R17 Regulation

Subject code: 1P5CA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech III Year I Semester Supplementary Examinations, February 2021

DESIGN OF MACHINE MEMBERS – I

(MECHANICAL ENGINEERING)

Maximum Marks: 70

Date: 17.02.2021 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks **(10x2M=20 Marks)**

1 Discuss in detail the factors which govern the selection of material for a machinecomponent?

2 Explain preferred numbers and their significance.

3 Explain notch sensitivity.

4 Differentiate the theoretical stress concentration factor and fatigue stress concentration factor.

5 What is the effect of gasket on the resultant load on the bolt, in a bolted joint?

6 What do you mean by efficiency of riveted joint?

7 What are the applications of a cotter joint?

8 Draw any two keys with neat sketches.

9 Define equivalent torsional moment and equivalent bending moment for a shaft.

10 What is the importance of muff couplings?

Part-B

Answer All the following questions. **(10MX 5=50Marks)**

1 a) What are the general considerations in the design of machine elements?[3M]

b) A cast iron pulley transmits 10 KW at 400 rpm. The diameter of the pulley is1.2meter and it has four straight arms of elliptical cross section. In which the majoraxis is twice the minor axis. Determine the dimensions of the arm if the allowablebending stress is 15 MPa. [7M]

OR

2 a) Explain the manufacturing considerations in design? [5M]

b) How do you understand failure? Explain the various theories of failure? [5M]

3 a) Describe the modified Goodman's line theory for designing the components subjected to fatigue loads? [4M]

b) A thin wall cylindrical pressure vessel of mean diameter of 60 cm is subjected to internal pressure varying from 0 to 40 MPa. Find the required thickness of the pressure vessel based on yield point of 400 MPa, endurance limit of 22MPa, and a factor of safety of 3. Use Soderberg criterion of failure. [6M]

OR

14 a) Explain the types of fluctuating stresses. [4M]
b) A hot rolled steel shaft is subjected to a torsional moment that varies from +350 Nm to -115 Nm and an applied bending moment at a critical section varies from 445Nm to 225 Nm. The shaft is of uniform cross section. Determine the required shaft diameter. The material has an ultimate strength of 550 MPa and yield strength of410 MPa. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62. (Using Goodman's Line). [6M]

15 a) What do you understand by the term welded joint? How it differs from the riveted joint? [4M]
b) A plate 90 mm wide and 15 mm thick is welded on to another plate by a single transverse weld and a double parallel fillet weld. Find the length of the parallel fillet weld if the plate is loaded by a static tensile load. Take the allowable tensile stress of the plates as 70 N/mm^2 and weld shear stress as 55 N/mm^2. [6M]

OR

16 a) Classify the rivet heads according to Indian Standard Specification.[3M]
b) A triple riveted butt joint with unequal cover plates is used to connect two 16 mm plates of a boiler. Design the joint completely if allowable stresses are 50, 40 and 80 N/mm^2 in tension, shear and crushing respectively for the plate and rivet material. Find also the efficiency of the joint. [7M]

17 a) Differentiate between a cotter and a key? Why a single taper is provide in cotter and not on both sides? [4M]
b) Two steel rods are to be connected by means of a sleeve, and two steel cotters. The rods are subjected to a tensile load of 40 kN. Design the joint, using the permissible stress in tension as 60 MPa, and in shear as 50 MPa, and in crushing as 120 MPa. [6M]

OR

18 Design a sleeve and cotter joint to resist a tensile load of 60 KN. All parts of the joint are made of the same material with the following allowable stresses.
$\sigma_t = 60$ MPa , $\tau = 70$ MPa and $\sigma_c = 125$ MPa. [10M]

19 Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. [10M]

OR

20 Design a bushed-pin type flexible coupling for connecting a motor shaft to a pump shaft, with the following service conditions:
Power to be transmitted = 40kW
Speed of the motor shaft = 1000rpm
Diameter of motor and pump shafts = 45mm
Bearing pressure on the rubber bush = 0.7N/mm^2
Allowable stress in the pins = 60MPa. [10M]

[10M]

R18 Regulation

Subject code: 2P5CA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech V Semester Regular Examinations, February 2021

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Maximum Marks: 70

Date: 17.02.2021 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks **(10x2M=20 Marks)**

1 A 50 mm diameter shaft is made to rotate in the bush. The tolerances for both shaft and bush are 0.050 mm. Determine the dimension of the shaft and bush to give a maximum clearance of 0.075 mm with the hole basis system.

2 Define factor of safety.

3 What is fatigue stress concentration factor?

4 What is endurance limit?

5 Mention the applications of riveted joints.

6 Define bolt of uniform strength.

7 List the uses of jib and cotter joints.

8 What is a socket and Spigot joint?

9 What are the different types of loads on a shaft?

10 Mention the different types of couplings.

Part-B

Answer All the following questions. **(10M X 5=50Marks)**

11 What are the general considerations in machine design? Give an account of the various mechanical properties of engineering materials. (10M)

OR

12 (a) List the various theories of failure for a member subjected to biaxial stress. (3M)

(b) A steel shaft 30 mm in diameter and 1.15 m long held rigidly at one end, has a hand wheel 500 mm in diameter keyed to the other end. The modulus of rigidity of steel is 80 GPa (i) What is the load applied tangentially to the rim of the wheel produces a torsional shear of 70 MPa? (ii) How many degrees will the wheel turn when this load is applied? (7M)

13 A machine component is subjected to a flexural stress which fluctuates between + 400 MN/m^2 and - 200 MN/m^2. Determine the value of minimum ultimate strength according to (i) Gerber relation (ii) Modified Goodman relation and (iii) Soderberg relation. Take yield strength = 0.55 times ultimate strength and Endurance strength = 0.5 times ultimate strength. Factor of safety as 1.5.(10M)

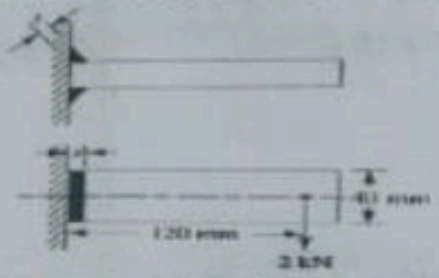
OR

14 A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material, an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9. (10M)

15 Find the efficiency of the following riveted joints: (i) Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm (ii) Double riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm, if Permissible tensile stress in rivets = 90 MPa, Permissible crushing stress in rivets = 180 MPa. (10M)

OR

16 A welded joint shown in figure below, is subjected to an eccentric load of 2 KN. Find the size of weld, if the maximum shear stress in the weld is 25 MPa.(10M)



17 Design a knuckle joint to transmit 150 KN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.(10M)

OR

18 A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick, made of steel with yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2.(10M)

19 Design a cast iron protective type flange coupling to transmit 15 KW at 900 rpm, from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: Shear stress for shaft, bolt and key material is 40MPa. Crushing stress for bolt and key=80 MPa, Shear stress for cast iron=8 MPa. Draw a neat sketch of the coupling. (10M)

OR

20 A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 KN. Another pulley 400 mm diameter, is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.(10M)

Code No: 135AG

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, May/June - 2019

DESIGN OF MACHINE MEMBERS - I

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.
Illustrate your answers with NEAT sketches wherever necessary.

PART - A

(25 Marks)

1.a) What is the difference between tolerance and allowance? [2]
b) Explain the terms 'Strain Energy', 'Resilience', and 'Modulus of resilience'. [3]
c) Distinguish between endurance limit and endurance strength. [2]
d) Explain the difference between the Gerber curve and Solderberg and Goodman lines. [3]
e) Distinguish between caulking and fullering. [2]
f) Define the following terms related to screw fastenings: Stress area, Major diameter, Minor diameter. [3]
g) Differentiate between a cotter and a key. [2]
h) What are the differences between Sunk key, Woodruff key, and Kennedy key? [3]
i) What is meant by strength basics design of shaft? [2]
j) Mention three practical applications of couplings. [3]

PART - B

(50 Marks)

2.a) List and explain briefly the manufacturing consideration in design.
b) The dimensions of the mating parts, according to basic hole system, are given as: Hole: 25.00 mm and 25.02 mm; Shaft: 24.97 mm 24.95 mm. Find the hole tolerance, shaft tolerance and allowance. [5+5]

OR

3.a) Write a note on Preferred Numbers and their use.
b) A machine part is statically loaded and has an yield point strength of 350 N / mm^2. If the principal stresses are 70 N / mm^2 and 35 N / mm^2, both tensile, find the factor of safety for the following cases: (i) Maximum normal stress theory, (ii) Maximum shear stress theory. [5+5]

4.a) What are the factors that affect the endurance limit of a machine part?
b) A shaft of diameter 'd' is subjected to a torque varying between 900 N -m and 1800 N-m. Assuming a factor of safety of 2 and stress concentration factor of 1.2, find the diameter of the shaft. Take σ_u = 650 N / mm^2 and σ_y = 480 N / mm^2, Size factor B = 0.85, and Surface finish factor = C = 0.5. [5+5]

OR

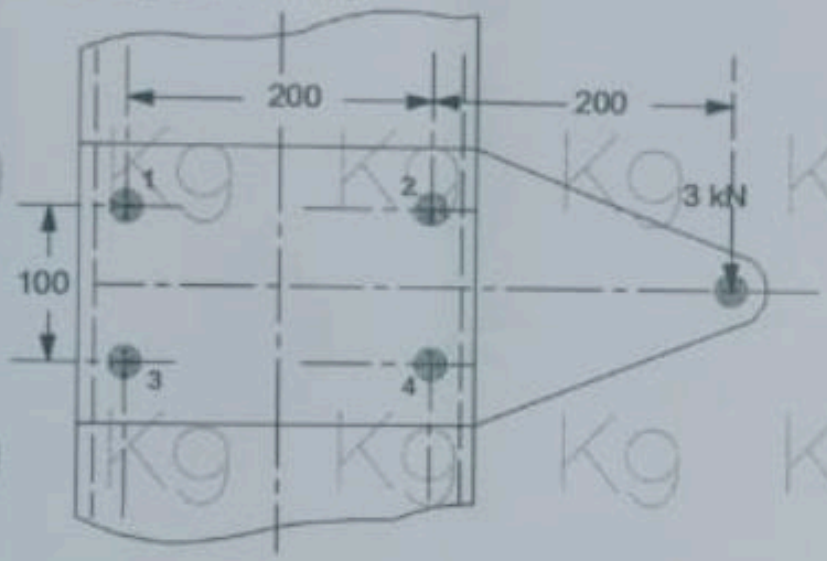
a) What is fluctuating stress? Draw a stress – time curve for fluctuating stress.

b) Determine the diameter of a circular rod made of ductile material with fatigue strength of 280 MPa and yield strength of 350 MPa. The member is subjected to a varying axial load from 700 kN to – 300kN. Assume K_f = 1.8 and Factor of Safety = 2. [5+5]

Prove that the plane, where maximum shear stress is induced, is inclined at 67.5^0 to the leg dimension in the case of transverse fillet weld of equal legs. Also find the expression for maximum shear stress. [10]

OR

A steel plate is subjected to a force of 3 kN, and fixed to a vertical channel by means of four identical bolts, as shown in figure. The bolts are made of plain carbon steel 45C8 (S_{yt} = 380 N / mm^2), and the factor of safety is 2. Find the diameter of the shank. (All dimensions in the figure are in *mm*). [10]



Draw a neat labeled sketch of Knuckle joint. List its various elements and state their functions. [10]

OR

.a) Select a key for a 100 mm diameter shaft transmitting 750 kW at 1000 rpm. The allowable shear stress in the key is 100 MPa, and the allowable compressive (crushing) stress is 200 MPa.

b) What is a Cotter? Why taper is provided on cotter? How much taper is provided? [5+5]

0. Design a Clamp coupling for mild steel shaft transmitting 40 kW at 100 rpm. Coefficient of friction between the muff and the shaft surface is 0.3 and number of bolts connecting the two halves are six. The allowable shear stress in the shaft and coupling bolts are 40MPa and 70MPa respectively. [10]

OR

1.a) Describe any two types of shaft couplings, with sketches.

b) A solid shaft is to transmit 1000 kW at 120 rpm. Find the shaft diameter if the permissible shear stress is 80 N / mm^2. If the shaft is made hollow, find the inside and outside diameters when the ratio of inside to outside diameters is 0.5. [5+5]

—ooOoo—