

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

Time: 3 hours

Max Marks: 70

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) Recommend suitable materials for the following components substantiating the reasons.
 - i. Connecting Rod
 - ii. Spur gears
 (b) State the advantage of preferred numbers in design.

2. (a) State the assumptions made in deriving the expression for bending stress in a beam subjected to pure bending moment and explain them.
 (b) Derive a relation for the shear stress developed in a shaft when it is subjected to torsion.

3. (a) Consider taper roller bearing with the following data. The radial reaction on the bearing is 9000N. It also carries a thrust of 5000N. The speed of the shaft is 1000rpm. The outer ring is stationary. Expected average life of bearing is about 25000 hours. The load on the bearing is smooth, the service is 8 hours/day.
 For the bearing assume
 C_o =Basic static load rating = 75710N
 C =Basic dynamic load rating=75450N
 X =Radial load factor = 0.4
 Y =Axial load factor = 1.45
 V =Race Rotation factor=1
 S =Service factor =1.2
 K =Exponent =10/3
 E = axial load/radial load=0.41
 What is the rated 90% life of selected bearing?
 (b) Name a few applications of rolling contact bearings. In what way rolling contact bearings are differed from sliding contact bearings?

4. A hot rolled steel shaft is subjected to a torsional moment that varies from 330Nm clockwise to 110Nm counter clockwise and an applied bending moment at a critical section varies from 440N-m to 220N-m. The shaft is of uniform cross section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m² and a yield strength of 410 MN/m² take the endurance limit as half the ultimate strength, factor of safety 2, size factor of 0.85 and a surface finish factor of 0.62.

5. Design a cast iron piston for a single acting four stroke IC engine for the following specifications. Cylinder bore = 100mm
Stroke length = 120mm
Maximum gas pressure = 6mpa
Break mean effective pressure = 0.7 mpa
Fuel consumption = 0.24 kg/kw/hr
Speed = 220 rpm
6. The connecting rod of a petrol engine is to be designed for the following data.
Piston diameter = 80mm
Stroke = 120mm
Weight of reciprocating parts = 15N
Length of connecting rod = 240mm
Speed (maximum) = 2800 rpm
Explosion pressure corresponding to 10° of crank angle is 3 mps. Factor of safety is 6.
Find the dimensions of the I-section connecting rod. Assume crushing stress for connecting rod material as 330 N/mm^2 and yield strength for bolts as 600 N/mm^2 .
7. Design a V-belt drive to transmit 50kw at 1440 rpm from an electric motor to be textile machine running 24hrs a day. The speed of the machine shaft is 480rpm.
8. Design a spur gear drive to transmit 30 KW at 1440 rpm speed reduction is 2.5. Assume any necessary data.
