Code No: 126VD

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, February/March - 2022
DESIGN OF MACHINE MEMBERS - II
(Mechanical Engineering)

Time: 3 hours
Max. Marks: 75

Answer any five questions
All questions carry equal marks
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1.a) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3.5 kN for 10 percent of time, 2.5 kN for 20 percent of time, 1.5 kN for 30 percent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 percent reliability, calculate dynamic load rating of the ball bearing.
   b) A bearing is required to carry 4500N stationary radial load. The shaft rotates at 1000 rpm and the life desired is 30,000 hrs. The running conditions are steady, no shock loading. Select a suitable bearing. [8+7]

2. Design a journal bearing for a centrifugal pump from the following data: Load on the journal = 20500 N; Speed of the journal = 950 rpm; Type of oil is SAE 10, for which the absolute viscosity at 55 ^{0}C = 0.017 kg / m-s; Ambient temperature of oil = 15.5 ^{0}C; Maximum bearing pressure for the pump = 1.5 N / mm^2 Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10^{0}C. Heat dissipation coefficient = 1232 W/m^2/^{0}C. [15]

3.a) The conical valve of an I.C. engine is 60 mm in diameter and is subjected to a maximum gas pressure of 4.1 N/ mm^2. The safe stress in bending for the valve material is 46 MPa. The valve is made of steel for which k = 0.42. The angle at which the valve disc seat is tapered is 30^0. Determine: i) thickness of the valve head; ii) stem diameter; and iii) maximum lift of the valve.
   b) State the function of the following for an internal combustion engine piston:
   (i) Ribs; (ii) Piston rings; (iii) Piston skirt; and (iv) Piston pin [8+7]

4.a) Design an overhung crank shaft with two main bearings and a flywheel in between them for an I.C. engine, single cylinder 0.25 m × 0.30 m. The flywheel weighs 27 kN. The maximum pressure is 2.1 MPa. The torsional moment is maximum when the crank at 35^0 form the I.D.C, while the pressure is 1.05 MPa. Assume missing data.
   b) What are the design considerations for a piston? [8+7]

5.a) A pulley is driven by a flat belt running at a speed of 600 m/min. The coefficient of friction between the pulley and the belt is 0.3 and the angle of lap is 160^0 If the maximum tension in the belt is 700 N; find the power transmitted by a belt.
   b) A V-belt drive system transmits 100 kW at 475 rpm The belt has a mass of 0.6 kg/m. The maximum permissible tension in the belt is 900 N. The groove angle is 38 ^{0} and the angle of contact is 160^0. Find minimum number of belts and pulley diameter. The coefficient of friction between belt and pulley is 0.2. [7+8]

6.a) What is an advantage of using flexible elements such as belts and chains when compared to gears?

b) Design a 120 cm diameter C.I. belt pulley transmitting 5 HP at 90 rpm. The tension in the belt is not to exceed 150 N per cm width of belt. The pulley has six elliptical arms. Tension on the tight side is double the tension on the slack side, and the centrifugal tension in the belt may be neglected. [7+8]

7.a) Discuss about the different modes of failure of gear teeth and their remedies briefly.

b) Write the expressions for static strength, limiting wear load and dynamic load for helical gears and explain various terms used. [7+8]

8. A cross bar of a planer weighing 10 kN is raised and lowered by means of two square threaded screws of 40 mm outside diameter and 5 mm pitch. The screw is made of steel and nut of phosphor bronze having 42 mm height. A steel collar bearing with 30 mm mean radius takes the axial thrust. The coefficient of friction at the threads and at the collar may be assumed as 0.14 and 0.10 respectively. Find the force required at a radius of 100 mm of a handwheel to raise and lower the load. Find also the shear stress in the nut material and the bearing pressure on the threads. [15]

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