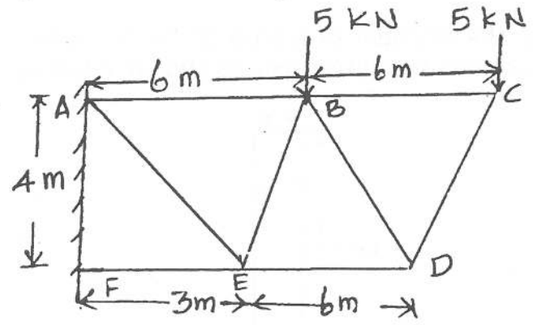
(Or)

(b) (i) A rectangular beam 200mm deep and 300mm wide is simply supported over a span of 8m. What will be the uniformly distributed load per meter the beam can carry, if the bending stress is not to exceed 120N/mm²?

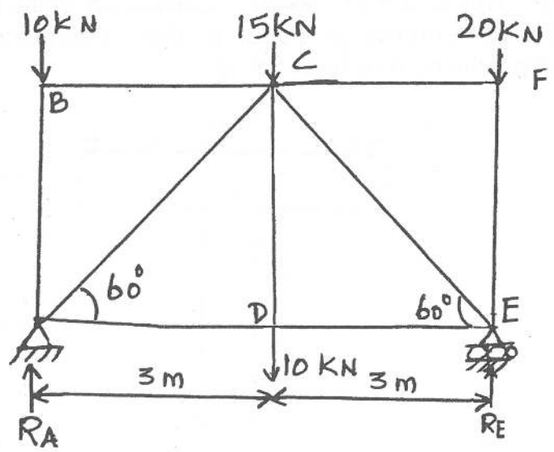
(ii) A $40mm \times 20mm$ rectangular steel shaft is subjected to a torque of 1kNm. What is the magnitude of maximum shear stress setup in the shaft and the corresponding angle of twist per unit length? For steel G=80GPa.

21. (a) Determine the forces in all the members of a cantilever by method of joints as shown in figure.



(Or)

(b) A truss is shown in figure. Find the forces in all the members of the truss by graphical method and indicate whether it is in tension or compression.



Register No.:

534

October 2017

Time – Three hours
(Maximum Marks: 75)

[N.B: (1) Q.No. 8 in PART – A and Q.No. 16 in PART – B are compulsory. Answer any FOUR questions from the remaining in each PART – A and PART – B.

(2) Answer division (a) or division (b) of each question in PART-C.

(3) Each question carries 2 marks in PART – A, 3 marks in Part – B and 10 marks in PART – C.]

PART – A

1. What is the relationship between (i) E, K and μ (ii) E, G and μ?
2. Write the expression to obtain elongation of a bar due to self weight.
3. Define indeterminacy. What is the degree of indeterminacy of fixed beams?
4. Define symmetry and anti-symmetry.
5. Define section modulus. What is the value of section modulus of a circle whose diameter is 'd'?
6. Write the bending and torsion equations and name the variables.
7. What are perfect frame and imperfect frame?
8. What are the assumptions made in the analysis of frames?

PART – B

9. Find the minimum diameter of a steel wire, which is used to raise a load of 4000N, if the stress in the rod is not to exceed 95N/mm².
10. Define modular ratio and give two examples of composite section.
11. What will be the maximum shear force and bending moment values when a cantilever of beam length 'l' subjected to uniformly distributed load 'w'?
12. Write parallel and perpendicular axes theorems.
13. A cantilever of length 2m fails when a load of 2kN is applied at the free end. If the section of the beam is $40mm \times 60mm$, find the stress at the failure.
14. Define deficient frame and redundant frame.

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15. A solid shaft of 150mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 45N/mm².

16. Write the expression for the centroids of semicircular and quadrant sections.

PART – C

17. (a) (i) A rod of 2.0m long and diameter 30mm is subjected to an axial pull of 30kN. If the Young's modulus of the material of rod is $2 \times 10^5 N/mm^2$, determine (i) stress, (ii) strain and (iii) the elongation of the rod.

(ii) An axial pull of 35kN is acting on a bar consisting of three lengths of 20mm dia with 200mm length, 30mm dia with 250mm length and 50mm dia with 220mm length. If the Young's modulus is $2.1 \times 10^5 N/mm^2$, determine (1)stresses in each section and (2)total extension of the bar.

(Or)

(b) (i) Determine the Poisson's ratio and bulk modulus of a material, for which Young's modulus is $1.2 \times 10^5 N/mm^2$ and modulus of rigidity is $4.8 \times 10^4 N/mm^2$.

(ii) Derive an expression for total elongation of a bar due to its self weight.

18. (a) (i) A cantilever beam of length 2m carries a point load of 1kN at its free end and another load of 2kN at a distance of 1m from the free end. Draw the SF and BM diagrams for the cantilever.

(ii) A cantilever of length 2m carries uniformly distributed load of 3kN/m run over a length of 1m from the fixed end. Draw the SF and BM diagrams.

(Or)

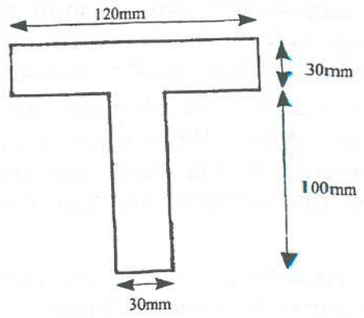
(b) A simply supported beam of length 8m carries point loads of 4kN, 10kN and 7kN at a distance of 1.5m, 2.5m and 4m respectively from the left end A. Draw the SF and BM diagrams for the simply supported beams.

19. (a) (i) Find the centre of gravity of the L-section of size $100mm \times 60mm \times 20mm$ thickness.

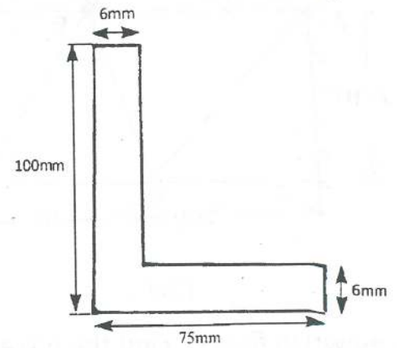
(ii) Derive an expression for a MI of triangular section of base 'b' and height 'h' about its base.

(Or)

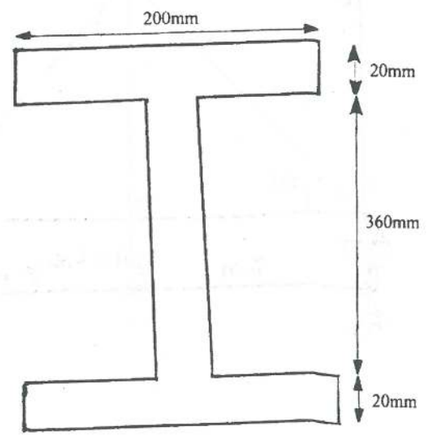
(b) (i) Find the centre of gravity of the 'T' section of size $120mm \times 130mm \times 30mm$ thickness as shown in figure.



(ii) Find the moment of inertia of $ISA\ 100 \times 75 \times 6mm$ about the centroidal XX and YY axis as shown in figure.



20. (a) A rolled steel joist of I-section has the dimensions as shown in figure. This beam of I-section carries an uniformly distributed load of 40kN/m run on a span of 10m. Calculate the maximum stress produced due to bending.



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