



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023**

Semester : Semester V - 2020

Course Code : MEC3004

Course Name : Sem V - MEC3004 - Design of Machine Elements-I

Program : B.Tech. Mechanical Engineering

Date : 16-JAN-2023

Time : 9.30AM - 12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE FIVE QUESTIONS

5 X 2 = 10M

1. Define Factor of safety.

(CO1) [Knowledge]

2. What are Reversed stresses?

(CO2) [Knowledge]

3. What are the Types of welding?

(CO3) [Knowledge]

4. Strength of welded joint is affected by?

(CO4) [Knowledge]

5. What is Fatigue failure? Explain with example

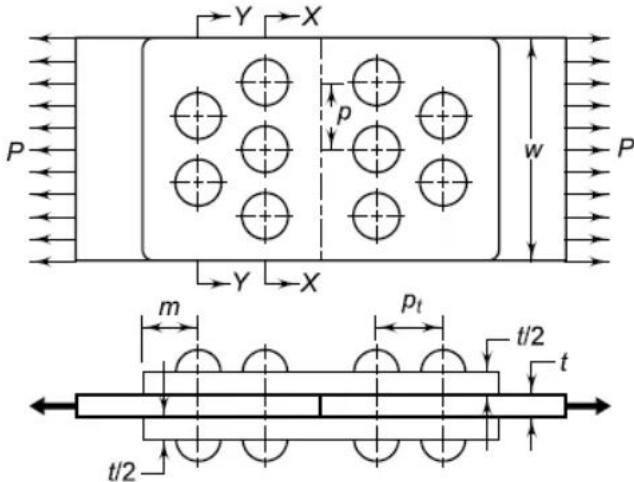
(CO5) [Knowledge]

PART B

ANSWER ALL THE SIX QUESTIONS

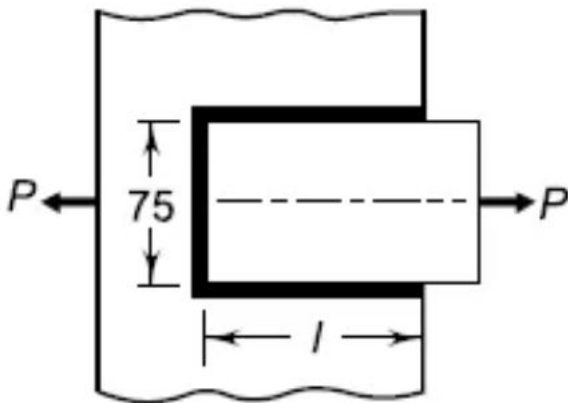
6 X 10 = 60M

6. Two flat plates subjected to a tensile force P are connected together by means of double-strap butt joint as shown in Fig. The force P is 250 kN and the width of the plate w is 200 mm. The rivets and plates are made of the same steel and the permissible stresses in tension, compression and shear are 70, 100 and 60 MPa respectively. Calculate:
- the diameter of the rivets;
 - the thickness of the plates;
 - the dimensions of the seam, viz., p , p_t and m



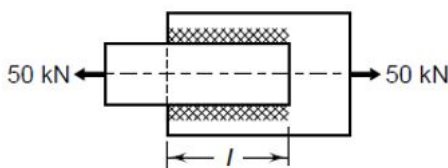
(CO3) [Comprehension]

7. A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 and 50 N/mm² respectively. Determine the required length of each parallel fillet weld.



(CO4) [Comprehension]

8. A steel plate 100 mm wide and 10 mm thick welded to another steel plate by means of double parallel fillet welds. Find the length of welds.



(CO4) [Comprehension]

9. A machine shaft running at 600 rpm is supported on bearings 750 mm apart. 15 kW of power is supplied to the shaft through 450 mm pulley located at 250 mm to the right of right bearing. The power is transmitted from the shaft through a 200 mm gear located 250 mm to the left of left bearing. The belt drive is vertical. The pulley weights 800 N to provide some flywheel effect. The angle of contact of the belt is 157° and co-efficient of friction between belt and pulley is 0.4. The gear is in mesh with another gear located directly above the shaft. The material of the shaft is steel 45C8 ($S_{ut} = 600$ MPa and $S_{yt} = 380$ MPa). The factors k_b and k_t of ASME code are 2.0 and 1.5 respectively to account for shock and fatigue in operating conditions. Determine the shaft diameter using the ASME code. Take pressure angle 20° . Take resultant bending moment as 635kN-mm.

(CO3) [Comprehension]

10. Discuss the types of keys available to use while 2 shafts are to be connected to transmit torque.

(CO5) [Comprehension]

11. It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. The shaft is transmitting 15 kW power at 720 rpm to the gear. The key is made of steel 50C4 of yield strength 460 MPa and the factor of safety is 3. For key material, the yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key if the breadth of key is 25% of diameter of shaft.

(CO5) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

2 X 15 = 30M

12. The BeLAZ 75710 is one of the largest vehicles in the world. A coupling need to be used to connect 2 shafts transmitting a huge power of 45kW from its transmission shaft to differential. Identify the type of coupling that can be used and determine its key parameters. Given yield strength of shaft material is 380 MPa, Factor of safety is 2.5 and the speed of shaft is 1440 RPM.

(CO3,CO4) [Application]

13. Two carts are to be pulled or pushed together by a joint which uses a Cotter. The total load they need to carry is 100kN. The permissible stresses are 120 MPa, 160 MPa & 80 MPa in tensile, compressive and shear respectively. Identify the type of joint, why the particular joint is used? and model the same.

(CO3,CO5) [Application]
