Code No: RR320305 **RR** **Set No. 2**

III B.Tech II Semester Examinations,December 2010
DESIGN OF MACHINE MEMBERS - II
Common to Mechanical Engineering, Production Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Indicate the influence of operating temperature on rolling bearing materials [2]

   (b) A journal bearing with a diameter of 200 mm and length 150 mm carries a load of 20 kN, when the journal speed is 150 rpm. The diametral clearance ratio is 0.0015. If possible, the bearing is to operate at 35^oC ambient temperature without external cooling with a maximum oil temperature of 90^oC. If external cooling is required, it is to be as little as possible to minimize the required oil flow rate and heat exchanger size.

   i. Will the bearing operate without external cooling?

   ii. If the bearing operates with external cooling, determine the operating oil temperature.

   iii. If the bearing operates with external cooling, determine the amount of oil in kg/min required to carry away the excess heat generated over heat dissipated, when the oil temperature rises from 85^oC to 90^oC, when passing through the bearing.

   [14]

2. It is desired to determine the proportions of a spur gear drive to transmit 8kW from a shaft rotating at 1200rpm to a low speed shaft, with a reduction of 3:1. Assume that the teeth are 20^o full depth involute, with 24 teeth on pinion. The pinion is to be of 40C8 Steel and gear of 30C8 steel. Assume that the starting torque is 130 percent of rated torque. [16]

3. (a) What is the function of a crank shaft? [4x4=16]

   (b) Explain the different stresses induced in crank pin.

   (c) Explain the different stresses induced in crank Web.

   (d) How crank shaft bearings are lubricated?

4. Design a horizontal belt drive for a centrifugal blower, the blower is belt driven at 600 r.p.m. by a 15 kW, 1750 r.p.m. electric motor. The center distance is twice the diameter of the larger pulley. The density of the belt material = 1500 kg/m^3; max allowable stress = 4 MPa;$\mu_1 = 0.5$ (motor pulley); $\mu_2 = 0.4$ (blower pulley); peripheral velocity of the belt = 20 m/s. Determine the following: [16]

   (a) Pulley diameters

   (b) Belt length

(c) Cross-sectional area of the belt

(d) Minimum initial tension for operation without slip

(e) Resultant force in the plane of the blower when operating with an initial tension 50 percent greater than the minimum value.

5. A composite spring has two closed coil helical springs. The outer spring is 15 mm larger than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter 5 mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4 mm. When the spring is subjected to an axial load of 400 N, find [16]

   (a) Compression of each spring,

   (b) Load shared by each spring, and

   (c) Shear stress induced in each spring.
   The modulus of rigidity may be taken as 84 kN/mm^2.

6. Design the connecting rod for a steam engine for the following data
   Length of the rod =840 mm
   Diameter of the crank pin =160 mm
   Diameter of the cross head pin =95 mm
   Maximum load on the rod = 160 kN
   The rod is to be made hollow by boring a central hole of 28 mm diameter through out its length. Calculations the following: [16]

   (a) External diameter of the rod at the center

   (b) Length of the crosshead pin

   (c) Length of the crank pin

   (d) Diameter of the big end bolt

7. (a) Why are square threads preferable to V threads for power transmission? Explain. [4]

   (b) The lead screw of a lathe has square threads of 24 mm outside diameter and 5 mm pitch. In order to drive the tool carriage, the screw exerts an axial pressure of 2.5 kN. Find the efficiency of the screw and the power required to drive the screw, if it is to rotate at 30 rpm. Neglect bearing friction. Assume coefficient of friction of screw threads as 0.12. [12]

8. (a) Briefly explain about [4]
      i. Nominal life and
      ii. average life of the rolling bearings

   (b) Select a suitable deep groove bearing to support a radial load of 4 kN and an axial load of 2 kN with a life of not less than 10,000 hours at 1000 rpm. For the selected bearing find the expected life under the given loads. Select from 64 series [12]

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Code No: RR320305 **RR** **Set No. 4**

III B.Tech II Semester Examinations,December 2010
DESIGN OF MACHINE MEMBERS - II
Common to Mechanical Engineering, Production Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A composite spring has two closed coil helical springs. The outer spring is 15 mm larger than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter 5 mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4 mm. When the spring is subjected to an axial load of 400 N, find [16]
   (a) Compression of each spring,
   (b) Load shared by each spring, and
   (c) Shear stress induced in each spring.
   The modulus of rigidity may be taken as 84 kN/mm^2.

2. Design the connecting rod for a steam engine for the following data
   Length of the rod =840 mm
   Diameter of the crank pin =160 mm
   Diameter of the cross head pin =95 mm
   Maximum load on the rod = 160 kN
   The rod is to be made hollow by boring a central hole of 28 mm diameter through out its length. Calculations the following: [16]
   (a) External diameter of the rod at the center
   (b) Length of the crosshead pin
   (c) Length of the crank pin
   (d) Diameter of the big end bolt

3. Design a horizontal belt drive for a centrifugal blower, the blower is belt driven at 600 r.p.m. by a 15 kW, 1750 r.p.m. electric motor. The center distance is twice the diameter of the larger pulley. The density of the belt material = 1500 kg/m^3; max allowable stress = 4 MPa;μ_1 = 0.5 (motor pulley); μ_2 = 0.4 (blower pulley); peripheral velocity of the belt = 20 m/s. Determine the following: [16]
   (a) Pulley diameters
   (b) Belt length
   (c) Cross-sectional area of the belt
   (d) Minimum initial tension for operation without slip
   (e) Resultant force in the plane of the blower when operating with an initial tension 50 percent greater than the minimum value.

Code No: RR320305 **RR** **Set No. 4**

4. (a) What is the function of a crank shaft? [4x4=16]
   (b) Explain the different stresses induced in crank pin.
   (c) Explain the different stresses induced in crank Web.
   (d) How crank shaft bearings are lubricated?

5. (a) Indicate the influence of operating temperature on rolling bearing materials [2]
   (b) A journal bearing with a diameter of 200 mm and length 150 mm carries a load of 20 kN, when the journal speed is 150 rpm. The diametral clearance ratio is 0.0015. If possible, the bearing is to operate at 35^oC ambient temperature without external cooling with a maximum oil temperature of 90^oC. If external cooling is required, it is to be as little as possible to minimize the required oil flow rate and heat exchanger size.
      i. Will the bearing operate without external cooling?
      ii. If the bearing operates with external cooling, determine the operating oil temperature.
      iii. If the bearing operates with external cooling, determine the amount of oil in kg/min required to carry away the excess heat generated over heat dissipated, when the oil temperature rises from 85^oC to 90^oC, when passing through the bearing.

   [14]

6. (a) Briefly explain about [4]
      i. Nominal life and
      ii. average life of the rolling bearings
   (b) Select a suitable deep groove bearing to support a radial load of 4 kN and an axial load of 2 kN with a life of not less than 10,000 hours at 1000 rpm. For the selected bearing find the expected life under the given loads. Select from 64 series [12]

7. (a) Why are square threads preferable to V threads for power transmission? Explain. [4]
   (b) The lead screw of a lathe has square threads of 24 mm outside diameter and 5 mm pitch. In order to drive the tool carriage, the screw exerts an axial pressure of 2.5 kN. Find the efficiency of the screw and the power required to drive the screw, if it is to rotate at 30 rpm. Neglect bearing friction. Assume coefficient of friction of screw threads as 0.12. [12]

8. It is desired to determine the proportions of a spur gear drive to transmit 8kW from a shaft rotating at 1200rpm to a low speed shaft, with a reduction of 3:1. Assume that the teeth are 20^o full depth involute, with 24 teeth on pinion. The pinion is to be of 40C8 Steel and gear of 30C8 steel. Assume that the starting torque is 130 percent of rated torque. [16]

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Code No: RR320305 **RR** **Set No. 1**

III B.Tech II Semester Examinations,December 2010
DESIGN OF MACHINE MEMBERS - II
Common to Mechanical Engineering, Production Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Briefly explain about [4]
   i. Nominal life and
   ii. average life of the rolling bearings
   (b) Select a suitable deep groove bearing to support a radial load of 4 kN and an axial load of 2 kN with a life of not less than 10,000 hours at 1000 rpm. For the selected bearing find the expected life under the given loads. Select from 64 series [12]

2. (a) Indicate the influence of operating temperature on rolling bearing materials [2]
   (b) A journal bearing with a diameter of 200 mm and length 150 mm carries a load of 20 kN, when the journal speed is 150 rpm. The diametral clearance ratio is 0.0015. If possible, the bearing is to operate at 35^oC ambient temperature without external cooling with a maximum oil temperature of 90^oC. If external cooling is required, it is to be as little as possible to minimize the required oil flow rate and heat exchanger size.
      i. Will the bearing operate without external cooling?
      ii. If the bearing operates with external cooling, determine the operating oil temperature.
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   [14]

3. (a) What is the function of a crank shaft? [4x4=16]
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   (c) Explain the different stresses induced in crank Web.
   (d) How crank shaft bearings are lubricated?

4. A composite spring has two closed coil helical springs. The outer spring is 15 mm larger than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter 5 mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4 mm. When the spring is subjected to an axial load of 400 N, find [16]

(a) Compression of each spring,
(b) Load shared by each spring, and
(c) Shear stress induced in each spring.
The modulus of rigidity may be taken as 84 kN/mm^2.

5. (a) Why are square threads preferable to V threads for power transmission? Explain. [4]
   (b) The lead screw of a lathe has square threads of 24 mm outside diameter and 5 mm pitch. In order to drive the tool carriage, the screw exerts an axial pressure of 2.5 kN. Find the efficiency of the screw and the power required to drive the screw, if it is to rotate at 30 rpm. Neglect bearing friction. Assume coefficient of friction of screw threads as 0.12. [12]

6. Design a horizontal belt drive for a centrifugal blower, the blower is belt driven at 600 r.p.m. by a 15 kW, 1750 r.p.m. electric motor. The center distance is twice the diameter of the larger pulley. The density of the belt material = 1500 kg/m^3; max allowable stress = 4 MPa;μ_1 = 0.5 (motor pulley); μ_2 = 0.4 (blower pulley); peripheral velocity of the belt = 20 m/s. Determine the following: [16]
   (a) Pulley diameters
   (b) Belt length
   (c) Cross-sectional area of the belt
   (d) Minimum initial tension for operation without slip
   (e) Resultant force in the plane of the blower when operating with an initial tension 50 percent greater than the minimum value.

7. It is desired to determine the proportions of a spur gear drive to transmit 8kW from a shaft rotating at 1200rpm to a low speed shaft, with a reduction of 3:1. Assume that the teeth are 20^o full depth involute, with 24 teeth on pinion. The pinion is to be of 40C8 Steel and gear of 30C8 steel. Assume that the starting torque is 130 percent of rated torque. [16]

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   Length of the rod =840 mm
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   The rod is to be made hollow by boring a central hole of 28 mm diameter through out its length. Calculations the following: [16]
   (a) External diameter of the rod at the center
   (b) Length of the crosshead pin
   (c) Length of the crank pin
   (d) Diameter of the big end bolt

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Code No: RR320305 **RR** **Set No. 3**

III B.Tech II Semester Examinations,December 2010
DESIGN OF MACHINE MEMBERS - II
Common to Mechanical Engineering, Production Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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   Length of the rod =840 mm
   Diameter of the crank pin =160 mm
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   Maximum load on the rod = 160 kN
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   (a) External diameter of the rod at the center
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   (c) Length of the crank pin
   (d) Diameter of the big end bolt

3. Design a horizontal belt drive for a centrifugal blower, the blower is belt driven at 600 r.p.m. by a 15 kW, 1750 r.p.m. electric motor. The center distance is twice the diameter of the larger pulley. The density of the belt material = 1500 kg/m^3; max allowable stress = 4 MPa;μ_1 = 0.5 (motor pulley); μ_2 = 0.4 (blower pulley); peripheral velocity of the belt = 20 m/s. Determine the following: [16]
   (a) Pulley diameters
   (b) Belt length
   (c) Cross-sectional area of the belt
   (d) Minimum initial tension for operation without slip
   (e) Resultant force in the plane of the blower when operating with an initial tension 50 percent greater than the minimum value.

4. (a) Briefly explain about [4]
      i. Nominal life and
      ii. average life of the rolling bearings

(b) Select a suitable deep groove bearing to support a radial load of 4 kN and an axial load of 2 kN with a life of not less than 10,000 hours at 1000 rpm. For the selected bearing find the expected life under the given loads. Select from 64 series [12]

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Code No: RR320305 **RR** **Set No. 3**

[14]

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