

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

B.Tech III Year I Semester Supplementary Examinations November-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

- 1 A shaft, as shown in Fig (a). is subjected to a bending load of 3 kN, pure torque of 1000 N-m and an axial pulling force of 15 kN. Calculate the stresses at A and B. CO1 L3 12M

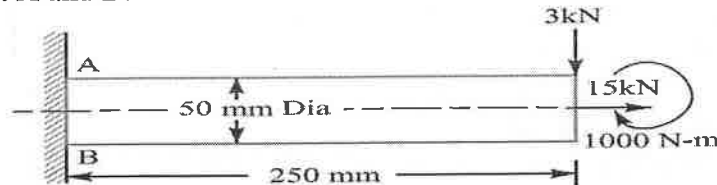


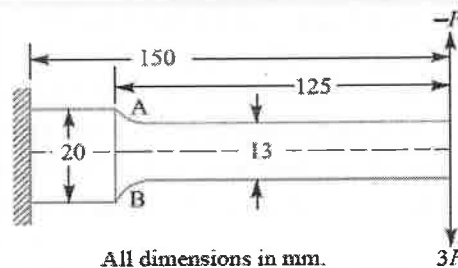
Fig (a)

OR

- 2 A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to 1. the maximum principal stress; 2. The maximum shear stress; and 3. the maximum distortion strain energy theory of yielding. CO1 L3 12M

UNIT-II

- 3 Cantilever beam made of cold drawn carbon steel of circular cross-section as shown in Fig. (b). Is subjected to a load which varies from $-F$ to $3F$. Determine the maximum load that this member can withstand for an indefinite life using a factor of safety as 2. The theoretical stress concentration factor is 1.42 and the notch sensitivity is 0.9. Assume the following values : Ultimate stress = 550 MPa Yield stress = 470 MPa Endurance limit = 275 MPa Size factor = 0.85 ,Surface finish factor= 0.89 CO2 L3 12M



All dimensions in mm.

Fig. (b).

OR

- 4 A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N.m clockwise to 110 N.m counter clockwise and an applied bending moment at a critical section varies from 440N-m to-220 N-m. The shaft is of uniform cross-section and no key way is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m² and yield strength of 410 MN/m².Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and surface finish factor of 0.62. CO2 L3 12M

UNIT-III

- 5 Determine the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded to another plate by means of CO3 L3 12M

1. A single transverse weld; and
2. Double parallel fillet welds when the joint is subjected to variable loads

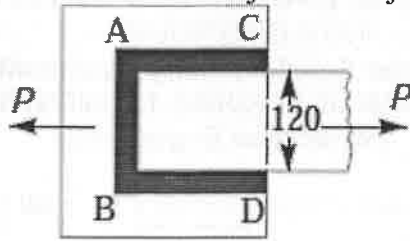


Fig. (c).

OR

- 6 A steam engine of effective diameter 300 mm is subjected to a steam pressure of 1.5 N/mm^2 . The cylinder head is connected by 8 bolts having yield point 330 MPa and endurance limit at 240 MPa. The bolts are tightened with an initial preload of 1.5 times the steam load. A soft copper gasket is used to make the joint leak-proof. Assuming a factor of safety 2, find the size of bolt required. The stiffness factor for copper gasket may be taken as 0.5. CO3 L3 12M

UNIT-IV

- 7 Design and draw a spigot and socket cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa; shear stress = 35 MPa and crushing stress = 90 MPa. CO4 L3 12M

OR

- 8 A steel solid shaft transmitting 15 kW at 200 r.p.m. is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft. CO4 L3 12M

UNIT-V

- 9 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. CO5 L3 12M

OR,

- 10 Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 r.p.m. The overall torque is 20 percent more than mean torque. The material properties are as follows :
 (a) The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.
 (b) The allowable shear stress for cast iron is 15 MPa.
 (c) The allowable bearing pressure for rubber bush is 0.8 N/mm^2 .
 (d) The material of the pin is same as that of shaft and key. Draw neat sketch of the coupling. CO5 L3 12M

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