Seat No.	

SQ - 92

Total No. of Pages : 4

T.Y.B.Tech. (Semester – V)
Examination – May 2025
Mechanical Engineering
MACHINE DESIGN – I
Sub. Code : 80756/66244/81010

Day and Date : Thursday 08/05/2025 **Total Marks : 70**

Time : 02.30 pm to 05.00 pm.

Instruction : 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non programmable calculator is permitted.
4) Draw neat diagrams wherever necessary

Q. 1. Solve Any two **[6]**

a) What are the important theories of elastic failures?

b) Summarize the guidelines for the selection of quantitative values of factor of safety.

c) Suggest suitable materials for the following parts 1. Diesel engine crankshaft; 2. Roller bearings; 3. High pressure steam pipes **[6]**

Q. 2. a) Two rods are connected by means of a knuckle joint. The axial force P acting on the rods is 25 kN. The rods and the pin are made of plain carbon steel 45C8 (Syt = 380 N/mm2) and the factor of safety is 2.5. The yield strength in shear is 57.7% of the yield strength in tension. **[6]**

Calculate: (i) the diameter of the rods, and (ii) the diameter of the pin.

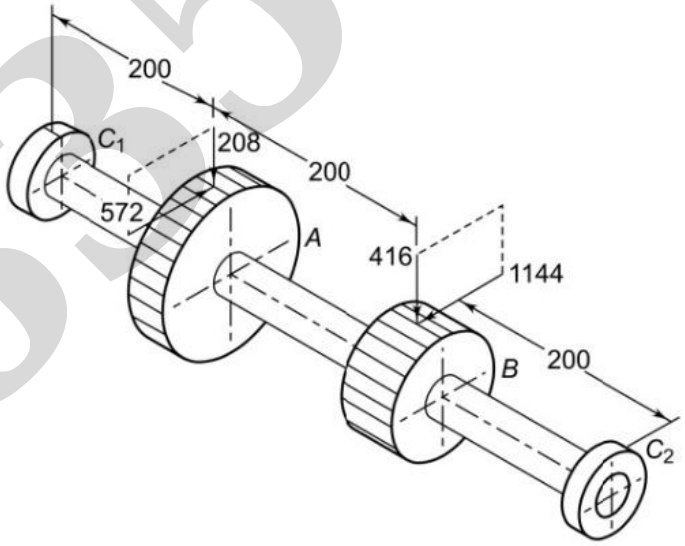
b) What are the advantages of square threads over trapezoidal threads? **[5]**

OR

b) What is self locking property of threads and where it is necessary?

Q. 3. a) What types of stresses are induced in shafts? How the shaft is designed based on rigidity? **[4]**

b) An intermediate shaft of a gearbox, supporting two spur gears A and B and mounted between two bearings C1 and C2, is shown in Fig. The pitch circle diameters of gears A and B are 500 and 250 mm respectively. The shaft is made of alloy steel 20MnCr5. (Sut = 620 and Syt = 480 N/mm2). The factors kb and kt of the ASME code are 2 and 1.5 respectively. The gears are keyed to the shaft. Determine the shaft diameter using the ASME code. **[8]**

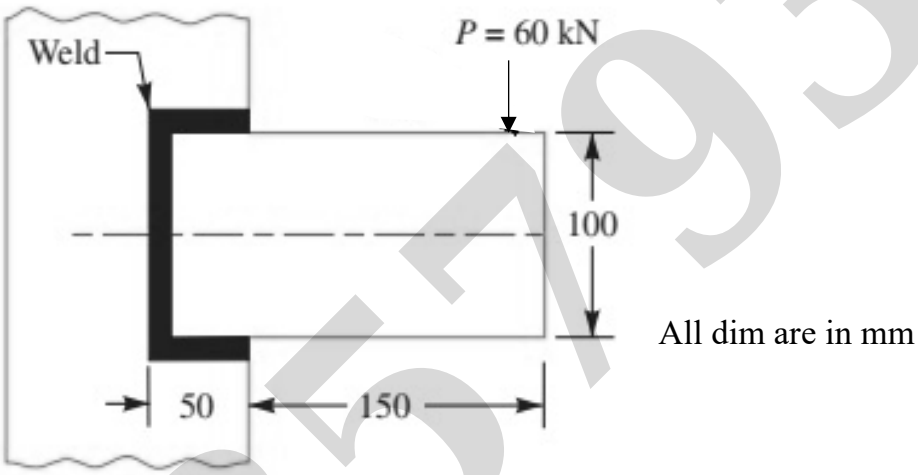


OR

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

Q. 4. a) State the advantages and disadvantages of welded joints over bolted joints. **[4]**

b) A rectangular steel plate is welded as a cantilever to a column and supports a single concentrated load of 60 KN as shown in figure. Determine the size of the weld if the permissible shear stress is limited to 145 N/mm2. **[8]**



OR

b) Describe the design procedure of the bolted joint subjected to eccentric loading in plane containing bolts.

Q. 5. a) Classify the spring and explain the various terms with the help of neat sketch in case helical compression spring. **[4]**

b) A helical spring is made from wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity is 84 KN/mm². Find the axial load which the spring can carry and the deflection per active turns. **[7]**

Q. 6. a) State the advantages and disadvantages of V-belt drive over Flat-belt drive. **[4]**

b) A belt pulley made of grey cast iron FG 150 has four arms of elliptical cross section in which the major axis is the twice the minor axis. The tensions on tight side and slack side of the belt are 750 N and 250 N respectively. The mean diameter of the pulley is 300 mm, while the hub diameter is 60 mm. Assume that the half the no. of arms are transmit the torque at any time. The factor of safety is 5. Determine the dimensions of the cross sections of the pulley arm near the hub. **[8]**
