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Code No: 156AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, July - 2023

DESIGN OF MACHINE MEMBERS - II

(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Give two applications of hydrodynamic journal bearings.	[2]
b)	State any four desirable properties of a good bearing material.	[3]
c)	Differentiate externally self-aligning and internally self-aligning bearing	[2]
d)	Briefly explain the selection of ball bearings.	[3]
e)	What is the function of connecting rod in IC engines?	[2]
f)	What is the criteria for calculating the thickness of piston head?	[3]
g)	The force acting on the spring is not constant but varies in magnitude with time. Justify the statement.	[2]
h)	With a neat sketch, briefly explain the terminology of helical springs.	[3]
i)	Why is the pinion weaker than the gear made of same material?	[2]
j)	Briefly explain how the beam strength of gear teeth is determined.	[3]

PART – B

(50 Marks)

2. A 100 mm long and 60 mm diameter journal bearing supports a load of 2500 N at 600 r.p.m. If the room temperature is 20^0C, what should be the viscosity of oil to limit the bearing surface temperature to 60^0C? The diametral clearance is 0.06 mm and the energy dissipation coefficient based on projected area of bearing is 210 W/$m^2/^0$C. [10]

OR

3.a) With suitable sketches, explain different types of sliding contact bearings.
b) Briefly discuss about the causes of journal bearing failure. Also mention the remedies for the same. [5+5]

4. Design a self-aligning ball bearing for a radial load of 7000 N and a thrust load of 2100 N. The desired life of the bearing is 160 millions of revolutions at 300 r.p.m. Assume uniform and steady load. [10]

OR

5.a) What are the criteria for selection of ball and roller bearings?
b) Briefly discuss about the design procedure of roller bearings. [5+5]

6. Design a cast iron piston for a single acting four stroke engine for the following data: Cylinder bore = 100 mm; Stroke = 125 mm; Maximum gas pressure = 5 N/mm^2; Indicated mean effective pressure = 0.75 N/mm^2; Mechanical efficiency = 80%; Fuel consumption = 0.15 kg per brake power per hour; Higher calorific value of fuel = 42×10^3 kJ/kg; Speed = 2000 r.p.m. Any other data required for the design may be assumed. [10]

OR

7. A connecting rod is to be designed for a high speed, four stroke I.C. engine. The following data are available. Diameter of piston = 88 mm; Mass of reciprocating parts = 1.6 kg; Length of connecting rod (center to center) = 300 mm; Stroke = 125 mm; R.P.M = 2200 (when developing 50 kW); Possible over speed = 3000 r.p.m; Compression ratio = 6.8:1 (approximately); Probable maximum explosion pressure (assumed shortly after dead center, say at about 3^0) = $3.5N/mm^2$. Draw fully dimensioned drawings of the connecting rod showing the provision for the lubrication. [10]

8. A V- belt drive is required for a 15 kW, 1440 rpm electric motor, which drives a centrifugal pump running at 360 rpm for a service of 24 hours per day. From space considerations, the center distance should be approximately 1 m. Determine the belt specification, number of belts, and correct center distance. [10]

OR

9. A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa. Determine: a) Size of the spring wire, b) Diameters of the spring, c) Number of turns of the spring, and d) Free length of the spring. The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as 80 kN/mm^2. [10]

10. A pair of straight teeth spur gears is to transmit 20 kW when the pinion rotates at 300 r.p.m. The velocity ratio is 1: 3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine: a) module; b) face width; and c) pitch circle diameters of both the pinion and the gear from the standpoint of strength only, taking into consideration the effect of the dynamic loading. (Assume appropriate equations for tooth form factor and velocity factor). [10]

OR

11. A pair of parallel helical gears consists of a 20 teeth pinion and the velocity ratio is 3: 1. The helix angle is 15° and the normal module is 5 mm. Calculate (a) the pitch circle diameters of the pinion and the gear; and (b) the centre distance. [5+5]

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