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Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (AE) (2018 Batch) (Sem.-3)

**STRENGTH OF MATERIALS**

Subject Code : BTAE301-18

M.Code : 76399

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

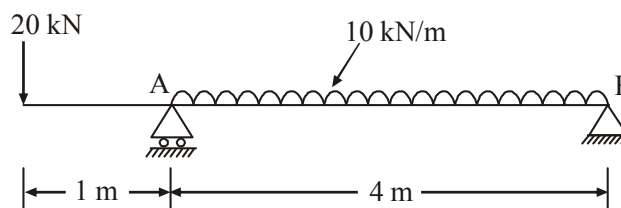
1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A****Answer briefly :**

- Q1 What is proportionality limit?
- Q2 If an element is subjected to pure shearing stress of 30MPa, then find the value of maximum principal stress.
- Q3 Explain the concept of pure bending.
- Q4 Draw the BMD and SFD of a cantilever beam of length 'l' having uniformly distribute load of intensity 'w' over the entire span.
- Q5 What is polar moment of inertia?
- Q6 Explain Maxwell's reciprocal theorem.
- Q7 What is section modulus?
- Q8 Derive the expression for deflection of a closely coiled helical spring under axial load.
- Q9 Derive an expression for equivalent stiffness of two springs joined in series.
- Q10 Define hoop stress.

### SECTION-B

- Q11 The stresses on two perpendicular planes through a point in a body are 30 MPa and 15 MPa both tensile along with shear stress of 25 MPa. Find
- The magnitude and direction of principal stresses.
  - Planes of max. shear stress
- Q12 An overhanging beam is on rollers at *A* and is hinged at *B* and is loaded as shown below. Determine the reactions at *A* and *B*. Draw SFD and BMD for the beam.



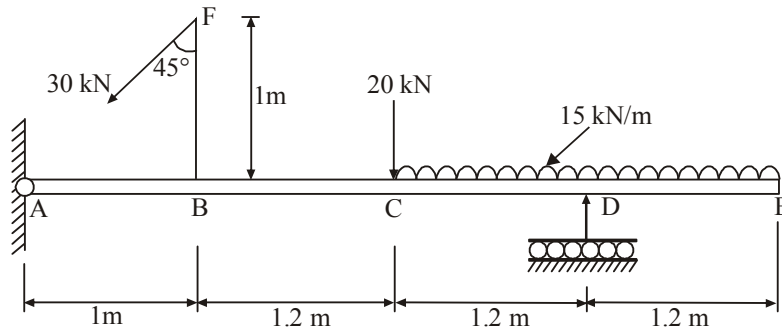
**FIG.1**

- Q13 A hollow circular shaft 200mm external diameter & 160 mm internal diameter transmitting power at 180 RPM, the angle of twist on a length of 2 m is found to be 0.550. Calculate power transmitted & maximum shear stress. Take  $G = 0.8 \times 10^5$  MPa.
- Q14 A beam of length 10m is symmetrically placed on two supports 7m apart. The loading is 15 kN/m between the supports and 20kN at each end. What is the central deflection of the beam?  $E = 210\text{GN/m}^2$ ;  $I = 200 \times 10^{-6}\text{m}^4$ .
- Q15 A boiler is subjected to an internal steam pressure of  $2\text{N/mm}^2$ . The thickness of boiler plate is 2 cm and permissible tensile stress is  $120\text{N/mm}^2$ . Find out the maximum diameter, when efficiency of longitudinal joint is 90% and that of circumferential joints is 40%.

### SECTIONC

- Q16 A beam AB of length '*l*' simply supported at ends carries a point load '*W*' at a distance '*a*' from the left end. Find deflection under the load and maximum deflection.
- Q17 A spherical vessel of 1.7 m diameter is made from 12 mm thick plate, and it is to be subject to a hydraulic test. Determine the additional volume of water which is necessary to pump into the vessel, when the vessel is initially just filled with water, in order to raise the pressure to the proof pressure of 116 bar ( $1.16 \text{ MN/m}^2$ ). The bulk modulus of water is  $2.9 \text{ GN/m}^2$ . For the material of the vessel,  $E = 200 \text{ GN/m}^2$  and  $\nu = 0.3$ .

Q18 A beam ABCDE is 4.6 m in length and loaded as shown in Fig. 2 below. Draw the S.F.D and B.M.D diagrams for the beam, indicating all major values and find the points of contraflexure, if any.

**FIG.2**

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**