



R20 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

Subject code: 3P5CB

B.Tech V Semester Regular Examinations, January 2023

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Maximum Marks: 70

Date: 09.01.2023 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 Why distortion energy theory is preferred over other theories of failure in ductile materials?
- 2 Compare hardness and toughness.
- 3 What is fatigue strength?
- 4 How will you reduce stress concentration in shafts with keyway?
- 5 List the different ways in which a riveted joints will fail.
- 6 How do you obtain bolt of uniform strength?
- 7 Mention the types and uses of keys.
- 8 Write the applications of spigot and socket joint.
- 9 Give the functional differences between rigid and flexible couplings.
- 10 What is torsional rigidity?

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 Explain the manufacturing considerations in design. Add a note on fits and tolerances. [10]

OR

- 12 A rotating shaft carries 18 kN pulley at the centre of a 0.75 m simply supported span. The average torque is 230 N m. Assume the torque range to be 10 % of the average torque. The material has yield point of 770 MPa and the endurance limit of 450 MPa. Determine the required diameter of the shaft based i) Maximum stress theory and ii) Distortion energy theory. Stress concentration factor may be taken as 1.5 and a factor of safety 2. [10]

- 13 a) Explain Goodman failure theory. [3]
b) A circular bar of 0.5 m length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size factor of 0.85, surface finish factor of 0.9. The material properties of bar is given by: Ultimate strength of 650 MPa, Yield strength of 500 MPa and Endurance strength of 350 MPa. [7]

OR

- 14 A leaf spring in an automobile is subjected to cyclical stresses. The average stress = 150 MPa, variable stress = 50 MPa, Ultimate stress = 630 MPa, Yield point stress = 350 MPa and endurance limit = 150 MPa. Estimate under what factor of safety the spring is working, by Goodman and Soderberg formulae. [10]

- 15 A circular steel bar 50 mm diameter and 200 mm long is welded perpendicularly to a steel plate to form a cantilever to be loaded with 5 kN at the free end. Determine the size of the weld, assuming the allowable stress in the weld as 100 MPa. [10]

OR

- 16 A flanged bearing is fastened to a frame by means of four bolts spaced equally on 500 mm bolt circle. The diameter of bearing flange is 650 mm and a load of 400 kN acts at a distance 250 mm from the frame. Determine the size of the bolts, taking safe tensile stress as 60 MPa for the material of the bolts. [10]

- 17 A square key is to be used to key a gear to a 35 mm diameter shaft. The length of the hub of gear is 60 mm. Both shaft and key are made of same material, having an allowable shear stress of 55 MPa. What are the minimum dimensions of the key, if 400 Nm of torque is to be transmitted? [10]

OR

- 18 Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses are 55 N/mm² in tension, 40 N/mm² in shear and 70 N/mm² in crushing. Draw a neat sketch of the joint. [10]

- 19 Explain about the design of Bushed pin flexible coupling with a neat sketch. [10]

OR

- 20 A line shaft is to transmit 30 kW at 160 rpm. It is driven by a motor placed directly under it by means of a belt running on a 1 m diameter pulley keyed to the end of the shaft. The tension in the tight side of the belt is 2.5 times that of the slack side and the centre of pulley overhangs 150 mm beyond the centre line of the end bearing. Determine the diameter of the shaft, if the allowable shear stress is 56 MPa and the pulley weighs 1600 N. [10]