No. of Printed Pages : 5 **BME-024**

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

01261

Term-End Examination
June, 2013

BME-024 : MECHANICAL ENGINEERING DESIGN

Time : 3 Hours *Maximum Marks : 70*

Note : *Attempt **any five** questions . **All** questions carry **equal** marks.Use of calculator and design data handbook is **allowed**. Assume missing data , if any .*

1. (a) Define following design terms and give design equations clearly specifying the parameters : 4x2=8

(i) Beam strength of spur gear tooth

(ii) Miner's rule

(iii) Wahl's correction factor

(iv) Overhauling condition for power screw

(b) Select suitable material for following components with proper justification : 1.5x4=6

(i) Gearbox Casing

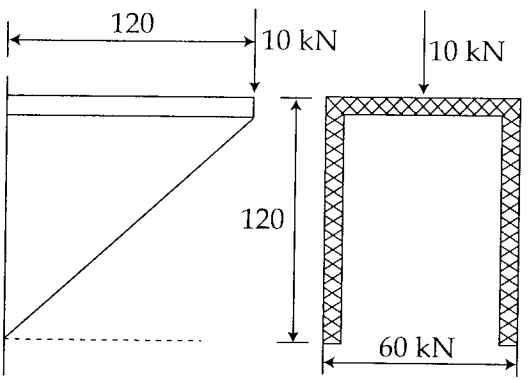
(ii) Pipe joint with flange

(iii) Rigid coupling

(iv) Shaft of a gear box

2. (a) Differentiate longitudinal riveted butt joint and circumferential lap joint (riveted joint) for a boiler. **4**

(b) Design the size of a fillet weld used to join a bracket to a vertical plate as shown in figure. A load of 16 kN acts at a distance of 125 mm from the plane of weld group. The allowable shearing stress of the weld is 45 MPa. **10**



(All dimensions are in mm)

3. Design a protected type flange coupling to transmit 20 kW at 960 rpm from an electric motor to run a compressor. Assume a service factor of 1.5. Shafts , bolts and keys are made of the same material with permissible shear stress of 42 MPa. Allowable crushing stress for bolts and keys is twice the shear stress. Take allowable shear stress in Cast iron flange as 10 MPa. **14**

4. A shaft is supported on two bearings 1000mm apart. A 500 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and drives a pulley directly below it by a belt having maximum tension of 2.5 kN. Another pulley 350 mm diameter is placed 250mm to the left of right hand bearing and is driven by an electric motor and belt drive, which is placed horizontally to the right. Assume $\mu = 0.22$ and angle of contact for both the pulleys is 180°. Design a suitable shaft for the above arrangement , if the shaft is made up of material having permissible tension and shear as 60 MPa and 40 MPa respectively. Assume that same tarques is being transmitted by both pulleys. **14**

5. A screw press is required to exert a force of 60 kN when applied torque is 500 Nm. The unsupported length of the screw is 400 mm. The permissible tensile and compression stresses in the screw are 80 MPa and 100 MPa respectively. and a shear stress of 50 MPa. Consider a permissible bearing pressure of 13 MPa between screw and nut. Assume shear stress of the nut as 15 MPa and coefficient of friction is 0.15. Design screw and nut. **14**

6. (a) A multiple disk clutch , steel on bronze is required to transmit 5 kW at 960 rpm. The inner radius of contact is 50 mm and outer radius of contact is 80 mm. The clutch runs in oil with coefficient of friction 0.1. The permissible pressure between the plates is 0.4 MPa. Calculate number of disks of bronze and steel and axial force required to keep the plates in contact. **9**

(b) Draw a neat sketch of an internal expanding brakes with leading and trailing shoe. Also differentiate leading and trailing shoe. **5**

7. A cast steel pinion (design stress=100 MPa) rotating at 900 rpm is to drive a CI gear (design stress = 60 MPa) at 150 rpm. The teeth are to have 20° full depth involute spur and the maximum power to be transmitted is 25 kW. Determine module no. of teeth and face width for these gears on the basis of strength , dynamic load and wear. **14**

Assume velocity factor as $C_v = 6/6 + V$ (Where V is pitchline velocity in m/sec) and Lewis form factor $'y'_{pinion} = 0.095$ and $'y'_{gear} = 0.135$. The gears are carefully cut with error of action 0.04 mm The value of constant 'C' to be used in Buckingham equation for dynamic tooth load is 300 kN/m

8. (a) Derive stribeck's equation for static capacity of a single row deep groove ball bearing. 7

(b) A shaft running at 900 rpm is supported by bearings 50mm in diameter by 75 mm in length. The bearings operate in still air at a room temperature of 30°C. The oil used has a viscosity of 0.013 kg/m sec at operating temperature of 130°C and the diameteral clearance is 0.05 mm. Determine the permissible load per bearing and the power loss 7