

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC Sem-I June-July Examination 2011

Subject code: X11102

Subject Name: Elements of Mechanical and Structural Engg.

Date: 04/07/11

Total Marks: 70

Time: 10:30am to 1:00pm

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define prime mover. List out the different sources of energy. **07**
(b) Draw Stress-strain curve for mild steel and mark various important points. **07**
Give a brief description of these points.

- Q.2** (a) Explain the operation of Window air conditioning with neat sketch **07**
(b) In water turbine, water is supplied at a rate of 500 liter per second under a head of 20 meter, and it is discharged from the turbine at velocity of 2 meter per second. Determine power developed by the turbine. **07**

OR

- (b) A two stroke internal combustion engine has a stroke length of 140 mm and cylinder bore 90 mm. Its mean effective pressure is 5.4 bar and speed of the engine is 1000 rpm. Determine brake power of the engine. Assume mechanical efficiency as 0.85 **07**

- Q.3** (a) Explain Carnot cycle on p-v and T-s diagram. **07**
(b) Why governing of IC Engine is done? Explain the working of Hit and miss method of governing. **07**

OR

- Q.3** (a) Explain the construction and working of single acting reciprocating pump with neat sketch. **07**
(b) Differentiate the Otto cycle and Diesel cycle on seven aspects. **07**

- Q.4** (a) What is the function of air compressor? Give the classification of air compressor. **07**
(b) A hollow steel tube 3.5 m long has external diameter of 120 mm. In order to determine the internal diameter, the tube was subjected to a tensile load of 400 kN and extension was measured to be 2 mm. If the modulus of elasticity for the tube material is 200 GPa, determine the internal diameter of the tube. **07**

OR

- Q.4** (a) The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component. **07**
(b) A solid steel shaft has to transmit 100 kW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. **07**

- Q.5 (a)** A steel bar 3 m long and 2500 mm^2 in area hangs vertically, which is securely fixed on its lower end. If a weight of 15 kN falls on the collar from a height of 10 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E as 200 GPa. **07**
- (b)** Draw the S.F and B.M diagram for the beam loaded as shown in the figure1. **07**

OR

- Q.5 (a)** For torsion of a circular shaft, derive the equation $T/I_p = \tau/R = C\theta/L$ with usual notations **07**
- (b)** Draw the S.F and B.M diagram for the beam loaded as shown in the figure2. **07**

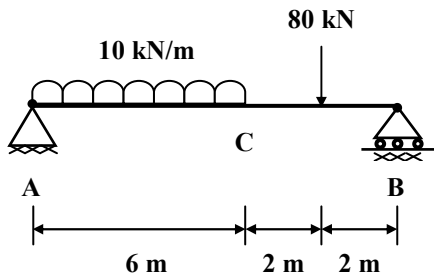


Fig.1

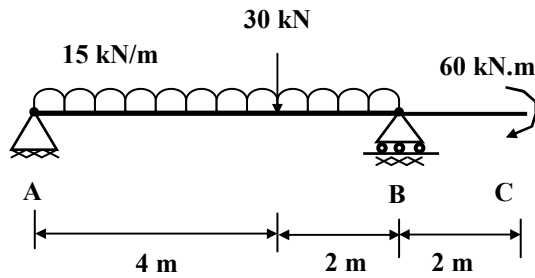


Fig.2