
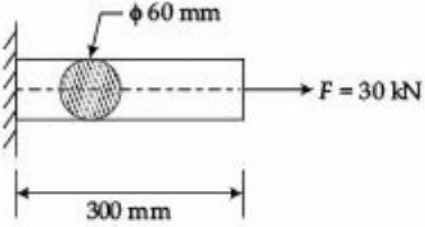


Name: Enrolment No:	
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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, December 2022	
Course: Design of Machine Elements Program: B. Tech ASE/ ASE Course Code: Mech 3024P	Semester: V Time : 03 hrs. Max. Marks: 100
Instructions: Machine Design Databook is Permitted.	

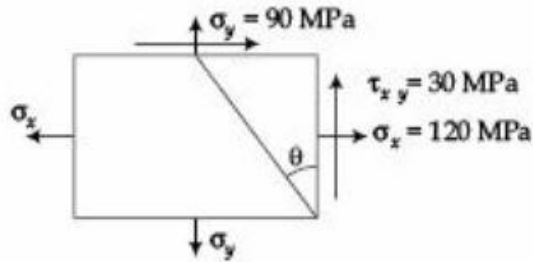
SECTION A (5Qx4M=20Marks)
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S.no.		Marks	CO
Q. 1	What are the factors to be considered for selection of material for a design component?	4	CO1
Q. 2	What are allowable stresses? How will you estimate out allowable stress for ductile parts using factor of safety?	4	CO2
Q. 3	Fig. shows a machine member of 60 mm diameter, 300 mm long and supported at on end, subjected to a tensile load of 30 kN. Find the tensile and shear stresses induced in the member. <div style="text-align: center; margin-top: 10px;">  </div>	4	CO2
Q. 4	List the properties required for shaft materials.	4	CO3
Q. 5	Explain stress-strain diagram of mild steel. State the properties that can be derived using the obtained stress-strain diagram.	4	CO1

SECTION B (4Qx10M= 40 Marks)

Q.6	Determine the diameter of the solid shaft required to transmit 50 KW at 1000 rpm. The allowable shear stresses may be taken as 90 MPa. Replace this solid shaft with a hollow shaft assuming the diameter ratio as 0.6, made of same material and FOS. As a result of replacement, determine:	10	CO4
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	(i) percentage reduction in weight assuming same length for both shafts. (ii) the ratio of torsional stiffness of the hollow shaft to that of the solid shaft.		
Q.7	Derive expressions for equivalent bending moment and equivalent torsional moment for a solid shaft subjected to combined bending and torsion. Assume any theory of failure.	10	CO3
Q.8	Select a rectangular parallel key to transmit 9 kW at 300 rpm. The yield stress for the steel used is 310 MPa. Take the factor of safety to be 2.5.	10	CO3
Q.9	An element is acted upon by the following stresses. $\sigma_x = 120$ MPa, $\sigma_y = 90$ MPa, $\tau_{xy} = 30$ MPa. (i) Compute the stresses on a plane inclined at 20° . (ii) Find principal stresses and their location. (iii) Find maximum shear stresses and its location.	10	CO2



SECTION-C
(2Qx20M=40 Marks)

Q.10	(a) A non-rotating shaft supporting a load of 2.5 kN is shown in figure. The shaft is made up of brittle material, with an ultimate tensile strength of 300 N/mm ² . The factor of safety is 3. Determine the dimensions of the shaft.	10	CO2
	(b) Derive the expressions for torque requirement for lifting and lowering the load using screw jack. Explain with conditions the self-locking and overhauling of screws.	10	CO3

