B.E./B.TECH. Degree Examination, December 2020

Fourth Semester

MR16401 - MECHANICS OF SOLIDS FOR MARINE ENGINEERING

(Regulation 2016)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar will induce
   a. no stress **b.** shear stress **c.** tensile stress **d.** compressive stress
2. A body is subjected to two normal stresses 20 kN/m^2 (tensile) and 10 kN/m^2 (compressive) acting perpendicular to each other. The maximum shear stress is
   a.5 kN/m^2 **b.**10 kN/m^2 **c.**15 kN/m^2 **d.**20 kN/m^2
3. Maximum deflection in a cantilever beam with W at the free end will be
   a. At the free end **b.** At the fixed end **c.** At the center d. None
4. The hoop stress in a thin cylindrical shell is
   a. longitudinal stress **b.** compressive stress **c.** radial stress **d.** circumferential tensile stress
5. Why the Factor of safety should be greater than one?
6. How will you apply clapeyron's theorem of three moment to a continuous beam with simply supported ends?
7. Why hollow circular shafts are preferred over solid circular shaft.
8. A cylinder pipe of diameter 1.5m and thickness 1.5 cm is subjected to an internal fluid pressure of 1.3 N/mm$^{2.}$ Find longitudinal stress developed in the pipe

PART B - (4 X16 = 64 marks)

09. (a) A reinforced column 500mm x 500mm. in section is reinforced with four steel bars of 25 mm diameter, one in each corner. The column is carrying a load of 1000KN. Find the stresses in the concrete and steel bars. Take E for steel =210GPa and for concrete = 14 GPa. **(16)**

(OR)

(b) A steel rod of 20 mm diameter passes centrally through a copper tube 40 mm external diameter and 30 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projected parts of the rod. If the temperature of the assembly is raised by 60°C, calculate the stresses developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 GN/m^2 and α for steel and copper as 12 x 10^{-6} per °C and 18 x 10^{-6} per °C. **(16)**

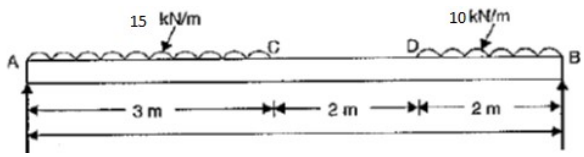
10. (a) (i) Calculate the maximum stress induced in a cast iron pipe external diameter 42mm, internal diameter 20mm and length of 4m when the pipe is supported at its ends and carries a point load of 82N at its Centre. **(8)**

(ii) A rectangular beam 150 mm wide and 250 mm deep is subjected to a maximum shear force of 60KN. Determine the i) Average shear stress ii) Maximum shear stress iii) shear stress at the distance of 25 mm above the neutral axis. **(8)**

(OR)

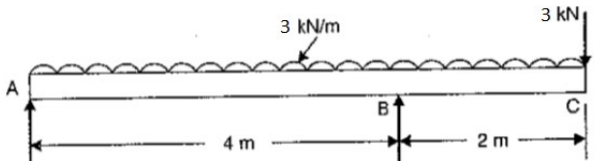
(b) At a point within a body subjected to two mutually perpendicular directions, the stresses are 100 N/mm^2 tensile and 75 N/mm^2 tensile. Each of the above stresses is accompanied by a shear stress of 75 N/mm^2.Determine the normal stress, shear stress and resultant stress on an oblique plane inclined at an angle of 45^0 with the axis of minor tensile stress. **(16)**

11. (a) Draw the SFD and BMD of the given diagram, also find the maximum bending moment. **(16)**



(OR)

(b) Draw the SFD and BMD for the overhanging beam carrying uniformly distributed load as shown in the figure. Locate the point of contraflexure. **(16)**



12. (a) (i) A beam 7 m long, simply supported at its ends, is carrying a point load 60 kN at its centre. The moment of Inertia of the beam is given as equal to 78 x 10^6 mm^4. If E for the material of the beam = 2.1 x 10^5 N/mm^2, calculate: (i) deflection at the centre of the beam and (ii) slope at the supports. **(8)**

(ii) A hollow shaft is to transmit 320KW power at 82rpm. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter of 0.6 of the external diameter, find the external and internal diameter. Assuming that the maximum torque is 1.4 times the mean torque. **(8)**

(OR)

(b) A 2.0 m long column has a circular cross-section of 6 cm diameter. One of the ends of the column is fixed in direction and position and other end is free. Taking factor of safety as 3, calculate the safe load using **(16)**

(i) Rankine s formula take yield stress f_c = 550 N/mm^2 and α = (1/1600) for pinned ends.

(ii) Euler's formula, Young's modulus for C.I. = 1.3 x 10^5 N/mm^2.