Question Paper 2014

Mechanical Engineering
(Paper II)

1. (*a*) Differentiate between single point and multipoint cutting tool. (15)

(*b*) Find the speed of a shaft which is driven with the help of a belt by an engine running at 300 rpm. The diameter of the engine pulley is 60 cm and that of the shaft is 40 cm. (15)

(*c*) Explain the role of cutting fluid in machining. (15)

(*d*) Explain the following terms : (15)

(*i*) Module

(*ii*) Pressure angle

(*iii*) Addendum

2. (*a*) Define the following terms : (15)

(*i*) Angle of friction

(*ii*) Coefficient of friction

(*iii*) Angle of repose

(*iv*) Poisson's ratio

(*v*) Elastic limit

(*b*) A cantilever beam of 8 m length is subjected to point loads of 10 kN, 15 kN, 25 kN, and 20 k N at distances of 2 m, 4 m, 6 m and 8 m respectively from the fixed end as shown in Figure 1. Draw the shear force diagram and bending moment diagram. (15)
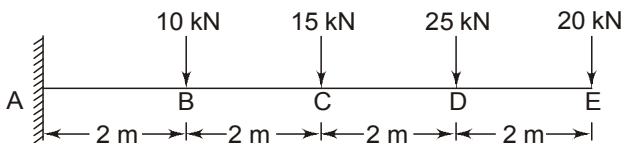

Figure : 1

(*c*) Find the lowest speed at which 250 kW could be transmitted through a shaft of diameter 63 mm. The maximum shear stress is limited to 50 MPa. If length of the shaft is 6 m, find the angle of twist. Take G = 80 GPa. (15)

(*d*) In separate experiments, Young's Modulus and Modulus of Rigidity of a material have been determined as 120 GPa and 50 GPa respectively. Calculate the Poisson's Ratio and Bulk Modulus of the material. (15)

3. (*a*) Compare the working principle of 4-stroke and 2-stroke cycle of internal combustion engines. (15)

(*b*) State and explain the Clausius statement of the second law of themodyynamics. (15)

(*c*) A mixture of gases expands at constant pressure from 1 MPa, 0.03 m^3 to 0.06 m^3 with 90 kJ heat transfer to the system. There is no work other than 'work done' on a piston. Find the change in internal energy of the mixture. (15)

(*d*) The properties of a certain fluid are related as follows: (15)

$$u = 196 + 0.718\ t$$

$$pv = 0\text{-}287\ (t + 273)$$

where u is the specific internal energy (kJ/kg), t is in °C, p is pressure (kN/m^2), and v is specific volume (m^3/kg). For this fluid, find C_u and C_p.

4. (*a*) A tank contains a liquid of specific gravity 0.80. Find the absolute pressure and gauge pressure at a point which is 2m below the, free surface of the liquid. The atmospheric pressure head is equivalent to 760 mm of mercury. (15)

(*b*) Define the following and give one practical example of each : (15)

(*i*) Laminar flow

(*ii*) Turbulent flow

(*iii*) Steady flow

(*iv*) Uniform flow

(*v*) Unsteady flow

(c) What is a centrifugal pump ? Explain the working of a single-stage centrifugal pump with sketches. (15)

(d) Derive the expression: (15)

$$C_d = C_v \times C_c$$

where C_d = co-efficient of discharge

C_v = co-efficient of velocity

C_c = co-efficient of contraction

5. (a) What is the difference between soldering and brazing ? (15)

(b) Describe with the help of neat sketches, TIG welding and MIG welding (15)

(c) What are the common defects of casting ? State their causes and remedies. (15)

(d) What are the advantages of centreless grinding ? (15)

6. (a) Explain the various safety precautions associated with lathe. (15)

(b) Define tool life and name the variables which affect tool life. (15)

(c) What is a syphon ? Where is it used ? Explain its working principle. (15)

(d) Sketch a schematic diagram of a steam power plant and explain the various processes of Rankine cycle on T-S or p-v diagram. (15)