Code No: RR310305 | RR | SET-1

B. Tech III Year I Semester Examinations, December 2011
DESIGN OF MACHINE MEMBERS – I
(MECHANICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

1.a) Discuss the factors which govern the selection of a material for a machine component.
b) State the advantages and drawbacks of cast iron as an engineering material. [8+8]

2.a) Explain the maximum shear stress theory and Distortion energy theory.
b) A shaft is designed based on maximum energy of distortion with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of 310 MPa. It is subjected to an axial load of 40 kN. Determine the maximum torque capacity. Diameter of shaft is 20 mm. [8+8]

3.a) Explain the basic difference between failure due to static load and that due to fatigue.
b) A simply supported shaft of 50 mm diameter and 0.5 m long is subjected at its mid-section, to a load that varies cyclically from 2P to 4P. Determine the value of P from the following:
Yield strength = 450 MPa
Endurance limit = 350 MPa
Factor of safety = 2
Size correction factor = 0.85
Surface correction factor = 0.90. [8+8]

4.a) Explain various failures of riveted joints with neat sketches.
b) Two mild steel tie bars for a bridge structure are to be joined by a double cover butt joint. The thickness of the tie bar is 20 mm and carries a tensile load of 45 tonnes. Design the joint if the allowable stresses are:
$f_t = 90$ N/mm^2
$f_s = 75$ N/mm^2
$f_c = 150$N/mm^2. [8+8]

5. Design and sketch a cotter joint to join two rods safely to resist 60 kN that acts along the coincidence axis of the rods connected by the cotter. The material of the cotter and the rods will permit the following safe stresses:
Tension = 60 N/mm^2
Crushing = 100 N/mm^2
Shear = 50 N/mm^2. [16]

6.a) What is the function of a key. Draw variety of keys commonly used in practice and explain.

b) It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. 15 kW power at 720 rpm is transmitted from the shaft to the gear. The key is made of steel (f_y=460 N/mm^2) and the factor of safety is 3. The yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key. [8+8]

7. A steel shaft 1.25 m long between bearings carries 1250 N pulley at its mid point. The pulley is keyed to the shaft and receives 20 kW at 200 rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600 mm. Compute the shaft diameter. [16]

8. Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The following permissible stresses may be taken.
Allowable shear stress for shaft, bolt and key material = 40 MPa
Allowable crushing stress for bolt and key = 80 MPa
Allowable shear stress for cast iron = 80 MPa. [16]

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Code No: RR310305 | RR | SET-2

B. Tech III Year I Semester Examinations, December 2011
DESIGN OF MACHINE MEMBERS – I
(MECHANICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

1.a) Explain the basic difference between failure due to static load and that due to fatigue.

b) A simply supported shaft of 50 mm diameter and 0.5 m long is subjected at its mid-section, to a load that varies cyclically from 2P to 4P. Determine the value of P from the following:
Yield strength = 450 MPa
Endurance limit = 350 MPa
Factor of safety = 2
Size correction factor = 0.85
Surface correction factor = 0.90. [8+8]

2.a) Explain various failures of riveted joints with neat sketches.

b) Two mild steel tie bars for a bridge structure are to be joined by a double cover butt joint. The thickness of the tie bar is 20 mm and carries a tensile load of 45 tonnes. Design the joint if the allowable stresses are:
f_t = 90 N/mm^2
f_s = 75 N/mm^2
f_c = 150N/mm^2. [8+8]

3. Design and sketch a cotter joint to join two rods safely to resist 60 kN that acts along the coincidence axis of the rods connected by the cotter. The material of the cotter and the rods will permit the following safe stresses:
Tension = 60 N/mm^2
Crushing = 100 N/mm^2
Shear = 50 N/mm^2. [16]

4.a) What is the function of a key. Draw variety of keys commonly used in practice and explain.

b) It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. 15 kW power at 720 rpm is transmitted from the shaft to the gear. The key is made of steel (f_y=460 N/mm^2) and the factor of safety is 3. The yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key. [8+8]

5. A steel shaft 1.25 m long between bearings carries 1250 N pulley at its mid point. The pulley is keyed to the shaft and receives 20 kW at 200 rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600 mm. Compute the shaft diameter. [16]

6. Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The following permissible stresses may be taken.
Allowable shear stress for shaft, bolt and key material = 40 MPa
Allowable crushing stress for bolt and key = 80 MPa
Allowable shear stress for cast iron = 80 MPa. [16]

7.a) Discuss the factors which govern the selection of a material for a machine component.
b) State the advantages and drawbacks of cast iron as an engineering material. [8+8]

8.a) Explain the maximum shear stress theory and Distortion energy theory.
b) A shaft is designed based on maximum energy of distortion with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of 310 MPa. It is subjected to an axial load of 40 kN. Determine the maximum torque capacity. Diameter of shaft is 20 mm. [8+8]

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Code No: RR310305 | RR | SET-3

B. Tech III Year I Semester Examinations, December 2011
DESIGN OF MACHINE MEMBERS – I
(MECHANICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

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1. Design and sketch a cotter joint to join two rods safely to resist 60 kN that acts along the coincidence axis of the rods connected by the cotter. The material of the cotter and the rods will permit the following safe stresses:
   Tension = 60 N/mm^2
   Crushing = 100 N/mm^2
   Shear = 50 N/mm^2. [16]

2.a) What is the function of a key. Draw variety of keys commonly used in practice and explain.
b) It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. 15 kW power at 720 rpm is transmitted from the shaft to the gear. The key is made of steel (f_y=460 N/mm^2) and the factor of safety is 3. The yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key. [8+8]

3. A steel shaft 1.25 m long between bearings carries 1250 N pulley at its mid point. The pulley is keyed to the shaft and receives 20 kW at 200 rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600 mm. Compute the shaft diameter. [16]

4. Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The following permissible stresses may be taken.
   Allowable shear stress for shaft, bolt and key material = 40 MPa
   Allowable crushing stress for bolt and key = 80 MPa
   Allowable shear stress for cast iron = 80 MPa. [16]

5.a) Discuss the factors which govern the selection of a material for a machine component.
b) State the advantages and drawbacks of cast iron as an engineering material. [8+8]

6.a) Explain the maximum shear stress theory and Distortion energy theory.
b) A shaft is designed based on maximum energy of distortion with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of 310 MPa. It is subjected to an axial load of 40 kN. Determine the maximum torque capacity. Diameter of shaft is 20 mm. [8+8]

7.a) Explain the basic difference between failure due to static load and that due to fatigue.

b) A simply supported shaft of 50 mm diameter and 0.5 m long is subjected at its mid-section, to a load that varies cyclically from 2P to 4P. Determine the value of P from the following:
Yield strength = 450 MPa
Endurance limit = 350 MPa
Factor of safety = 2
Size correction factor = 0.85
Surface correction factor = 0.90. [8+8]

8.a) Explain various failures of riveted joints with neat sketches.

b) Two mild steel tie bars for a bridge structure are to be joined by a double cover butt joint. The thickness of the tie bar is 20 mm and carries a tensile load of 45 tonnes. Design the joint if the allowable stresses are:
$f_t = 90\ N/mm^2$
$f_s = 75\ N/mm^2$
$f_c = 150 N/mm^2$. [8+8]

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Code No: RR310305 | RR | SET-4

B. Tech III Year I Semester Examinations, December 2011
DESIGN OF MACHINE MEMBERS – I
(MECHANICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

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1. A steel shaft 1.25 m long between bearings carries 1250 N pulley at its mid point. The pulley is keyed to the shaft and receives 20 kW at 200 rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600 mm. Compute the shaft diameter. [16]

2. Design a cast iron protective type flange coupling to transmit 15 kW at 900 rpm from an electric motor to a compressor. The following permissible stresses may be taken.
   Allowable shear stress for shaft, bolt and key material = 40 MPa
   Allowable crushing stress for bolt and key = 80 MPa
   Allowable shear stress for cast iron = 80 MPa. [16]

3.a) Discuss the factors which govern the selection of a material for a machine component.
   b) State the advantages and drawbacks of cast iron as an engineering material. [8+8]

4.a) Explain the maximum shear stress theory and Distortion energy theory.
   b) A shaft is designed based on maximum energy of distortion with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of 310 MPa. It is subjected to an axial load of 40 kN. Determine the maximum torque capacity. Diameter of shaft is 20 mm. [8+8]

5.a) Explain the basic difference between failure due to static load and that due to fatigue.
   b) A simply supported shaft of 50 mm diameter and 0.5 m long is subjected at its mid-section, to a load that varies cyclically from 2P to 4P. Determine the value of P from the following:
   Yield strength = 450 MPa
   Endurance limit = 350 MPa
   Factor of safety = 2
   Size correction factor = 0.85
   Surface correction factor = 0.90. [8+8]

6.a) Explain various failures of riveted joints with neat sketches.

b) Two mild steel tie bars for a bridge structure are to be joined by a double cover butt joint. The thickness of the tie bar is 20 mm and carries a tensile load of 45 tonnes. Design the joint if the allowable stresses are:

$f_t = 90$ N/mm^2

$f_s = 75$ N/mm^2

$f_c = 150$N/mm^2. [8+8]

7. Design and sketch a cotter joint to join two rods safely to resist 60 kN that acts along the coincidence axis of the rods connected by the cotter. The material of the cotter and the rods will permit the following safe stresses:

Tension = 60 N/mm^2

Crushing = 100 N/mm^2

Shear = 50 N/mm^2. [16]

8.a) What is the function of a key. Draw variety of keys commonly used in practice and explain.

b) It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. 15 kW power at 720 rpm is transmitted from the shaft to the gear. The key is made of steel (f_y=460 N/mm^2) and the factor of safety is 3. The yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key. [8+8]

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