GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

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Registration No:

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M.TECH 3rd SEMESTER REGULAR EXAMINATIONS, NOV / DEC 2019

MMDPE3013 – MECHANICAL DRIVES

(Machine Design)

Time: 3 Hours **Max Marks : 70**

PART-A **(10 X 2=20 MARKS)**

1. Answer the following questions.

a) Define Coupling with its application.

b) Compare the advantages of hollow shaft over solid shaft?

c) Does the mounting of a flywheel reduce the stress induced in the shafts? Justify

d) State the reasons for adopting involute curves for a gear tooth profile.

e) Represent forces acting on worm and worm gears with suitable diagram.

f) Sketch the center distance in terms of axial lead, lead angle and velocity ratio.

g) Define 'coefficient of fluctuation of energy'.

h) What are splines? List any two applications.

i) State Castigliano's theorem.

j) Enumerate the conditions to be satisfied to avoid interference.

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. **5**

b Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may beassumed as 15 MPa. **5**

3. a A single cylinder, single acting, four stroke oil engine develops 20 kW at 300 r.p.m. The workdone by the gases during the expansion stroke is 2.3 times the workdone on the gases during the compression and the workdone during the suction and exhaust strokes is negligible. The speed is to be maintained within ± 1%. Determine the mass moment of inertia of the flywheel. **5**

b A single disc clutch with both sides of the disc effective is used to transmit 10 kW power at 900 r.p.m. The axial pressure is limited to 0.085 N/mm2. If the external diameter of the friction lining is 1.25 times the internal diameter, find the required dimensions of the friction lining and the axial force exerted by the springs. Assume uniform wear conditions. The coefficient of friction may be taken as 0.3. **5**

4. a A double threaded worm drive is required for power transmission between two shafts having their axes at right angles to each other. The worm has 14½° involute teeth. The centre distance is **5**

approximately 200 mm. If the axial pitch of the worm is 30 mm and lead angle is 23°, find 1. lead; 2. Pitchcircle diameters of worm and worm gear; 3. helix angle of the worm; and 4. efficiency of the drive if the coefficient of friction is 0.05.

	b	Design a speed reducer unit of worm and worm wheel for an input of 1 kW with a transmission ratio of 25. The speed of the worm is 1600 r.p.m. The worm is made of hardened steel and wheel of phosphor bronze for which the material combination factor is 0.7 N/mm2. The static stress for the wheel material is 56 MPa. The worm is made of double start and the centre distance between the axes of the worm and wheel is 120 mm. The tooth form is to be 14½° involute. Check the design for strength, wear and heat dissipation.	**5**
5.a		A pair of bevel gears is required to transmit 11 kW at 500 r.p.m. from the motor shaft to another shaft, the speed reduction being 3 : 1. The shafts are inclined at 60º. The pinion is to have 24 teeth with a pressure angle of 20º and is to be made of cast steel having a static stress of 80 MPa. The gear is to be made of cast iron with a static stress of 55 MPa. The tooth form factor may be taken asy = 0.154 – 0.912/TE, where TE is formative number of teeth. The velocity factor may be taken as 3/(3+v)where v is the pitch line velocity in m/s. The face width may be taken as 1/4 th of the slant height of the pitch cone. The mid-plane of the gear is 100 mm from the left hand bearing and 125 mm from the right hand bearing. The gear shaft is to be made of colled-rolled steel for which the allowable tensile stress may be taken as 80 MPa. Design the gears and the gear shaft.	**5**
	b	Design worm and gear speed reducer to transmit 22 kW at a speed of 1440 r.p.m. The desired velocity ratio is 24 : 1. An efficiency of atleast 85% is desired. Assume that the worm is made of hardened steel and the gear of phosphor bronze.	**5**
6.a		Design a pair of spur gears with stub teeth to transmit 55 kW from a 175 mm pinion running at 2500 r.p.m. to a gear running at 1500 r.p.m. Both the gears are made of steel having B.H.N. 260. Approximate the pitch by means of Lewis equation and then adjust the dimensions to keep within the limits set bythe dynamic load and wear equation.	**5**
	b	Describe, with the help of a neat sketch, a centrifugal clutch and deduce an expression for the total frictional torque transmitted. How the shoes and springs are designed for such a clutch?	**5**
7. a		Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 r.p.m. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa	**5**
	b	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.	**5**
8.		Write short notes on	
	a	Materials used for lining of friction surfaces	**5**
	b	Theories of failure are applicable for shafts	**5**

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