



Printed Pages : 4

TME – 603

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4095

Roll No.

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B. Tech.

(SEM. II) EXAMINATION, 2006-07

MACHINE DESIGN - II

Time : 3 Hours]

[Total Marks : 100

- Note :*
- (1) Attempt all questions.*
 - (2) Assume any missing data suitably.*
 - (3) Use of design data book is permitted.*

1 Attempt any **two** of the following : **10×2=20**

- (a) A pair of 20° full depth straight teeth spur gears is to transmit 25 kW. The pinion rotates at 400 rpm and the velocity ratio is 1:4. The allowable static stresses for gear and pinion materials 100 MPa and 120 MPa respectively. The pinion has 16 teeth and the face width is 12 times the module. Design the gear for static strength.
- (b) A pair of helical gears are used to transmit 18 kW at 8000 rpm of the pinion. The teeth are 20° stub in diametral plane and the helix angle is 45° . The gear and the pinion have a pitch diameter of 320 mm and 80 mm respectively. Both gear and pinion are made of cast steel with a allowable static strength of 100 MPa. Suggest a suitable module and face width for the gear pair and check the strength

of the design in wear. Take modulus of elasticity for cast steel as 2×10^5 MPa. and $\sigma_{es} = 618$ MPa.

- (c) Answer the following in brief:
- (1) Failures in gear tooth and their causes.
 - (2) Advantages and disadvantages of stub gear tooth.

2 Attempt any **two** of the following : **10×2=20**

- (a) A 20° full depth straight teeth bevel gear rotates at 600 rpm and transmits 10 kW power to other gear rotating at 200 rpm. The outer module is 3.5 mm and the number of teeth on pinion is 24. Ratio between the cone distance and face width is 3. Check the safety of design for steady loading if allowable static stress in bending is 105 MPa.
- (b) For a hardened steel worm and gear the center distance is 480 mm. Transmission ratio is 20. Find the axial module and lead angle.
- (c) Answer the following in brief :
- (1) Explain the forces acting on a bevel gear tooth.
 - (2) Importance of heat dissipation in worm and worm gear.

3 Attempt any **two** of the following : **10×2=20**

- (a) A turbine shaft running at 1800 rpm has a diameter of 300 mm. The load on the bearing due to shaft is 180 kN. Determine the length of the bearing if the allowable bearing pressure is 1.6 N/mm^2 . Also find the amount of heat removed by the lubricant per minute if the

bearing temperature is 60°C and viscosity of the oil is 0.02 kg/m-s and the bearing clearance is 0.25 mm .

- (b) A shaft rotating at 1440 rpm is supported by two bearings. The forces acting on each bearing are 6 kN radial load and 3.5 kN axial thrust. If the shaft diameter is 40 mm and the expected life of bearing is 500 hours , suggest a suitable bearing for the application.
- (c) Answer the following in brief:
- (1) Hydrodynamic theory of lubrication
 - (2) Thrust ball bearings.

4 Attempt any **two** of the following : **10×2=20**

- (a) Determine the thickness of a cast iron cylinder wall and the stresses for a 250 mm petrol engine with a maximum gas pressure of 3.0 N/mm^2 . Take the reboring factor for the cylinder wall as 7.5 mm and poisson ratio as 0.25 for cylinder material. Take maximum hoop stress as 45 MPa for the material.
- (b) Find the thickness of a piston crown for a four stroke engine developing power at 1500 rpm . Other relevant data for the engine are given as:
- (1) piston diameter = 87 mm
 - (2) length of the stroke = 96 mm
 - (3) mean effective pressure = 0.7 N/mm^2
 - (4) bsfc = 0.26 kg/kW/h
 - (5) L/r ratio = 4
 - (6) heat conducted through the crown = 10% of heat generated during combustion.

(7) Calorific value of fuel = 42 MJ/kg

Assume that the piston is made of aluminum alloy with thermal conductivity 1600 J/sm² °c/mm and allowed temperature difference is 111 °C.

- (c) Explain the following in brief:
- (1) Effect of piston crown thickness and diameter on heat flow.
 - (2) Lubrication of piston rings.
 - (3) Stresses induced in connecting rods.

5 Answer any **four** of the following in brief : **5×4=20**

- (1) Interference in the gear teeth and its remedy.
- (2) Formative number of teeth in helical gears.
- (3) Why dynamic load is not a problem in worm gears?
- (4) Advantage of taper roller bearing over cylindrical roller bearing.
- (5) Methods of gear manufacturing.
- (6) Herringbone gears.
- (7) Crank-shafts.
