R18 Regulation *Subject code:* 2P5CA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Supplementary Examinations, June 2022

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Maximum Marks: 70 Date:02.07.2022 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 What are the different phases of design?
2 Why preferred numbers are important in design?
3 How will you reduce stress concentration in shaft with keyway?
4 What information do you obtain from Soderberg diagram?
5 Explain briefly the advantages and limitations of bolted joints?
6 Distinguish the riveted and the welded joints?
7 Explain the applications of spigot and socket joint?
8 Write notes on Types of keys?
9 What is the importance of split muff couplings?
10 Why BIS designation is important in design of shafts?

Part-B

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

11 a) Explain the manufacturing considerations in design? [5]
b) How do you understand failure? Explain the various theories of failure? [5]

OR

12 a) What are alloy steels? Discuss the effect of adding different alloying elements in steel? [3]
b) At a critical section in a shaft, the following stresses are induced: Bending stress=50 Mpa Torsional shear stress =30 Mpa Determine the factor of safety, according to (i) maximum normal stress theory, (ii) maximum shear stress theory, (iii) maximum principal strain theory. The proportional limit in a simple tension test is found to be 200 Mpa. Take Poisson's ratio as 0.3. [7]

13 a) Explain the effect of the following factors on the type of fatigue failure i) Type of material ii) Surface treatment iii) Range of imposed stress [4]
b)) A leaf spring in an automobile is subjected to cyclical stresses. The average stress = 250 MPa, variable stress = 60 MPa, Ultimate stress = 730 MPa, Yield point stress = 450 MPa and endurance limit = 160 MPa. Estimate under what factor of safety the spring is working, by Goodman and Soderberg formulae. [6]

OR

14 a) A torsion bar spring has a solid round 20 mm diameter section which blends smoothly at each end with a larger splined section. It is subjected to a completely reversed nominal torsional stress of 310 MN/m^2 . Stress concentration is negligible, and the surfaces are machined. Estimate the fatigue life corresponding to each of the following materials : i) steel= 350 HB, ii) Cast iron Su= 450 MN/m^2
b) Describe the estimation of endurance strength? [7+3]

15 a) How is the allowable stress calculated for a riveted joint subjected to alternating type of load?
b) The end of a receiver, cylindrical in shape is closed by a lap joint using rivets. The maximum pressure in the receiver is 2MPa. The axial length of the receiver is limited to 3m while its storing capacity is $3m^3$. Design the suitable lap joint giving a neat sketch. The permissible stresses in shear and crushing of rivets may be taken as 40 MPa and 80 MPa. The permissible tensile stress for the plate material is 90 MPa. [4+6]

OR

16 a) How is the strength of transverse fillet weld evaluated?
b) The cylinder head of a steam engine is subjected to a steam pressure of 0.8N/mm2 . It is held in position by means of 14 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder 400mm. Find the size of the bolt so that the stress in the bolts is not to exceed 200 MPa. [4+6]

17 a) Design and draw a socket and spigot cotter joint two connect two mild steel rods for a pull of 40 KN. The maximum permissible stresses are 65 MPa in tension, 50 MPa in shear and 80 MPa in crushing.
b) Explain the importance of applications of Keys and Knuckle joints? [7+3]

OR

18 a) Design a cotter joint to support a load varying from 40KN in compression to 40KN 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 = 60MPa; shear stress = 45MPa and crushing shear stress = 80MPa
b) Explain the importance and applications of jib and cotter joints? [7+3]

19 a) 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 10 bolts. If the shaft transmits 80kW at 220 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 τ = 45MPa ; σc = 55MPa
b) Explain the various types of stresses are induced in shafts? [7+3]

OR

20 a) Distinguish between rigid and flexible couplings?
b) Design and draw a muff coupling to transmit 60 KW at 220 rpm. The shaft and key are made of the same material having allowable shear stress of 40N/mm2 and compressor stress of $90N/mm^2$. The flange is made, as cast Iron with allowable shear stress is $25N/mm^2$

[3+7]