BMET- 304

Roll No. | | | | | | | | | | |

Odd Semester Examination, 2019-20
B.Tech-Mechanical Engineering (Semester-3rd)
Strength of Materials

Time : 3:00 Hrs **Max. Marks: 100**

Total no. of printed pages: 2

Note: All questions are compulsory:

Q1. Answer any four of the following. **4x5=20**

a) Explain the law of parallelogram of force. and set up the formula resultant and its direction with force (P)

b) A steel bar, 300 mm long and 30 mm×30 mm cross-section is subjected to a tensile force of 150 kN in the direction of its length. Determine the change in volume, taking $E = 2\times10^5$ N/mm^2 and 1/m = 0.3.

c) Two parallel walls 8mm apart, are stayed together by steel rod of 20 mm diameter passing through metal plates and nuts at each end. The nuts are screwed up to the plates while bar is at the temperature of 400K. Find the pull exerted by the bar after it has cooled to 300K, if ends do not yield Take α for steel = 12 x 10^{-6}per K and E = 2 x 10^5 N/mm^2.

d) State Rankine's theory of failure with drawing region of safety.

e) A simply supported beam of span L is carrying point load W at the mid span. What is the deflection at the center of the beam?

f) Differentiate between following :
   i. Co-planar & Non coplanar force system
   ii. Concurrent & Non concurrent force system
   iii. Resolution & composition of force
   iv. Resultant & Equilibrant

Q2. Answer any two of the following. **2x10=20**

a) Derive the torsion equation giving assumptions made.

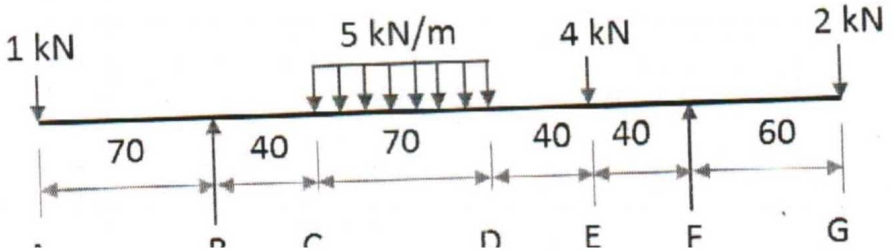
b) A Hollow steel shaft 3m long transmits a torque of 24 kNm. The total angle of twist is not to exceed 2.5° and the allowed shear stress is 90MPa. Determine inside and outside of shaft G= 85GPa

c) Derive the relation between elastic Modulus (E), Modulus of Rigidity (G) and Bulk Modulus (K).

Q3. Answer any two of the following. **2x10=20**

a) Give the assumptions made for bending equation and also derive the bending equation with the usual symbols.

b) Draw the Shear Force and Bending Moment Diagram of beam shown in fig.



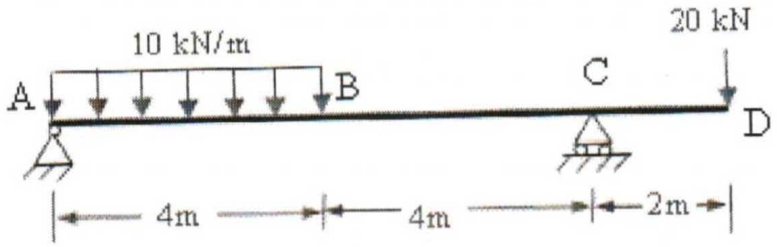
c) A simply supported beam of 5m span carries a uniformly distributed load of 10kN per meter run and a point load of 10 kN at 2m from left support. Determine the magnitude and location of peak bending moment. Proceed suitable section of this beam if the maximum allowable stress is limited to $8N/mm^2$. Take depth twice the width.

Q4. Answer any two of the following. **2x10=20**

a) Derive the differential equation of a deflected beam as given by $EI\frac{d^2y}{dx^2} = M$, where M is the bending moment, E is the young modulus of elasticity and I is the moment of inertia

b) Write a short note on the following
   i. Maximum principal stress theory (Rankine theory)
   ii. Maximum shear stress theory (Guest Theory)
   iii. Maximum strain theory (st.Venant Theory)
   iv. Strain energy theory (Haigh's theory)
   v. Distortion energy theory (Von-Mises theory)

c) Determine the slope and deflection at point B and D , Take $E = 2\times10^5\, N/mm^2$, $I = 7200\, cm^4$



Q5. Answer any two of the following. **2x10=20**

a) Derive the Lame's equation for thick cylindrical shell and sate the meaning of each term appearing in the equation.

b) Show that in case of a thin cylindrical shell to internal fluid pressure, the volumetric strain is equal to the sum of twice the hoop strain and longitudinal strain and also obtain for $\varepsilon_v = \frac{Pd}{4tE}(5-4\mu)$ with usual notations.

c) A cast iron pipe of 40cm internal diameter and 10cm thickness carries water under a pressure of $80kg/cm^2$. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section.
