

Code No: 126ED

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, October/November - 2016

DESIGN OF MACHINE MEMBERS – II

(Common to ME, AME)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

- 1.a) Define dynamic load carrying capacity of rolling-contact bearing. [2]
- b) Why is hydrostatic journal bearing called 'self acting' bearing? [3]
- c) What are the functions of compression piston rings? [2]
- d) Why are connecting rods made of I sections? [3]
- e) What are the desirable properties of belt material? [2]
- f) What is polygonal effect in chain drives? [3]
- g) State two important reasons for adopting involute curve for gear tooth profile. [2]
- h) What is virtual or formative bevel gear? [3]
- i) What are the applications of power screws? [2]
- j) What is 'over hauling' of power screw? What is the condition for it? [3]

PART - B

(50 Marks)

2. A ball bearing is subjected to a radial force of 2500 N and an axial force of 1000 N. The dynamic load carrying capacity of the bearing is 7350 N. The values of X and Y factors are 0.56 and 1.6 respectively. The shaft is rotating at 720 rpm. Calculate the life of the bearing. [10]

OR

3. The following data is given for a full hydrodynamic bearing:
Length to diameter ratio = 1; journal speed = 1350 rpm; journal diameter = 100 mm;
Diametral clearance = 100 μm ; external load = 9 kN.
The value of the minimum film thickness variable is 0.3. Find the viscosity of the oil that need to be used. [10]

4. The bore of a cylinder of the four-stroke diesel engine is 120 mm. The maximum gas pressure inside the cylinder is limited to 4 MPa. The cylinder head is made of cast iron and allowable tensile stress is 40 N/mm^2 . Determine the thickness of cylinder head. The studs, which are made of steel, have allowable stress as 50 N/mm^2 . Calculate the number of studs, nominal diameter of studs and pitch of studs. [10]

OR

5. The following data is given for the piston of a four-stroke diesel engine:
Cylinder bore = 100 mm; Maximum gas pressure = 5 MPa; Bearing pressure at small end of connecting rod = 25 MPa; Length of piston pin in bush of small end = 0.45 D; Mean diameter of piston boss = 1.4 × outer diameter of the piston pin; Allowable bending stress for piston pin = 140 N/mm². Calculate:
a) Inner and outer diameters of the piston pin
b) Mean diameter of the piston boss and check the design for bending stresses. [5+5]

6. It is required to design a V-belt drive to connect a 7.5 kW, 1440 rpm induction motor to a fan, running at approximately 480 rpm, for a service of 24 h per day. Space is available for a centre distance of about 1 m. [10]

OR

7. A simple chain No. 10B is used to transmit power from a 1440 rpm electric motor to a line shaft running at 350 rpm. The number of teeth on the driving sprocket wheel is 19. The operation is smooth without any shocks. Calculate
a) The rated power for which the chain drive can be recommended.
b) The tension in the chain for this rated power and
c) The factor of safety for the chain based on the breaking load. [3+3+4]

8. A double-threaded power screw, with ISO metric trapezoidal threads is used to raise a load of 300 kN. The nominal diameter is 100 mm and the pitch is 12 mm. The coefficient of friction at the screw threads is 0.15. Neglecting collar friction, calculate
a) Torque required to raise the load
b) Torque required to lower the load and
c) Efficiency of the screw. [3+4+3]

OR

9. Explain the construction and working of a recirculating ball screw. What are its advantages and application? [10]

10. It is required to design a pair of spur gears with 20^o full-depth involute teeth consisting of a 20 teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 22.5 kW, 1440 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe 410, while the gear is made of grey cast iron FG 200. The factor of safety is 1.5. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. [10]

OR

11. Derive the expression for virtual number of teeth on a helical gear. [10]

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