



R18 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

Subject code: 2P5CA

B.Tech V Semester Regular/Supplementary Examinations, December 2021

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Maximum Marks: 70

Date: 30.12.2021 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 Name the various theories of failure.
- 2 What are preferred numbers? Give their significance.
- 3 What are the causes of stress concentration?
- 4 Draw S-N Curve and mark all salient points.
- 5 List advantages of bolted joints over welded joints.
- 6 Draw a sketch of triple riveted double cover butt joint with zig-zag type of riveting.
- 7 Mention the different types of keys.
- 8 What are the applications of cotter joints?
- 9 Draw a split coupling.
- 10 Compare the rigidity of a hollow and solid shaft.

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 Find the diameter of shaft required to transmit 60 kW at 150 rpm, if the maximum torque is likely to exceed the mean torque by 25% for a maximum permissible torsional shear stress of 60 N/mm². Also find the angle of twist for a length of 2.5 meters. Take $G = 80 \text{ GPa}$. (10M)

OR

- 12 Considering fits and tolerances, give the dimensions for the hole and shaft for the following:
 - (a) a 12 mm electric motor sleeve bearing
 - (b) a medium force fit on a 200mm shaft
 - (c) a 50 mm sleeve bearing on the elevating mechanism of a road grader. (10M)
- 13 A leaf spring in an automobile is subjected to cyclic 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. (10M)

OR

- 14 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 445 Nm 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 of 410 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). (10M)

- 15 Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2 . Assume joint efficiency as 75%, allowable tensile stress in the plate is 90 MPa, compressive stress is 140 MPa and shear stress in the rivet is 56 MPa. (10M)

OR

- 16 The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2 . It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder 300 mm. Find the size of the bolt so that the stress in the bolts is not to exceed 100 MPa. (10M)

- 17 It is required to design a knuckle joint to connect circular shafts subjected to an axial force of 50 kN. The rods are coaxial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. The allowable tensile, compressive and shear stress in the rod and pin material is limited to 80 MPa, 100 MPa and 40MPa respectively. (10M)

OR

- 18 Design a cotter joint to support a load varying from 30 KN in compression to 30 KN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa; shear stress = 35 MPa and crushing shear stress = 90M Pa. (10M)

- 19 Design and draw a muff coupling to transmit 50Kw at 120 rpm. The shaft and key are made of the same material having allowable shear stress of 30 N/mm^2 and compression stress of 80 N/mm^2 . The flange is made of cast Iron with allowable shear stress of 15 N/mm^2 . (10M)

OR

- 20 A propeller shaft is made-up by joining together number of solid shafts. The joint is made by forging the ends of the shaft in the form of a flange, and bolting the flanges together by means of 8 bolts. If the shaft transmits 60 kW at 120 rpm, determine the size of the shaft, the diameter and thickness of the flange and the diameter and pitch circle diameter of bolts. Permissible stresses are $\tau = 35 \text{ MPa}$; $\sigma_c = 45 \text{ MPa}$. (10M)