| Name:<br>Enrolment No: | UPES |
|---|---|

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, April/May 2018**

**Course: Theory of plates & shells (CIVL 7012)** **Semester: II**
**Program: M. Tech**
**Time: 03 hrs.** **Max. Marks: 100**

**Instructions: Answer all the questions**

## SECTION A

| S. No. | | Marks | CO |
|---|---|---|---|
| Q.1 | How do you classify plates as per various theories? | 5 | CO1 |
| Q.2 | Explain the various assumptions in the analysis of orthotropic plates. | 5 | CO3 |
| Q.3 | Give a sketch for at least five types of reinforced concrete shells | 5 | CO2 |
| Q.4 | Briefly explain the finite difference method for the bending of simply supported shells. | 5 | CO4 |

## SECTION B

| | | | |
|---|---|---|---|
| Q.5 | Obtain the expression for deflection in case of non-uniformly loaded circular plates with clamped edges. | 10 | CO1 |
| Q.6 | Derive an expression for Bending moments of orthotropic rectangular plate subjected to loading of $q = q_o \sin\frac{\pi x}{a}\sin\frac{\pi y}{b}$ . | 10 | CO3 |
| Q.7 | Using Classical Shell theory, Derive the various stresses developed in simply supported shells with circular directrix. | 10 | CO2 |
| Q.8 | For a square plate of side 2.5m, under UDL of 10kN/m$^2$, finds the maximum deflection & maximum slope taking $\gamma$ = 0.5, E = 250kN/mm$^2$ & thickness of plate = 100mm. Obtain the deflection using Folded plate theory | 10 | CO3 |
| | **OR** | | |
| Q.9 | Derive the expression of equilibrium for hyperbolic shells subjected to live & snow loads. | | CO4 |

## SECTION-C

| | | | |
|---|---|---|---|
| Q.10 | Using **levy's method**, Derive an expression for simply supported rectangular plate under hydrostatic pressure | 20 | CO2 |
| Q.11 | Derive an expression for Spherical dome with Parabolic directrix under Dead, live & snow load. | 20 | CO3 |
| | **OR** | | |
| Q.12 | Derive an expression for rectangular plate with two edges built in, third edge simply supported & fourth edge simply supported with patch loading. | | CO1 |

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**Instructions:**

**SECTION A**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q.1 | Explain the various thermal stresses produced in plates with clamped edges. | **5** | **CO1** |
| Q.2 | Write down finite difference expression for deflection in plate theory with three edges clamped & one edge simply supported. | **5** | **CO4** |
| Q.3 | How does membrane theory different from bending theory. | **5** | **CO2** |
| Q.4 | What are the various assumption considered in analysis of folded plates | **5** | **CO3** |

**SECTION B**

| | | | |
|---|---|---|---|
| Q.5 | Obtain an expression for simply supported slab with a circular hole & with the concentric loading | **10** | **CO1** |
| Q.6 | Obtain the maximum deflection for orthotropic plate with the dimension of L = 50”; h = 0.5”; q = 10 kN/m. Also determine the maximum stresses. Take E = 30 X $10^6$N/mm$^2$. μ= 0.3 | **10** | **CO3** |
| Q.7 | Using Classical shell theory, Derive an expression for various stresses developed in cylindrical shells with catenary as directrix. | **10** | **CO2** |
| Q.8 | Derive an expression for simply supported circular slab with uniformly distributed load distributed inside the concentric circle. Also determine the deflection using folded plate theory. | **10** | **CO3** |
| | **OR** | | |
| Q.9 | Derive an expression for the displacements in parabolic shells loaded unsymmetrically with respect to their axis. <br> . | | **CO4** |

**SECTION-C**

| | | | |
|---|---|---|---|
| Q.10 | Using Navier’s theory, Derive an expression for simply supported rectangular plates with triangular loading. | **20** | **CO2** |
| Q.11 | Derive an expression for the membrane forces Nφ & Nθ of a parabolic dome of radius “a” having an upper reinforcing beam to accommodate an opening at top. | **20** | **CO3** |
| | **OR** | | |
| Q.12 | A Circular plate of radius “a” has a hole of radius “b” at the middle of the plate. Plate is subjected to uniformly distributed load of Intensity $P_0$. The plate has inner edges clamped & outer edges free. Find the maximum deflection, moment & bending stress if b = a/4 | | **CO1** |