Code No: NR321401 **NR**

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

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A shaft is transmitting 100 kW at 180 rpm. If the allowable stress in the material is 60 Mpa, find the suitable diameter for the shaft. The shaft is not to twist more than 1^0 in a length of 3 meters. Take C = 80 Gpa. [16]

2. A cast gear wheel is driven by a pinion and transmits 100 kW at 375 rpm. The gear has 200 machine cut teeth having 20^0 pressure angle and is mounted at the center of a 0.4 m long shaft. The gear weights 2000 N and its pitch circle diameter is 1.2 m. Design the gear shaft. Assume that the axes of the gear and pinion lie in the same horizontal plane. [16]

3. (a) Write the relation between bearing load and Rating life in hrs at a particular speed.
   (b) An 02 series ball bearing is to be selected to carry a radial load of 9 kN and a thrust of 4.5 kN. The average life is to be 5000 hours with inner ring rotation of 900 rpm. What basic load rating must be used in selecting the bearing ? If this bearing is to have a life of 5000 hrs at a reliability of 98 % what is the basic loads ratings under these conditions.
   Assume that the load is steady and continuous, Radial load factor X=0.56, Axial load factor Y=1.43. [8+8]

4. (a) Sketch three different types of couplings and discuss their applications.
   (b) Design a protected type flange coupling to transmit 15 kW at 750 rpm.Write all your assumptions clearly. [8+8]

5. A steel connecting rod having σ_u=1000 MN/m^2, σ_y=900 MN/m^2, is subjected to a completely reversed axial load of 50 kN. Assuming C_L= 0.85, C_D= 0.9, C_s= 0.82 and N= 2, determine the size of the rod. Take K_t=1.5, q=0.6 and neglect any column action. [16]

6. The following projected data refer to a four cylinder petrol engine of a car:

Diameter of the piston	= 68 mm
Stroke length	= 75 mm
Maximum pressure	= 2.5 MN/m^2
Connecting rod length	= 175 mm
Brake power	= 32 kW at 5000 rpm
bsfc	= 0.33 kg/kWh

   Design a suitable piston. [16]

7. A machine is driven at 1440 rpm by means of a flat belt. The pulleys on the motor and machine shafts are of 200 mm and 800 mm diameter, respectively. Design the belt for transmitting 25 kW power. [16]

8. Calculate the power that can be transmitted safely by a pair of spur gears with the data given below. Calculate also the bending stresses induced in the two wheels when the pair transmits this power. [8+7+4=16]

No. of teeth in the pinion	= 20
No. of teeth in the gear	= 80
Module	= 4 mm
Width of teeth	=60 mm
Tooth profile	= 20^0 in volute
Allowable bending strength of the material	
	= 200 MPa, for pinion
	=160 MPa, for gear
Speed of the pinion	= 400 rpm
Service factor	= 0.8
Lewis from factor	= $0.154 - \frac{0.912}{T}$

Velocity factor = $\frac{3}{3+v}$

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