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College of Engineering, Pune.

STRUCTURAL MECHANICS-I [CE-203]

S.Y. B. Tech. (Production)

End Sem Examination

Maxi. Marks: 50

Duration: 3 hrs: date 27/11/2011

Instructions

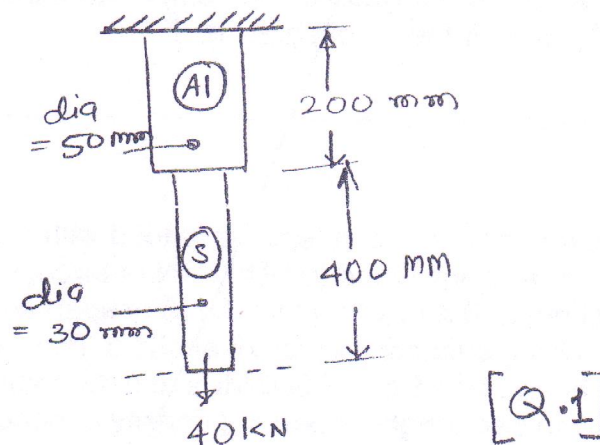
- All questions are compulsory
- Use of electronic pocket calculator is allowed.
- All questions carry equal marks.

Q. 1

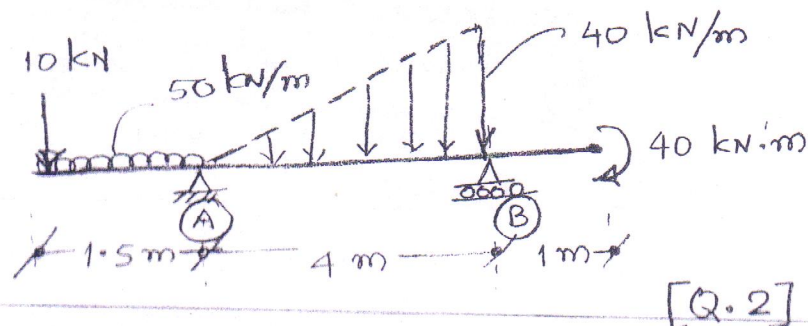
A composite bar of aluminum and steel is fixed at one end and free at other. It is subjected to a gradual axial load of 40 kN. Assume $E_s = 2 \times 10^5$ N/sq.mm and $E_a = 0.7 \times 10^5$ N/sq.mm

[a] Find the stresses and elongation in bar if temperature is deviated by 25 degree Celsius.

[b] If the rod is suddenly loaded in tension by a weight of 40 kN falling through a height of 10 mm, find the stresses and elongation.



Q.2 Draw the SFD and BMD of the following beam. Find also the bending stress and shear stress at support A if a rectangular section of 200 mm x 450 mm is provide throughout. .



[10]

Q.3 Derive the relation between twisting moment, twist and shear stress.

A steel shaft of 5 m length is to transmit 120 kW power at 200 rpm. Allowable shear stress is 110 N/sq.mm and shear modulus is equal to 1×10^5 N/sq.mm

- [a] Find the necessary diameter of the solid shaft.
- [b] If total angle of twist is restricted to 2 degree, work out the inside and outside diameter of the shaft .

[10]

Q.4

[a] Explain the concept of equivalent length for various end conditions and quantify the respective values with suitable reasons.

[b] A mild steel circular hollow column having external diameter of 150 mm and internal 120 mm is 3 m apart and fixed at both ends. Work out the critical load on column based on Euler's /Rankine's theory as applicable. Use yield stress = 250 N/sq.mm and $E = 2 \times 10^5$ N/sq.mm

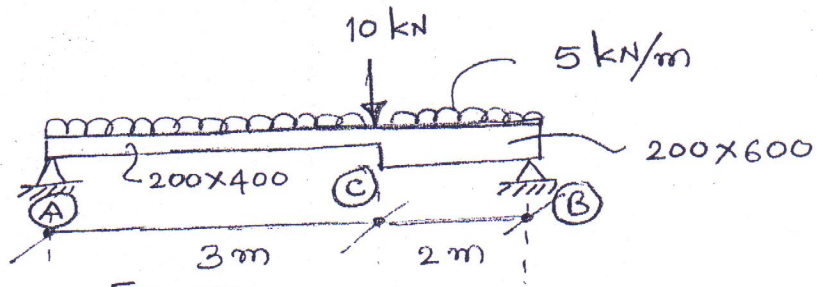
[b] if column experiences net variation in temperature about 25 degree , estimate the safe load , if factor of safety is 2.

[10]

Q.5

A reinforced concrete beam of 5 m span is loaded with a point load, 10 kN at 3 m from one support and subjected to UDL 5 kN/m throughout. The beam is having cross section, 200 mm x 400 mm for 3 m span and 200 mm x 600 mm for 2 m portion . Using suitable method of analysis, find the deflection under the load point of the beam. Use $E_c = 22360$ MPa and $G = 9300$ MPa. Also calculate the deflection due to self-weight of beam. (density of concrete = 25 kN./cu.m)

[10]



[Q.5]