II B. Tech II Semester Supplementary Examinations, November - 2019
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) Define principal stresses and principal planes? (2M)
b) Define fatigue and endurance limit? (2M)
c) Explain about methods of riveting? (3M)
d) What are the elements of a welding symbol? (2M)
e) Explain about general procedure in machine design? (3M)
f) Define the terms used in compression springs? (2M)

PART -B

2. a) State and explain theories of failures under static load? (7M)
b) The load on a bolt consists of an axial pull of 10kN together with a transverse shear force of 5kN. Find the diameter of bolt required according to (7M)
i). Maximum principal stress theory; ii). Maximum shear stress theory;
iii). Maximum principal strain theory; iv). Maximum strain energy theory;
and v). Maximum distortion energy theory.
Take permissible tensile stress at elastic limit = 100MPa and
Poisson’s ratio = 0.3.

3. a) Write short notes on the influence of various factors of the endurance limit of a ductile material? (7M)
b) A 50 mm diameter shaft is made from carbon steel having ultimate tensile strength of 630MPa. It is subjected to a torque which fluctuates between 2000 N-m to – 800 Nm. Using Soderberg method, calculate the factor of safety. Assume suitable values for any other data needed. (7M)

4. a) What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint. (7M)
b) Obtain an expression for total load on a bolt in a bolted joint with gasket. (7M)

5. a) Design a knuckle joint to transmit 150kN. The design stresses may be taken as 75MPa in tension, 60MPa in shear and 150MPa in compression. (7M)
b) A mild steel shaft transmits 20 kW at 200r.p.m. It carries a central load of 900N and is simply supported between the bearings 2.5metres apart. Determine the size of the shaft, if the allowable shear stress is 42MPa and the maximum tensile or compressive stress is not to exceed 56MPa. What size of the shaft will be required, if it is subjected to gradually applied loads? (7M)
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6. a) Write the design procedure for flange coupling with neat sketch? (7M)

   b) Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960r.p.m. The overall torque is 20 percent more than mean torque. (7M)
   The material properties are as follows:
   (i) The allowable shear and crushing stress for shaft and key material is 40MPa and 80MPa respectively.
   (ii) The allowable shear stress for cast iron is 15MPa.
   (iii) The allowable bearing pressure for rubber bush is 0.8 N/mm^2.
   (iv) The material of the pin is same as that of shaft and key

7. a) Explain about composite springs? (7M)

   b) A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770MPa and endurance stress in shear is 350MPa, find: i). Size of the spring wire, ii). Diameters of the spring, iii). Number of turns of the spring, and 4. Free length of the spring. (7M)
   The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as $80kN/mm^2$.