Registration No :

Total Number of Pages : 02   **B.Tech**
PME5I001

5ᵗʰ Semester Regular / Back Examination 2018-19
DESIGN OF MACHINE ELEMENTS
BRANCH : MECH
Time : 3 Hours
Max Marks : 100
Q.CODE : E317
Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1   Short Answer Type Questions (Answer All-10)   (2 x 10)
   a)   What are the fits and tolerances?
   b)   What is the difference between caulking and fullering?
   c)   What is notch sensitivity?
   d)   Name the three commonly used types of cotter joints to connect two coaxial rods.
   e)   What are the advantages of welded joints over riveted joints
   f)   What is endurance limit?
   g)   What is distortion energy of failure criterion?
   h)   The ball bearings are usually made from which materials?
   i)   What is the material used for rivets?
   j)   What is nipping in a leaf spring?

Part- II

Q2   Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 x 8)
   a)   Classify the engineering materials.
   b)   What are the factors affecting the endurance limit.
   c)   Explain the Flexible coupling
   d)   Write short note on maximum shear stress theory *verses* maximum strain energy theory.
   e)   Derive the Goodman's formulae.
   f)   What is an eccentric riveted joint? Explain the method adopted for designing such a joint?
   g)   Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses :
            σ_t = 60 MPa ; τ = 70 MPa ; and σ_c = 125 MPa.
   h)   Describe, with the help of neat sketches, the types of various shaft couplings mentioning the uses of each type.
   i)   Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.
   j)   How are the keys classified? Draw neat sketches of different types of keys and state their applications.
   k)   What are the different theories of failure of static loading, explain
   l)   Prove that in a spring, using two concentric coil springs made of same material, having same length and compressed equally by an axial load, the loads shared by the two springs are directly proportional to the square of the diameters of the wires of the two springs.

Part-III
Long Answer Type Questions (Answer Any Two out of Four)

Q3 A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N-m **(16)** clockwise to 110 N-m counterclockwise and an applied bending moment at a critical section varies from 440 N-m to – 220 N-m. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m^2 and yield strength of 410 MN/m^2. 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.

Q4 Design a double riveted butt joint with two cover plates for the longitudinal seam of a **(16)** 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 90 MPa ; compressive stress 140 MPa ; and shear stress in the rivet 56 MPa.

Q5 Design a cast iron protective type flange coupling to transmit 15 kW at 900 **(16)** r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used :
Shear stress for shaft, bolt and key material = 40 MPa
Crushing stress for bolt and key = 80 MPa
Shear stress for cast iron = 8 MPa
Draw a neat sketch of the coupling.

Q6 a) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. **(8)** The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2. Also calculate the maximum shear stress induced.

b) A ball bearing subjected to a radial load of 5 kN is expected to have a life of 8000 **(8)** hours at 1450 r.p.m. with a reliability of 99%. Calculate the dynamic load capacity of the bearing so that it can be selected from the manufacturer's catalogue based on a reliability of 90%.