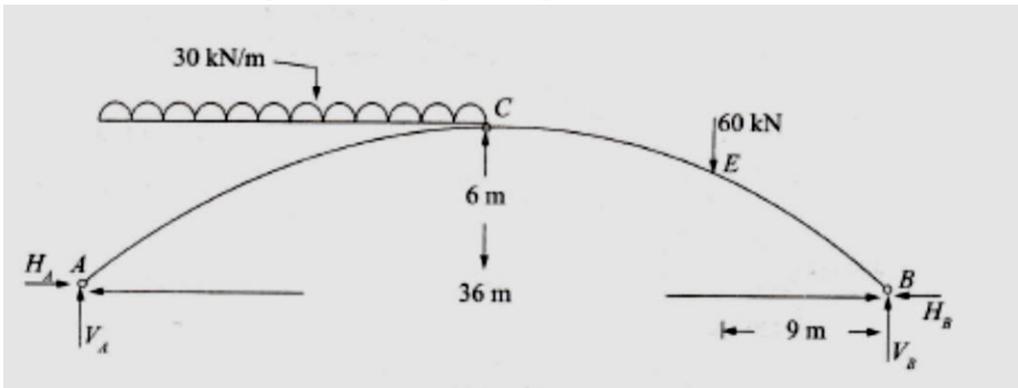
- (b) Determine the slopes at supports and deflection under the load for the beam shown in figure. Take young's modulus E as 210GPa , moment of inertia as $120 \times 10^6 \text{ mm}^4$. Adopt conjugate beam method.



4. (a) Calculate the deflection under the load for truss shown in figure. All the members are have equal areas of 1250mm^2 in cross-section and $E=200\text{kNm}^2$.



- (b) A three hinged parabolic arch is shown in figure. Determine the normal thrust, radial shear and bending moment at quarter span and draw BMD.



5. Figure shows a frame subjected to a load of 3.4kN. find the resultant stress at A and B.

