Code No: R1622034 **R16** SET - 1

II B. Tech II Semester Supplementary Examinations, April - 2021
DESIGN OF MACHINE MEMBERS-I
(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) What are preferred numbers? (2M)
   b) What is mean by stress concentration factor and notch sensitivity? (2M)
   c) Explain about strength of transverse fillet welded joints? (3M)
   d) Explain about square thread and acme thread? (3M)
   e) Define a key? What are the types of keys? (2M)
   f) Define the terms used in compression springs? (2M)

PART -B

2. a) Define principal stresses and principal planes? (7M)
   b) A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200MPa, find the maximum value of this torque without causing yielding of the shaft according to 1. the maximum principal stress; 2. The maximum shear stress; and 3. the maximum distortion strain energy theory of yielding. (7M)

3. a) Explain about Soderberg method for combination of stresses? (7M)
   b) A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4 P. 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 700MPa, a yield stress of 500MPa, endurance limit of 330MPa 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. (7M)

4. a) A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400MPa in tension, 320MPa in shear and 640MPa in crushing, find the minimum force per pitch which will rupture the joint.If the above joint is subjected to a load such that the factor of safety is 4, find out the actual stresses developed in the plates and the rivets. (7M)
   b) A plate 100 mm wide and 10 mm thick is to be welded with another plate by means of transverse welds at the ends. If the plates are subjected to a load of 70kN, find the size of weld for static as well as fatigue load. The permissible tensile stress should not exceed 70MPa. (7M)
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5. a) Write the design procedure for knuckle joint with neat sketch? (7M)

   b) Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70kN. The ultimate strength of the material of the rod against tearing is 420MPa. The ultimate tensile and shearing strength of the pin material are 510MPa and 396MPa respectively. (7M)
   Determine the tie rod section and pin section. Take factor of safety = 6.

6. a) Write the design procedure for sleeve or muff coupling? (7M)

   b) Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250r.p.m. The allowable shear stress in the shaft is 40MPa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30MPa. (7M)

7. a) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350MPa and modulus of rigidity 84kN/mm^2, find the axial load which the spring can carry and the deflection per active turn. (7M)

   b) A concentric spring for an aircraft engine valve is to exert a maximum force of 5000 N under an axial deflection of 40 mm. Both the springs have same free length, same solid length and are subjected to equal maximum shear stress of 850MPa. If the spring index for both the springs is 6, find (i) the load shared by each spring, (ii) the main dimensions of both the springs, and (iii) the number of active coils in each spring. (7M)
   Assume G = 80kN/mm^2 and diametral clearance to be equal to the difference between the wire diameters