Total No. of Questions : 10]

SEAT No. :

P2850

[Total No. of Pages : 3

[4958]-1031

T.E. (Automobile Engineering)

DESIGN OF MACHINE ELEMENTS

(2012 Pattern) (Semester - I) (316481)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer any five questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain the design procedure of a lever. **[6]**

b) How do you classify shafts? **[4]**

OR

Q2) a) A knuckle joint is to connect two members of 50 mm diameter. If the shear stress in the pin is 20 MPa, what is the axial load and the torque transmitting capacity? **[4]**

b) Differentiate between straight beam and curved beam. **[4]**

c) Define factor of safety. **[2]**

Q3) a) What are the different types of keys? **[2]**

b) A machine slide weighing 3 kN is elevated by a double start Acme threaded screw at the rate of 0.84m/min. If the coefficient of friction is 0.12, calculate the power to drive the slide. The end of the screw carries a thrust collar of 32 mm inside diameter and 58 mm outside diameter. Pitch of the screw thread is 7 mm and outside diameter is 44 mm. Take coefficient of friction as 0.09. **[8]**

OR

P.T.O.

Q4) a) Prove that a square key is strong in shear and compression. **[2]**

b) Derive an expression for torque required to raise the load in power screws. **[8]**

Q5) A cold drawn steel rod of circular section is subjected to a variable bending moment of 565 Nm to 1130 Nm as axial load varies from 4500 to 13500 N. the maximum bending moment occurs at the same extent that of axial load is maximum. Determine the diameter of rod for factor of safety 2. Assume Ultimate stress as 550 MPa, yield point stress as 470 MPa, K_{ft} as 1, A as 1 for bending and 0.7 for axial, B as 0.85 and C as 0.89. **[16]**

OR

Q6) A hot rolled steel rod is subjected to torsional load varying from - 110 Nm to 440 Nm and an axial load varies from 4500 to 13500 N. Assume factor of safety 8, ultimate stress as 550 MPa, yield point stress as 470 MPa, K_{ft} as 1, A as 1 for torsion and 0.7 for axial, B as 1 and C as 0.89. Calculate the diameter of rod. **[16]**

Q7) a) How do you classify bearings. **[6]**

b) The following data is given for full hydrodynamic bearing used for electric motor. Radial load = 1200N, Journal speed = 1440 rpm, journal diameter = 50mm, static load on the bearing = 350 N. The values of surface roughness of the journal and the bearing are 2 and 1 micron respectively. The maximum oil film thickness should be 5 times the sum of surface roughness of the journal and the bearings. Determine length of the bearing, radial clearance, minimum oil film thickness, viscosity of lubricant and flow of lubricant. Select suitable oil for this application assuming the operating temperature as 65°C and bearing pressure as 1 MPa. **[10]**

l/d	S	(h_o/c)	Q/rcnl
1	0.121	0.4	4.33
0.5	0.779	0.6	4.29

OR

Q8) a) Derive petroff's equation for bearing. **[6]**

b) The bearing of a system carries a radial load of 3000N and axial load 1000N. The angular speed of shaft is 60 rad/sec. The bearing has to operate 8 hrs/day. The diameter of shaft is 50 mm. Check the design for safety. Take C = 27070N, C_0 = 20595N, X = 0.56, Y = 1.71 and v = 1. **[10]**

Q9) a) What are the standard systems of gear tooth? **[4]**

b) Design spur gear set to transmit 20 KW at 900rpm of pinion. The transmission ratio is 3. Take 20^o FDI, Z_1 = 18, σ_d = 193.2Mpa, BHN = 250 for pinion and σ_d = 47.1 MPa, BHN = 200 for gear. Check only tangential tooth load. Take Form factor Y = π (0.154-0.912/Z) and C_v = 3.05/3.05 + V. **[14]**

OR

Q10) a) Draw the spur gear nomenclature. **[4]**

b) Design a pair of helical gears are to transmit 15KW at 10,000 rpm of the pinion with PCD 80 mm. The transmission ratio is 3:1 Assume $\alpha = 20^o$FDI, $\beta = 45^o$. σ_d = 193.2MPa, BHN = 250 for pinion and gear. Check only tangential tooth load.

Y = π (0.154-0.912/Z_e), C_v = 5.55/5.55 + $V^{0.5}$. **[14]**