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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

B.Tech III Year I Semester Regular Examinations March-2023

DESIGN OF MACHINE ELEMENTS - I

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 60

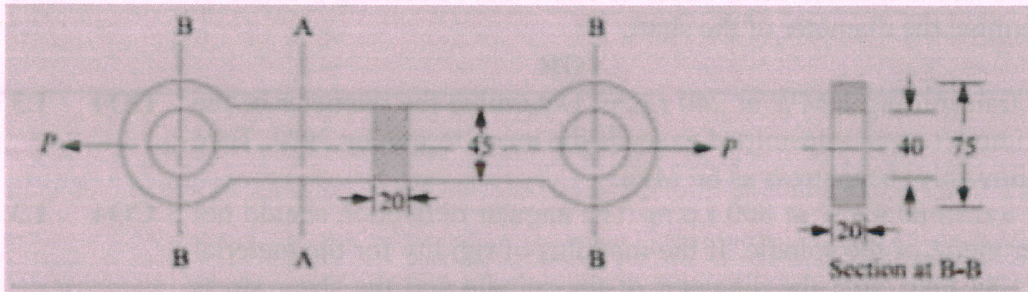
(Answer all Five Units 5 x 12 = 60 Marks)

UNIT-I

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|---|--|-----|----|----|
| 1 | a How do you classify materials for engineering use? | CO1 | L1 | 6M |
| | b Draw and Explain the stress-strain diagram for mild steel. | CO1 | L2 | 6M |

OR

- | | | | | |
|---|--|-----|----|----|
| 2 | a A cast iron link, as shown in Fig. is required to transmit a steady tensile load of 45 kN. Find the tensile stress induced in the link material at sections A-A and B-B. | CO1 | L3 | 6M |
|---|--|-----|----|----|



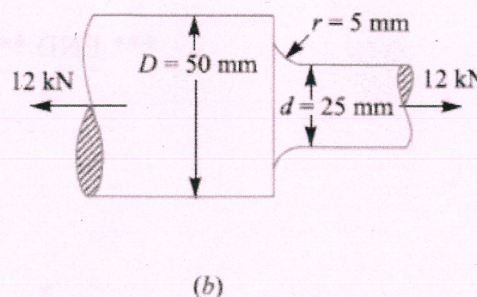
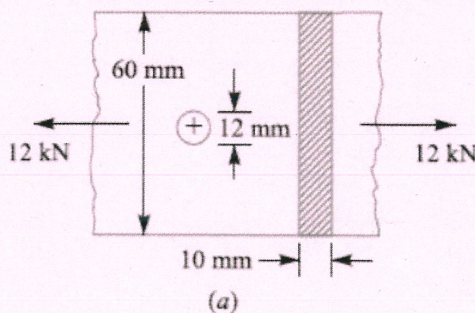
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|---|---|-----|----|----|
| b | A hydraulic press exerts a total load of 3.5 MN. This load is carried by two steel rods, supporting the upper head of the press. If the safe stress is 85 MPa and $E = 210 \text{ kN/mm}^2$, find : 1. diameter of the rods, and 2. extension in each rod in a length of 2.5m. | CO1 | L3 | 6M |
|---|---|-----|----|----|

UNIT-II

- | | | | | |
|---|--|-----|----|----|
| 3 | a What is meant by factor of safety? Explain how it can be used in design applications. | CO2 | L2 | 6M |
| | b Describe the following theories of failures in detail (i) Rankine's theory (ii) Guest's or Tresca's theory (iii) Saint Venant theory | CO2 | L2 | 6M |

OR

- | | | | | |
|---|---|-----|----|----|
| 4 | a What is the notch sensitivity? And also write the expression for it. | CO2 | L1 | 4M |
| | b Find the maximum stress induced in the following cases taking stress concentration into account: | CO2 | L3 | 8M |
| | 1. A rectangular plate 60 mm × 10 mm with a hole 12 diameter as shown in Fig. (a) and subjected to a tensile load of 12 kN. | | | |
| | 2. A stepped shaft as shown in Fig. (b) and carrying a tensile load of 12 kN. | | | |



UNIT-III

- 5 a Discuss on bolts of uniform strength with practical applications of such bolts. CO3 L2 6M
 b A lever loaded safety valve has a diameter of 100 mm and the blow off pressure is 1.6 N/mm². The fulcrum of the lever is screwed into the cast iron body of the cover. Find the diameter of the threaded part of the fulcrum if the permissible tensile stress is limited to 50 MPa and the leverage ratio is 8. CO3 L3 6M

OR

- 6 a What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint. CO3 L2 6M
 b A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa. CO3 L3 6M

UNIT-IV

- 7 a Classify the type of stresses induced in shafts. CO4 L2 5M
 b A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10 000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. CO4 L3 7M

OR

- 8 a A solid shaft is transmitting 1 MW at 240 r.p.m. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 MPa. CO4 L3 6M
 b A steel spindle transmits 4 kW at 800 r.p.m. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle. CO4 L3 6M

UNIT-V

- 9 a What is the effect of keyway cut into the shaft? CO6 L1 6M
 b A 45 mm diameter shaft is made of steel with yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with 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. CO6 L3 6M

OR

- 10 a Discuss the function of a coupling. Give at least three practical applications. CO6 L2 6M
 b Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. CO6 L3 6M

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