Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

Course: Theory of Plates **Semester: VI**
Program: B.Tech ASE **Time 03 hrs.**
Course Code: ASEG 3007 **Max. Marks: 100**

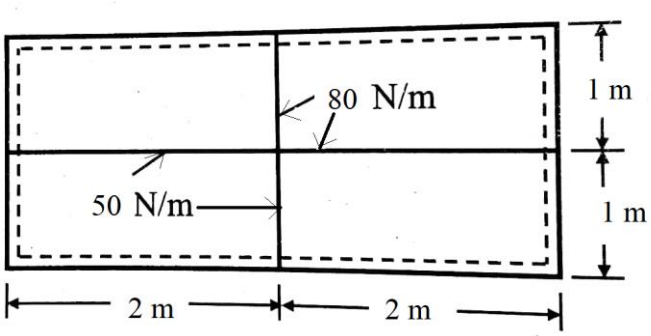
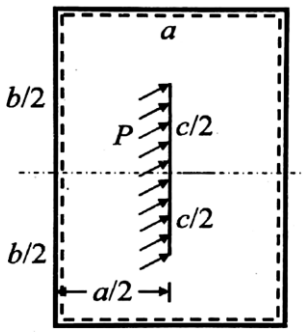
Instructions:

1. **Read the Instruction carefully before attempting**
2. **For Theory based : Type the Answers in word file**
3. **For Figures if any : Draw a free hand sketch and insert the same word file**
4. **For Numerical : Solve it in a paper and insert in the same word file**
5. **Upload as a single word file for all the Question in Blackboard.**

Note : Please upload the word document only, Do not upload PDF and or other format. The answer scripts will be considered for evaluation only through Blackboard. No other mode of submission is acceptable.

SECTION A 60 Marks

S. No.		Marks	CO
Q 1	A square plate *(0 ≤ x,y ≤ a)*simply supported at all edges and subjected to uniformly distributed load of intensity q_0. Show that the deflection function $$w = A\,x(x-a)\,y\,(y-a)$$ Can be represented for the deflected form of the plate. Calculate the value of constant A and the central deflection of the plate using energy method	**5**	**CO3**
Q 2	A rectangular plate a x b, is simply supported along each edge and carries a uniformly distributed load of intensity q0. Assuming a deflected shape given by $$w = A_{11}\,sin\frac{\pi x}{a}\,sin\frac{\pi y}{b}$$ Determine the value of constant A_{11} and hence the central deflection of the plate using Energy Method.	**10**	**CO3**
Q 3	The deflection of a square plate of side a which supports a lateral load represented by the function *q(x,y)* is given by $$w(x,y) = w_0\,cos\frac{\pi x}{a}\,cos\frac{3\pi y}{a}$$ Where *x* any *y* are referred to axes whose origin coincides with the center of the plate and w_0 is the deflection at the center.	**10**	**CO3**

	If the flexural rigidity of the plate is D and Poisson's ration is ν, determine the loading function *q*, the support conditions of the plate, the reactions at the plate corner and the bending moments at the center of the plate.		
Q 4	A horizontal square plate 1 m x 1 m x 5 mm thick is simply supported at all edges. The plate is made of mild steel (E = 200 GPa, ν = 0.3) and is subjected to a uniformly distributed load of 100 N/m2 over a centrally located patch of size 0.5mx0.5m. for this case, using one-term Navier approach determine the central deflection of plate while (i) neglecting the weight of the plate; (ii) considering the weight of the plate. The density of Mild steel is 7.8 gm/cc.	**10**	**CO2**
Q 5	Using a one-term Navier's approach, determine the flexural rigidity and the thickness of the mild steel (E = 200 GPa) plate required for the line-loaded plate as shown below if the maximum deflection is not to exceed 5 mm. 	**10**	**CO2**
Q 6	(A) Using One term navier approach, determine the central deflection of the plate due to a transverse line load of P per unit length as shown below. Assume a = b = 1m, c = 0.8 m. (B) Using one term Navier approach, determine the thickness required if the central deflection is not to exceed 1 mm. Take E = 200 GPa, ν = 0.3, a = b = 1m, c = 0.8 m and P = 50 N/m. 	**10**	**CO2**
Q 7	Explain the procedure to calculate the deflected form for a thin rectangular plate of size 'a' supporting a uniformly distributed load of intensity 'q' per unit area, using Galerkin's method.	**5**	**CO4**

SECTION B [Numerical and Short Answers] 40 Marks			
Q 8	Define the following terms: Thin Plate, Buckling stress, Boundary conditions, radius of curvature and flexural rigidity of plate.	**4**	**CO1**
	Explain the concept of buckling. Why buckling is important in aircraft structure? For the thin rectangular plate of size a x b is simply supported at x = 0 and x = a and fixed at y = 0 and y = b. Write all the boundary condition of the plate.	**8**	**CO4**
Q 9	Consider a thin rectangular plate of size "axb" is subjected to a uniformly distributed load of intensity "q" per unit area. Prove that $\partial w/\partial y$ is constant along the edges y = 0 and y = b.	**4**	**CO1**
Q 10	A plate 10 mm thick is subjected to bending moments Mx equal to 10 Nm/mm and My equal to 5 Nm/mm (a) calculate the maximum direct stress in the plate.	**8**	**CO1**
Q 11	Consider square plate with the following boundary condition: (i) SfSf, (ii) SFSF, (iii) CCSS, (iv) SCCC, (v) SSSC (s-simply supported, C – clamped, F – Fixed, f – free)). Assuming the geometry and the material to the same for all the plates, list them in the order of increasing fundamental frequency. Explain why.	**8**	**CO4**
Q 12	Consider a thin rectangular plate of sides a × b, subjected to a uniformly distributed load of intensity 'q' per unit area, subjected to the following boundary conditions: Simply supported along x = 0, y = 0 and Built in along x = a, y = b. The assume deflected shape to satisfy the above boundary conditions is: $w = A\, f(x, y)$ Where $f(x, y) = X(x)Y(y)$, Determine the value of $X(x)$ and $Y(y)$ to satisfied the above boundary conditions.	**8**	**CO3**