Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 1014137

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV / DEC 2024
Fourth Semester
Aeronautical Engineering
U20AE404 – ADVANCED SOLID MECHANICS
(Regulation 2020)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Define a Statically indeterminate beam.

2. Define a continuous beam.

3. Recall strain energy.

4. State Castigliano's first theorem.

5. Define effective length of column.

6. State about Slenderness Ratio of a column.

7. Compare ductile and brittle materials.

8. Define Fatigue failure.

9. Name the types of riveted joints based upon the way the members are connected.

10. List any two advantages of welded joint.

PART – B (5 x 16 = 80 Marks)

11. (a) A continuous beam ABCD is carrying a uniformly distributed load of 1 kN/m over span ABC in addition to concentrated loads as shown in Figure (1). Solve for the support reactions. Also, construct the bending moment and shear force diagram. Assume EI to be constant for all members. (16)

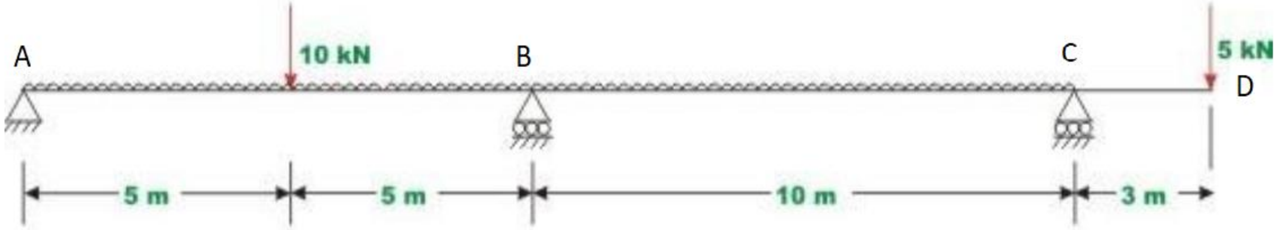

Figure (1)

(OR)

(b) Analyze the truss shown in the Figure (2) and solve for the forces in the members. (16)

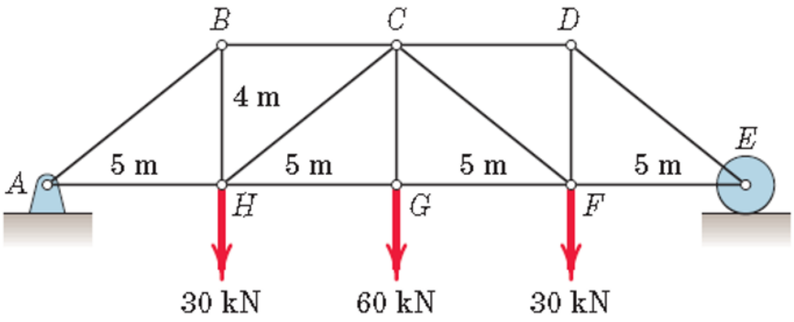

Figure (2)

12. (a) Two bars A and B are each 30cm long and are of the same material. Bar A is 20mm in diameter for a length of 10cm and 40mm in diameter for the remaining length. Bar B is 2cm in diameter for a length of 20cm and 4cm in diameter for the remaining length. An axial blow given to bar A produces a maximum instantaneous stress of 200 N/mm^2. Calculate the maximum instantaneous stress produced by the same blow on bar B.
If each bar is stresses up to the elastic limit, solve for the ratio of energy stored by A and B at proof stress. (16)

(OR)

(b) Solve for the horizontal displacement at D of the frame shown in Figure (3). Assume the flexural rigidity of the beam to be constant throughout the member. Neglect strain energy due to axial deformations. (16)

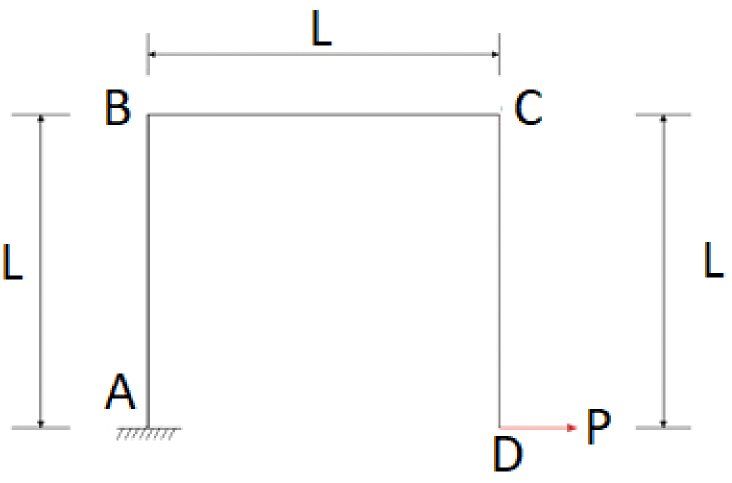

Figure (3)

13. (a) A 6 m long concrete column having an Elastic Modulus of 200 kN/mm^2 and the cross section shown in the Figure (4) is to be used in a building. Determine the maximum allowable axial load (Pallow) the column can support so that it does not buckle. The safety factor is taken as 2.0. Given that: (16)

(i) Both end of the columns is pinned ends

(ii) Both end of the column are fixed ends

(iii) One end is fixed and the other end is free to move

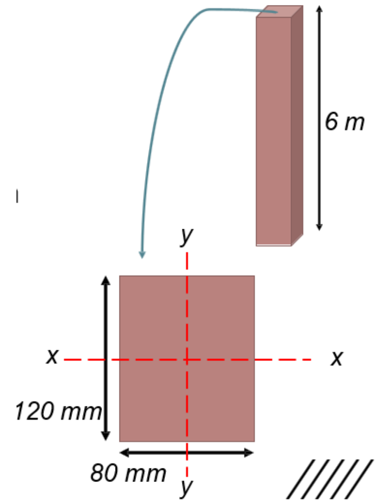

Figure (4)

(OR)

(b) Deduce the Secant Formula for eccentric loading of columns. (16)

14. (a) Explain in detail about maximum normal stress and maximum shear stress theories of failures. (16)

(OR)

(b) A force F = 45,000 N is necessary to rotate the shaft shown in Figure (5) at uniform speed. The crank shaft is made of ductile steel whose elastic limit is 207,000 kPa, both in tension and compression. With E = 207 x 10^6 kPa, n = 0.25, determine the diameter of the shaft, using the octahedral shear stress theory and the maximum shear stress theory. Use a factor of safety N = 2. (16)

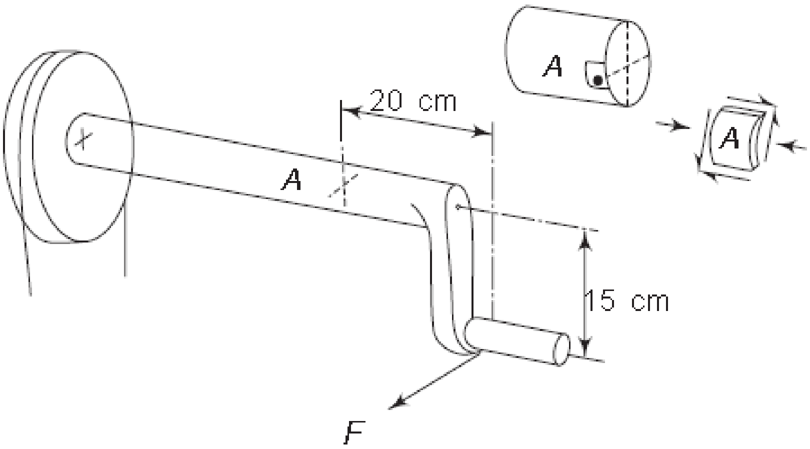

Figure (5)

15. (a) Two plates 10 mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 50 mm. The rivets are 20 mm diameter and permissible stresses are: shearing of rivets= 70 MPa, bearing of rivets = 160 MPa, Tearing of the plate = 100 MPa. Determine the maximum tensile force on the joint and efficiency of the joint. (16)

(OR)

(b) A 100 mm x 12 mm plate is connected to another plate by fillet welds around the end of the bar and inside a machined slot as shown in Figure (6). All the dimensions are in mm. Determine the size of the weld, if the joint is subjected to a pull of 250 kN. Take working stresses for the transverse welds and longitudinal welds as 100 MPa and 80 MPa respectively. (16)

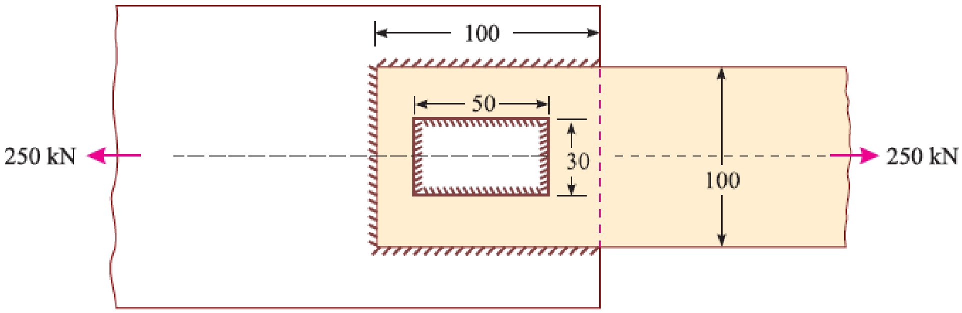

Figure (6)

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