



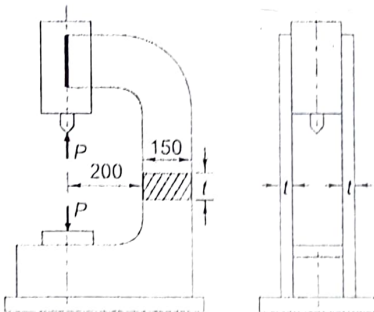
SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST -I
FALL SEMESTER 2024-2025

SLOT: A1

Programme Name & Branch : B.Tech (Mechanical Engineering)
Course Code : BMEE301L
Course Name : Design of Machine Elements
Faculty Name(s) : Dr. A. Vinoth Jebaraj, Dr. Benedict Thomas, Dr. J. Naveen,
Dr. Niranjana Behera, Dr. K. Venkatesan
Class Number(s) : VL2024250103776, VL2024250103772,
VL2024250103773, VL2024250103774,
VL2024250103775
Date of Examination :25.08.2024
Exam Duration : 90 minutes Maximum Marks: 50

General instruction(s):

- PSG data book is permitted
- Assume the suitable data if necessary

Q. No	Question	Marks
1.	The frame of a hydraulic press consisting of two identical steel plates is shown in Fig 1. The maximum force P acting on the frame is 20 kN. The plates are made of steel 45C8 with tensile yield strength of 380 N/mm². The factor of safety is 2.5. Determine the plate thickness.  Fig.1	10
2.	A mild steel bracket as shown in Fig. 2, is subjected to a pull of 6000 N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60 MPa. Assume maximum normal stress theory of failure.	10

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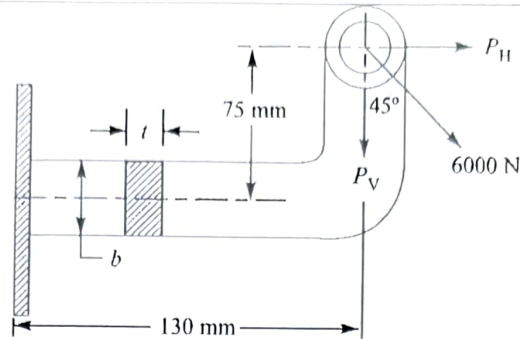


Fig.2

3. A rotating shaft, subjected to a nonrotating force of 5 kN and simply supported between two bearings A and E is shown in Fig.3. The shaft is machined from plain carbon steel 30C8 ($S_{ut} = 500 \text{ N/mm}^2$) and the expected reliability is 90% (Reliability factor = 0.897). The equivalent notch radius at the fillet section can be taken as 3 mm. What is the life of the shaft?

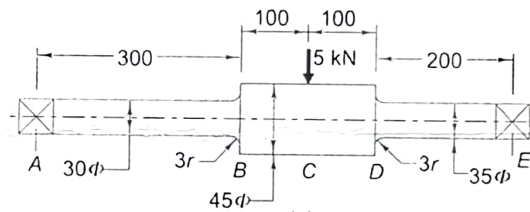


Fig.3

Take Surface finish factor and Notch sensitivity factor as 0.79 and 0.78 respectively.

4. A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm^2 . The corrected endurance limit stress for the machine component is 270 N/mm^2 . The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm^2 respectively. Find the factor of safety using

- (i) Soderberg line
(ii) Goodman line

5. It is required to design a helical compression spring subjected to a force of 500 N. The deflection of the spring corresponding to this force is approximately 20 mm. The spring index should be 6. The spring is made of cold-drawn steel wire with ultimate tensile strength of 1000 N/mm^2 . The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength ($G = 81\,370 \text{ N/mm}^2$). Design the spring and calculate:

- (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils. The spring has square and ground ends