Code No: R05321403 **R05** **Set No. 2**

III B.Tech II Semester Examinations,December 2010
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 semi-elliptical laminated spring is made of no.10.B.W.G.steel 50mm wide. The length between the supports is 66.25cm and the band is 63 mm wide. The spring has two full length and five graduated leaves. A central load of 158 kg is carried.
   (a) Determine the maximum stress in each set of leaves for an initial condition of no stress in the leaves.
   (b) Draw to half or quarter full size the elevation and plan of the spring.
   (c) Determine the maximum stress if the initial stress is provided to cause equal stresses when loaded.
   (d) Determine the deflection in parts (a) and (b) respectively. [4+4+4+4]

2. (a) What are the effects of the additions of the following, in the alloy steel
      i. Chromium
      ii. Tungsten
      iii. Vanadium
      iv. Molybdenum.
   (b) Give the dimensions for the hole and shaft for the following :
      i. A 12mm electric motor sleeve bearing
      ii. A medium force fit on a 200 mm shaft and
      iii. A 50mm sleeve bearing on the elevating mechanism of a road grader.
   [4+12]

3. (a) What is the difference between full journal & partial journal bearing?
   (b) Design a journal bearing for a centrifugal pump from the following data: load on the journal=20,000N; Speed of the journal=900r.p.m.;type of the oils is SAE 10, for which the absolute viscosity at 55^0C=0.017kg/m-s; Ambient temperature of oil=15.5^0C; Maximum bearing pressure for the pump =1.5N/mm^2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10^0C. Heat dissipation coefficient = 1232 W/m^2/^0C. [4+12]

4. A horizontal shaft 1.2m long is supported on bearings at its ends and transmits 2kW at 1440 rpm. The critical section of the shaft which is at the mid span is subjected to a vertical load of 500N, a horizontal load of 400N and an axial load of 200N. Determine the diameter of the shaft for an allowable shear stress. Draw the BM & S.F diagrams. [16]

5. (a) Explain the following methods of reducing stress concentration
   i. Drilled holes
   ii. Using large fillet radius.
   (b) A shaft supported as a simple beam, 0.45 mm long, is made of AISI 3120 steel. With the shaft rotating a steady load of 8000 N is applied midway between the bearings. The surfaces are ground. Indefinite life is desired with a factor of safety of 1.6 based on endurance strength. What should be the minimum diameter of the shaft if there are no surface discontinuities? Endurance limit is 630 MPa. Size factor is 0.85 and machine surface finish factor 0.87. [4+12]

6. (a) Enumerate the different types of riveted joints.
   (b) Two plates 16 mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 90 mm. The rivets are 25 mm in diameter. The permissible stresses are 140 MPa in tension, 80 MPa in shear and 160 MPa in crushing. Find the efficiency of the joint. [8+8]

7. A CI flat pulley transmits 20kW at a sped of 560 rpm. The pulley overhangs the nearest bearing by 200mm. assuming the ratio of the belt tension as 2: determine
   (a) Shaft diameter
   (b) Pulley diameter and
   (c) Cross section of eight arms. [16]

8. Design a pair of helical gears to transmit 30kW power at a speed reduction ratio of 4:1 . The input shaft rotates at 2000rpm. Take helix and normal pressure angles equal to 25 degree and 20degree. Both pinion and gear are made of steel (the following data is given)

Name of the part	Permissible	BHN
Pinion	55MPa	340MPa
Gear	40MPa	300MPa

   The number of teeth on the pinion may be taken 30. [16]

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Code No: R05321403 **R05** **Set No. 4**

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PRINCIPLES OF MACHINE DESIGN
Mechatronics

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

Answer any FIVE Questions
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Name of the part	Permissible	BHN
Pinion	55MPa	340MPa
Gear	40MPa	300MPa

The number of teeth on the pinion may be taken 30. [16]

2. A CI flat pulley transmits 20kW at a sped of 560 rpm. The pulley overhangs the nearest bearing by 200mm. assuming the ratio of the belt tension as 2: determine
   (a) Shaft diameter
   (b) Pulley diameter and
   (c) Cross section of eight arms. [16]

3. (a) Enumerate the different types of riveted joints.
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4. (a) Explain the following methods of reducing stress concentration
      i. Drilled holes
      ii. Using large fillet radius.
   (b) A shaft supported as a simple beam, 0.45 mm long, is made of AISI 3120 steel. With the shaft rotating a steady load of 8000 N is applied midway between the bearings. The surfaces are ground. Indefinite life is desired with a factor of safety of 1.6 based on endurance strength. What should be the minimum diameter of the shaft if there are no surface discontinuities? Endurance limit is 630 MPa. Size factor is 0.85 and machine surface finish factor 0.87. [4+12]

5. A semi-elliptical laminated spring is made of no.10.B.W.G.steel 50mm wide. The length between the supports is 66.25cm and the band is 63 mm wide. The spring has two full length and five graduated leaves. A central load of 158 kg is carried.
   (a) Determine the maximum stress in each set of leaves for an initial condition of no stress in the leaves.

(b) Draw to half or quarter full size the elevation and plan of the spring.

(c) Determine the maximum stress if the initial stress is provided to cause equal stresses when loaded.

(d) Determine the deflection in parts (a) and (b) respectively. [4+4+4+4]

6. A horizontal shaft 1.2m long is supported on bearings at its ends and transmits 2kW at 1440 rpm. The critical section of the shaft which is at the mid span is subjected to a vertical load of 500N, a horizontal load of 400N and an axial load of 200N. Determine the diameter of the shaft for an allowable shear stress. Draw the BM & S.F diagrams. [16]

7. (a) What is the difference between full journal & partial journal bearing?

(b) Design a journal bearing for a centrifugal pump from the following data: load on the journal=20,000N; Speed of the journal=900r.p.m.;type of the oils is SAE 10, for which the absolute viscosity at 55^0C=0.017kg/m-s; Ambient temperature of oil=15.5^0C; Maximum bearing pressure for the pump =1.5N/mm^2. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10^0C. Heat dissipation coefficient = 1232 W/m$^2/^0C$. [4+12]

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i. Chromium
ii. Tungsten
iii. Vanadium
iv. Molybdenum.

(b) Give the dimensions for the hole and shaft for the following :

i. A 12mm electric motor sleeve bearing
ii. A medium force fit on a 200 mm shaft and
iii. A 50mm sleeve bearing on the elevating mechanism of a road grader. [4+12]

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Code No: R05321403 **R05** **Set No. 1**

III B.Tech II Semester Examinations,December 2010
PRINCIPLES OF MACHINE DESIGN
Mechatronics

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5. (a) Explain the following methods of reducing stress concentration

i. Drilled holes

ii. Using large fillet radius.

(b) A shaft supported as a simple beam, 0.45 mm long, is made of AISI 3120 steel. With the shaft rotating a steady load of 8000 N is applied midway between the bearings. The surfaces are ground. Indefinite life is desired with a factor of safety of 1.6 based on endurance strength. What should be the minimum diameter of the shaft if there are no surface discontinuities? Endurance limit is 630 MPa. Size factor is 0.85 and machine surface finish factor 0.87. [4+12]

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III B.Tech II Semester Examinations,December 2010
PRINCIPLES OF MACHINE DESIGN
Mechatronics

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