Registration No : | | | | | | | | | | |

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

PME5I001

5th Semester Regular / Back Examination 2019-20

DESIGN OF MACHINE ELEMENTS

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : HRB234

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 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Write the advantages of standardization.

b) What do you mean by Preferred Numbers? Give example of series R5.

c) Differentiate between chain and zigzag riveting.

d) Define stress concentration and notch sensitivity.

e) Differentiate shaft basis and hole basis system. Which one is better and why?

f) Show failure of cotter in bending.

g) Write the advantages and disadvantages of woodruff key.

h) Define bearing characteristic number and bearing modulus and write its significance

i) State the differences between hydrostatic and hydrodynamic bearings.

j) Define surge and nipping in springs.

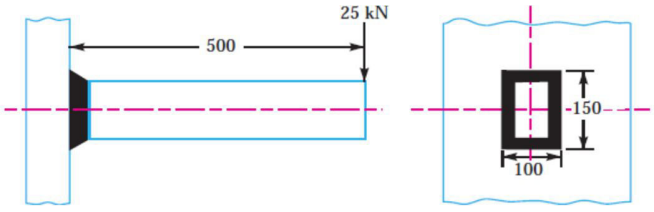
Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Which factors should be taken into consideration during selection of materials for machine elements? Briefly explain.

b) Calculate the tolerances, fundamental deviations and limits of sizes for the shaft designated as *40 H 8 / f 7.*

c) A rectangular cross-section bar is welded to a support by means of fillet welds as shown in Fig. Determine the size of the welds, if the permissible shear stress in the weld is limited to 75 MPa.



d) Write the purposes of shaft coupling. Differentiate rigid coupling and flexible coupling.

e) What is an eccentric riveted joint? Explain the method adopted for designing such a joint.

f) What do you mean by factor of safety? List the important factors that inflence the magnitude of factor of safety.

g) How are the keys classified? Draw neat sketches of different types of keys and state their applications.

h) A hollow shaft has greater strength and stiffness than solid shaft of equal weight. Explain.

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

j) In a journal bearing the load on the journal is 3kN, diameter 50 mm, length 75 mm, speed 1600 rpm, diametral clearance 0.001 mm, ambient temperature 15.50C and oil film temperature is 600C. Determine the heat generated and dissipated. Absolute viscosity of oil is 0.014kg/ms.

k) A 45mm diameter shaft is made of steel with a yield strength of 400MPa. A parallel key of size 14mm wide and 9mm thick made of steel with a yield strength of 340 MPa is to be used. Find the required length of key if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2.

l) Describe the design procedure of a knuckle joint with neat sketch.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 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/mm2. 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. **(16)**

Q4 A shaft is supported on bearings A and B, 800 mm between centres. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3:1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa. **(16)**

Q5 Design a helical spring for a spring loaded safety valve (Rams bottom safety valve) for the following conditions: **(16)**
Diameter of valve seat = 65 mm ; Operating pressure = 0.7N/mm^2;
Maximum pressure when the valve blows off freely = 0.75N/mm^2;
Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm^2 = 3.5 mm ;
Maximum allowable stress = 550 MPa ;
Modulus of rigidity = 84 kN/mm^2;
Spring index = 6.
Draw a neat sketch of the free spring showing the main dimensions.

Q6 Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa. **(16)**