6. (a) Design a pair of straight teeth cast iron bevel gears to transmit 75 kW from a shaft running at 300 RPM to another running at 75 RPM. Check the gears for continuous operations. Assume steady load. Select high grade C.I. material for gear set with $S_0 = 105$ MPa. Also assume 20 degree full depth teeth profile. 16

(b) Discuss in detail, various types of gear teeth failure. 4

7. Design a cast iron piston for a single acting four stroke engine for the following specifications :

Cylinder bore = 100 mm

Stroke = 120 mm

Maximum gas pressure = 5 N/mm^2

Break mean effective pressure = 0.65 N/mm^2

Fuel consumption = 0.227 kg/kW/hr.

Speed = 2200 rev/min.

Assume suitable data. 20

OR

8. Design a worm gear drive to transmit 40 kw from a shaft rotating at 1440 RPM to another at 60 RPM. Select material for worm SAE 3120 steel and norm gear Ph. Bronze SAE65. [Design of gear blank is expected]. 20

Faculty of Engineering & Technology
Seventh Semester B.E. (Mech. Engg.)/P.E. (C.B.S.)
Examination
DESIGN OF MECHANICAL DRIVES

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve Question No. **1 OR** Question No. **2**.

(3) Solve Question No. **3 OR** Question No. **4**.

(4) Solve Question No. **5 OR** Question No. **6**.

(5) Solve Question No. **7 OR** Question No. **8**.

(6) Assume suitable data wherever necessary.

(7) Illustrate your answers wherever necessary with the help of neat sketches.

(8) Use of non programmable calculator is permitted.

(9) Use of design data book is permitted.

1. (a) Design a bush pin type of flexible coupling for connection two shafts of dia 30 mm and 25 mm respectively used to transmit 10 kW power at 1440 RPM. The maximum allowable bearing pressure for rubber bush is 0.35 N/mm^2. 10

(b) A single cylinder double acting steam engine delivers 150 kW at 100 RPM. The maximum fluctuation of energy per revolution is 15% (percent) of energy developed per revolution. The speed variation is limited to 1 percent either way from the mean. The mean diameter of rim is 2.4 meter. Design the flywheel and check the same for maximum induced stress.

10

OR

2. (a) A Journal bearing is proposed for a centrifugal pump. The diameter of the journal is 150 mm and the load on it is 45 kN and it's speed is 900 rev./min. The lubricating oil used is SAE-30. Take oil temperature as 70^0C and room temperature as 30^0C. Complete the design calculation for the bearing.   10

(b) A 70 mm diameter shaft of a machine operates continuously for 8 hrs daily. Because of an overrunning clutch one of the shaft bearings will be subjected to a varying load and speed cycle as follows :

Sr. No.	Fraction of cycle	F_R (N)	F_A (N)	RPM	Service Condition
1	1 / 4	5000	2500	1200	steady
2	1 / 4	3000	2500	600	light shock
3	1 / 2	5500	2500	600	light shock

Select a suitable ball bearing for the life of 25000 hours. The inner ring rotates.   10

3. A line shaft requires 1250 N/m torque at 240 rpm and it is driven by a flat belt and chain drive. An electric motor is running 2400 rpm. Flat belt drive is used in Ist stage i.e. motor shaft to intermediate shaft and chain drive is used in 2nd state i.e. intermediate shaft to output shaft. Design both the drive and show the schematic arrangements of the drive. [Pulley design is not expected]   20

OR

4. (a) A V-Belt drive is used to transmit 15 kW to a compressor the motor speed is 1200 RPM and the compressor pulley runs at 400 RPM. Design the V-Belt drive.   8

(b) Design a suitable wire rope for the elevator in the building 180 meter high for a total load of 30 kN. The desired speed is 5 m/sec; and the full speed must be reached in 8 seconds. Also determine the proportions of shear.   12

5. (a) Derive Lewis equation used to obtain bending strength of gear tooth.   4

(b) A pair of spur gears with 20^0 stub teeth must transmit 60 kW at a pinion speed of 3600 RPM. The velocity ratio is 6 and it is meant for continuous duty. Design the spur gear [design of gear blank is not expected]. Select material for pinion SAE 1045 heat treated S_0 = 245 MPa and for gear cast steel 0.20% carbon heat treated S_0 = 196 MPa.   16

OR