

III B.Tech II Semester Supplementary Examinations, April/May 2005
PRINCIPLES OF MACHINE DESIGN
(Mechatronics)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. A line shaft rotating at 200 rpm is to transmit 20 kW. The allowable shear stress for the material of the shaft is 42 MPa. If the shaft carries a central load of 900 N and is simply supported between bearing 3 meter apart, determine the diameter of the shaft. The maximum tensile or compressive stress is not to exceed 56 MPa.
2. (a) Discuss the effect of keyways on shafts .
(b) A 15kW , 960 rpm motor has a mild steel shaft of 40mm diameter and the extension being 75mm. The permissible shear and crushing stresses for the mild steel key are 56 N/mm^2 and 112 N/mm^2 . Design the keyway in the motor shaft extension. Check the shear strength of the key against the normal strength of the shaft.
3. (a) What are the rolling contact bearings? Discuss their advantages over sliding contact bearings.
(b) Write short note on different types of antifriction bearings.
4. Design a compression coupling for a shaft to transmit 1300 N-m. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are 4. The permissible tensile stress for the bolts material is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3.
5. A steel rod is subjected to a reversed axial load of 180 kN. Find the diameter of the rod for a factor of safety of 2. Neglect column action. The material has an ultimate tensile strength of 1070 MPa and yield strength of 910 MPa. The endurance limit in reversed bending may be assumed to be one-half of the ultimate tensile strength. Other correction factors may be taken as follows:
For axial loading = 0.7; For machined surface = 0.8; For size = 0.85; For stress concentration = 1.0.
6. Design and draw a trunk type of piston for a single cylinder four-stroke diesel engine running at 1000 rpm. Other data available are:
Maximum explosion pressure = 3.5 MN/m^2
Mean effective pressure = 0.65 MN/m^2
Diameter of piston = 150 mm
Stroke length = 200 mm
Connecting rod length = 450 mm
bsfc = 0.27 kg/kWh

7. Power of 60 kW at 730 rpm. from an electric motor is to be transmitted to a compressor shaft at 300 rpm. by V-belt. Approximate larger pulley diameter is 1500 mm. Approximate center distance is 1650 mm. Overload factor is 1.5. Design the V-belts.
8. Design and draw a spur gear drive transmitting 30 kW at 400 rpm to another shaft running approximately at 100 rpm. The load is steady and continuous. The materials for the pinion and gear are cast steel and cast iron respectively. Take module as 10 mm. Also check the design for dynamic load and wear.
