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Code No: 126ED

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, May - 2017

DESIGN OF MACHINE MEMBERS – II

(Common to AME, ME)

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.

Assume suitable data, if necessary.

PART - A

(25 Marks)

1.a) State any two advantages and disadvantages of deep groove ball bearings. [2]
b) What is meant by conformability and embeddability with respect to sliding contact bearing materials? [3]
c) Name the materials used for piston rings. [2]
d) What is the difference between the centre and overhung crank shafts? [3]
e) What are the desirable properties of the belt materials? [2]
f) How will you designate roller chain? [3]
g) Why is the pinion weaker than the gear made of same material? [2]
h) What kind of contact occurs between worm and worm wheel? How does it differ from other types of gears? [3]
i) What are the applications of square threads? [2]
j) What is self-locking of power screw? State the applications where self-locking is essential. [3]

PART - B

(50 Marks)

2. The following data is given for a 360^0 hydrodynamic bearing:

Journal diameter	= 100 mm	Bearing length	= 100 mm
Radial load	= 50 kN	Journal speed	= 1440 rpm
Radial clearance	= 0.12 mm	Viscosity of lubricant	= 16 cp

Calculate (a) minimum film thickness (b) coefficient of friction and (c) power lost in friction. [10]

OR

3.a) Define dynamic load carrying capacity of rolling contact bearing.
b) The radial load acting on a ball bearing is 2500 N for the first 5 revolutions and reduces to 1500 N for the next ten revolutions. The load variation then repeats itself. The expected life of the bearing is 20 million revolutions. Determine the dynamic load carrying capacity of the bearing. [5+5]

4. Determine the dimensions of small and big end bearings of the connecting rod for a diesel engine with the following data:
Cylinder bore = 100 mm
Maximum gas pressure = 2.45 MPa
(l/d) ratio for piston pin bearing = 1.5
(l/d) ratio for crank pin bearing = 1.4
Allowable bearing pressure for piston pin bearing = 15 MPa
Allowable bearing pressure for crank pin bearing = 10 MPa [10]

OR

5. The following data is given for the piston of a four-stroke diesel engine:
Cylinder head = 250 mm
Material of piston rings = Grey cast iron
Allowable tensile stress = 100 N/mm^2
Allowable radial pressure on cylinder wall = 0.03 MPa.
Thickness of piston head = 42 mm
Number of piston rings = 4
Calculate all the dimensions related to piston and piston rings. [10]

6. It is required to select a flat-belt drive to connect two transmission shafts rotating at 800 and 400 rpm respectively. The centre to centre distance between the shafts is approximately 3 m and the belt drive is open-type. The power transmitted by the belt is 30 kW and the load correction factor is 1.3. The belt should operate at a velocity between 17.8 to 22.9 m/s. The power transmitting capacity of the belt per mm width per ply at 180^0 arc of contact and at a belt velocity of 5.08 m/s is 0.0147 kW. Select preferred pulley diameters and specify the belt. [10]

OR

7. A simple roller chain 10B is used to drive the camshaft of an internal combustion engine. Both shafts rotate at 350 rpm and the centre distance between their axes should be approximately 550 mm. The number of teeth on each sprocket wheel is 19. Calculate:
a) The number of chain links and
b) The correct centre distance. [5+5]

8. It is required to design a pair of spur gears with 20^0 full-depth involute teeth consisting of a 20- teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 25 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 Fe410, while the gear is make of grey cast iron FG 200. The factor of safety is 2. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. [10]

OR

9. A pair of helical gears consists of an 18 teeth pinion meshing with a 45 teeth gear. 7.5 kW power at 2000 rpm is supplied to the pinion through its shaft. The normal module is 6 mm, while the normal pressure angle is 20^0. The helix angle is 23^0. Determine the tangential, radial and axial components of the resultant tooth force between the meshing teeth. [10]

10. A triple threaded power screw, used in a screw jack, has a nominal diameter of 50 mm and a pitch of 8 mm. The threads are square and the length of nut is 48 mm. The screw jack is used to lift a load of 7.5 kN. The coefficient of friction at the threads is 0.12 and the collar friction is negligible. Calculate:
a) The principal shear stress in the screw body
b) The transverse shear stresses in the screw and the nut and
c) The unit bearing pressure
State whether the screw is self locking. [10]

OR

11. The lead screw of a lathe has single-start ISO metric trapezoidal threads of 52 mm nominal diameter and 8 mm pitch. The screw is required to exert an axial force of 2 kN in order to drive the tool carriage during turning operation. The thrust is carried on a collar of 100 mm outer diameter and 60 mm inner diameter. The values of coefficient of friction at the screw threads and the collar are 0.15 and 0.12 respectively. The lead screw rotates at 30 rpm. Calculate
a) The power required to drive the lead screw and
b) The efficiency of the screw. [5+5]

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