M18002095

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M.TECH 2ND SEMESTER REGULAR EXAMINATIONS, MAY 2018
MECHANICAL DRIVES
Branch: MD, Subject Code:MMDPE2033
Time: 3 Hours
Max Marks : 70

PART-A (10 X 2=20 MARKS)

1. Answer the following questions.

a) Discuss the function of a coupling. Give at least three practical applications. **[CO1]**
b) What is a key ? State its function **[CO1]**
c) Distinguish clearly, giving examples between pin, axle and shaft. **[CO1]**
d) What is nipping in a leaf spring? Discuss its role. **[CO1]**
e) Define 'coefficient of fluctuation of speed' and 'coefficient of steadiness'. **[CO4]**
f) Establish a formula for the frictional torque transmitted by a cone clutch. [**CO2]**
g) Explain the phenomenon of interference in involute gears. What are the conditions to be satisfied in order to avoid interference ? **[CO3]**
h) Explain the following terms used in helical gears : (a) Helix angle; (b) normal pitch.[**CO3]**
i) How the bevel gears are classified ? Explain . [**CO3]**
j) What are the various forces acting on worm and worm gears. **[CO3]**

PART-B (5 X 10=50 MARKS)

Answer any five questions from the following.

2

a) A 45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with a yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2. [**CO1]**
b) Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. **[CO1]**

3

a) A shaft made of mild steel is required to transmit 100 kW at 300 r.p.m. The supported length of the shaft is 3 metres. It carries two pulleys each weighing 1500 N supported at a distance of 1 metre from the ends respectively. Assuming the safe value of stress, determine the diameter of the shaft. **[CO1]**
b) Design and draw a valve spring of a petrol engine for the following operating conditions : Spring load when the valve is open = 400 N Spring load when the valve is closed = 250 N Maximum inside diameter of spring = 25 mm Length of the spring when the valve is open = 40 mm Length of the spring when the valve is closed = 50 mm Maximum permissible shear stress = 400 MPa **[CO1]**

a) A single cylinder double acting steam engine develops 150 kW at a mean speed of 80 r.p.m. The coefficient of fluctuation of energy is 0.1 and the fluctuation of speed is ± 2% of mean speed. If the mean diameter of the flywheel rim is 2 metres and the hub and spokes provide 5 percent of the rotational inertia of the wheel, find the mass of the flywheel and cross-sectional area of the rim. Assume the density of the flywheel material (which is cast iron) as 7200 kg / m^3. **[CO2]**

b) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear. **[CO2]**

5

a) A rope drum of an elevator having 650 mm diameter is fitted with a brake drum of 1 m diameter. The brake drum is provided with four cast iron brake shoes each subtending an angle of 45°. The mass of the elevator when loaded is 2000 kg and moves with a speed of 2.5 m / s. The brake has a sufficient capacity to stop the elevator in 2.75 metres. Assuming the coefficient of friction between the brake drum and shoes as 0.2, find: 1. width of the shoe, if the allowable pressure on the brake shoe is limited to 0.3 N/mm^2; and 2. heat generated in stopping the elevator **.** **[CO2]**

b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **[CO3]**

6

a) Write the procedure for the design of a shaft for bevel gears. **[CO3]**

b) A worm drive transmits 15 kW at 2000 r.p.m. to a machine carriage at 75 r.p.m. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The coefficient of friction between the mating teeth may be taken as 0.10. Calculate : 1. tangential force acting on the worm ; 2. axial thrust and separating force on worm; and 3. efficiency of the worm drive. **[CO3]**

7.

a) Find the maximum shear stress and deflection induced in a helical spring of the following specifications, if it has to absorb 1000 N-m of energy. Mean diameter of spring = 100 mm ; Diameter of steel wire, used for making the spring = 20 mm; Number of coils = 30 ; Modulus of rigidity of steel = 85 kN/mm^2 **.** **[CO4]**

b) Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 r.p.m. The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa. **[CO4]**

8 Write short notes on

a) Protected type flange coupling [CO1]

b) Centrifugal clutch **[CO2]**

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