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Code No: 156AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, August/September - 2021

DESIGN OF MACHINE MEMBERS - II

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

1.a) What are the various terms used in journal bearings analysis and their design? And also discuss the factors that influence most the formation and maintenance of the thick oil film in hydrodynamic bearings. [7+8]

b) Explain the significance bearing modulus.

2. A shaft is supported by two bearings placed 1m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. [15]

3.a) How do you express the life of a bearing? What is an average or median life? Explain.

b) Define the following terms as applied to rolling contact bearings:

(i) Basic static load rating (ii) Static equivalent load (iii) Basic dynamic load rating. [6+9]

4. A ball bearing subjected to a radial load of 4000 N is expected to have a satisfactory life of 12000 hours at 720 r.p.m. with a reliability of 95%. Calculate the dynamic load carrying capacity of the bearing, so that it can be selected from manufacturers catalogue based on 90% reliability. If there are four such bearings each with a reliability of 95% in a system, what is the reliability of the complete system? [15]

5. Design the various components of the valve gear mechanism for a horizontal diesel engine for the following data: Bore = 140 mm; Stroke = 270 mm; Power = 8.25 kW; Speed = 475 r.p.m.; Maximum gas pressure = 3.5 N/mm^2 . The valve opens 33° before outer dead centre and closes 1° after inner dead centre. It opens and closes with constant acceleration and deceleration for each half of the lift. The length of the rocker arm on either side of the fulcrum is 150 mm and the included angle is 160° . The weight of the valve is 3 N. [15]

6.a) What is the function of a connecting rod of an internal combustion engine and explain its design procedure?

b) Why the area of the inlet valve port is made larger than the area of exhaust valve port? Discuss. [7+8]

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7. A semi-elliptical laminated spring is made of 50 mm wide and 3 mm thick plates. The length between the supports is 650 mm and the width of the band is 60 mm. The spring has two full length leaves and five graduated leaves. If the spring carries a central load of 1600 N, find:

a) Maximum stress in full length and graduated leaves for an initial condition of no stress in the leaves.

b) The maximum stress if the initial stress is provided to cause equal stress when loaded. [7+8]

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8. A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth have 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4. [15]

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