UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, May 2021

Course: Strength of Materials   Semester: IV
Program: B. Tech ASE/ASE-AVE   Time 03 hrs.
Course Code: MECH 2012   Max. Marks: 100

Instructions: a) **All questions are compulsory.**
   b) **Assume any suitable value for the missing data**
   c) **Q1-Q3 are TRUE/FALSE**

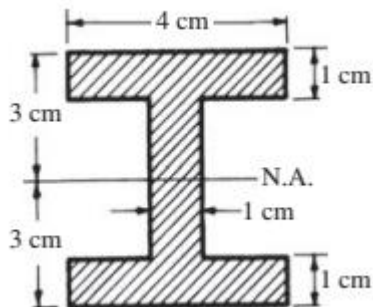| SECTION A			
S. No.		Marks	CO
Q 1	a) At point of contraflexure, shear force is zero. (2 M) b) Higher the section modulus of beam, greater the resistance for bending (3 M)	**5**	**CO1**
Q2.	a) Pressure is a scalar while stress is tensor quantity(2 M) b) Maximum shear stress in pure torsion occurs at centroidal axis of bar (3 M)	**5**	**CO1**
Q3.	a) The deflection shape of beam under load is an arc of circle (2 M) b) A rod is fixed at one end and free at the other, if the rod is heated uniformly across length then both stress and strain will produced in the bar (3 M)	**5**	**CO1**
Q4.	a) Two rods, one is made rod of wood and the other is steel. If both rod has same cross section and subjected a same load then stress is same in the both rods. (2M) b) Two spherical pressure vessel of same radius, one is aluminum and other is steel are subjected to same internal pressure, then maximum stress is identical in both the vessel. (3M)	**5**	**CO2**
Q5.	Two cantilever beam subjected to same load P at its free end. Both beams are of same material and length, however of different cross-section. The cross-section of one beam is circular with radius ' r' and other of square cross-section of side 'a', if a = r, then which beam has greater deflection and why?	**5**	**CO2**
Q6	A circular punch 20 mm in diameter is used to punch a hole through a steel plate 10 mm thick. If the force necessary to drive the punch through the metal is 250 kN, determine the maximum shearing stress developed in the material.(Note: write only correct answer)	**5**	**CO2**
SECTION B			

Q 7	Under cruising conditions the distributed load acting on the wing of a small airplane has the idealized variation shown in the figure. Calculate the shear force V and bending moment M at the inboard end of the wing.	10	CO3
Q8.	The copper pipe has an outer diameter of 6 cm and an inner diameter of 5 cm. If it is tightly secured to the wall at C and a uniformly distributed torque is applied to it as shown, determine the shear stress developed at points A and B. These points lie on the pipe's outer surface. Sketch the shear stress on volume elements located at A and B	10	CO3
Q9 .	A spherical gas container having an outer diameter of 5 m and a wall thickness of 22 mm is made of steel for which E = 200 GPa and v = 0.29. Knowing that the gage pressure in the container is increased from zero to 1.7 MPa, determine (a) the maximum normal stress in the container, (b) the corresponding increase in the diameter of the container **OR** A spherical tank for storing gas under pressure is 25 m in diameter and is made of structural steel 15 mm thick. The yield point of the material is 250 MPa and a safety factor of 2.5 is adequate. Determine the maximum permissible internal pressure, assuming the welded seams between the various plates are as strong as the solid metal	10	CO5
Q10.	The wood member has cross-sectional area of bar ABCD is 1000 mm². Determine the maximum normal stress in the bar, and find the total elaongation of the bar, if Elastic modulus of the bar, E = 15 GPa	10	CO3

40 kN   35 kN   20 kN

A   B•→   ←•C   D•→
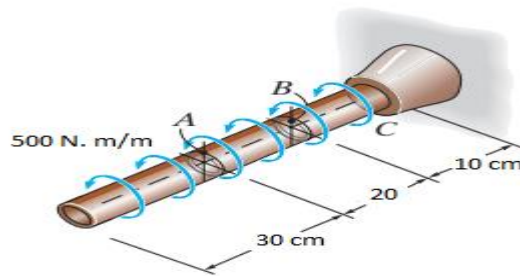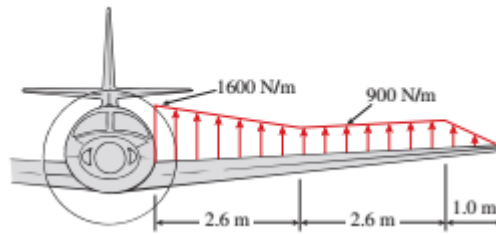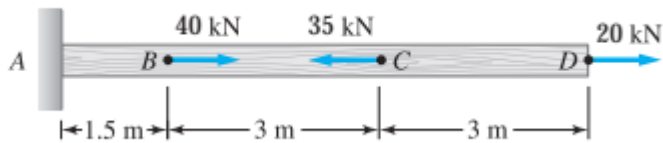
|←1.5 m→|←— 3 m —→|←— 3 m —→|

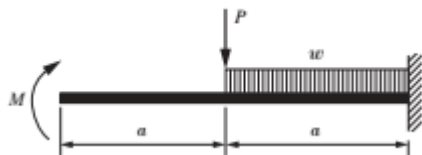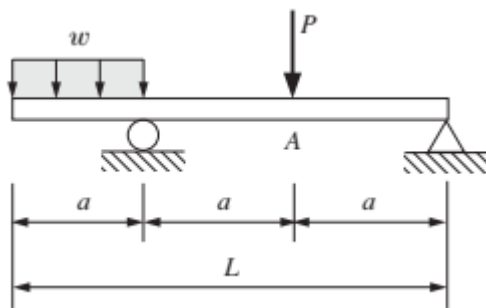| Q11	Determine ethe maximum shear stress in I-section beam subjeted a shear force of 100 N also show the nature of shear stress distribution	10	CO3

SECTION-C

Q12	Determine the equation of slope and deflection equation of the cantilever beam shown in fig. below. Also, a) Find the magnitude of maximum slope and deflection of the beam, if length of the beam = 100mm, P = 100 N, w= 20N/mm and E = 200 GPa b) Draw the shear force and bending moment diagram of the beam and determine the value of maximum shear force and bending moment Assume beam of square cross-section of side a =10mm and length = 100mm **OR** The overhanging beam is loaded by the uniformly distributed load as well as the concentrated force shown. 	20	CO4

c) Determine the deflection of point A of the beam in terms of parameters. Use singularity functions

d) Draw the shear force and bending moment diagram of the beam and determine the value of maximum shear force and bending moment Assume beam of square cross-section of side a =10mm and length = 100mm, P = 100 N, w= 20N/mm, and E = 200 GPa