Ref. No.: Ex/PG/CE /T/113A/2025

M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025
Subject: ADVANCED STRUCTURAL DESIGN

Full Marks:100 **Time: 3hours**

(Use Separate Answer scripts for each Part)

Part- I (Marks 60)

IS 1893 Part 1, Part 2 are allowed in the examination hall

1. Consider a beam with free ends is resting on elastic foundation, its dimension and loading are as shown in **Fig. 1**. Find the **deflection at** point C. Given, $E=2\times10^5 N/mm^2$, Winkler foundation modulus, $K_0=0.25N/mm^2/mm$. Cross section of the beam is considered to square of dimension 200mm. 30

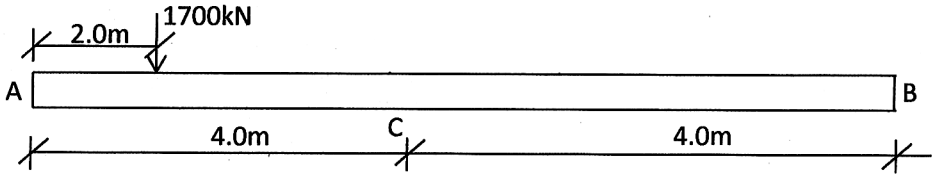

Fig. 1

$$P_\theta^{'} = 4E_r\left[Q_A^{'}(1+D_{\beta x}) + \beta M_A^{'}(1-A_{\beta x})\right]$$

$$M_\theta^{'} = -\frac{2}{\beta}E_r\left[Q_A^{'}(1+C_{\beta x}) + 2\beta M_A^{'}(1-D_{\beta x})\right]$$

$$E_r = \frac{1}{\left[2(1+D_{\beta x})(1-D_{\beta x}) + (1-A_{\beta x})(1+C_{\beta x})\right]}$$

$$P_\theta^{''} = 4E_{rr}\left[Q_A^{''}(1-D_{\beta x}) + \beta M_A^{''}(1+A_{\beta x})\right]$$

$$M_\theta^{''} = -\frac{2}{\beta}E_{rr}\left[Q_A^{''}(1-C_{\beta x}) + 2\beta M_A^{''}(1+D_{\beta x})\right]$$

$$E_{rr} = \frac{1}{\left[2(1+D_{\beta x})(1-D_{\beta x}) + (1+A_{\beta x})(1-C_{\beta x})\right]}$$

2. A ground supported rectangular RC tank has plan dimension 8m × 7 m and height of 4.0m (including free board of 0.5m). Wall has uniform thickness of 500mm. The base slab is 400mm thick. The tank is located on hard soil in Zone V. Grade of concrete is M30. Analysis the tank for seismic load. 30

TABLE 5.2.1 Selected Values of Terms Defined by Eqs. 5.2.7.

βx	$A_{\mu x}$	$B_{\mu x}$	$C_{\mu x}$	$D_{\mu x}$
0	1	0	1	1
0.02	0.9996	0.0196	0.9604	0.9800
0.04	0.9984	0.0384	0.9216	0.9600
0.10	0.9907	0.0903	0.8100	0.9003
0.20	0.9651	0.1627	0.6398	0.8024
0.30	0.9267	0.2189	0.4888	0.7077
0.40	0.8784	0.2610	0.3564	0.6174
0.50	0.8231	0.2908	0.2415	0.5323
0.60	0.7628	0.3099	0.1431	0.4530
0.70	0.6997	0.3199	0.0599	0.3798
$\pi/4$	0.6448	0.3224	0	0.3224
0.80	0.6354	0.3223	−0.0093	0.3131
0.90	0.5712	0.3185	−0.0657	0.2527
1.00	0.5083	0.3096	−0.1108	0.1988
1.10	0.4476	0.2967	−0.1457	0.1510
1.20	0.3899	0.2807	−0.1716	0.1091
1.30	0.3355	0.2626	−0.1897	0.0729
1.40	0.2849	0.2430	−0.2011	0.0419
1.50	0.2384	0.2226	−0.2068	0.0158
$\pi/2$	0.2079	0.2079	−0.2079	0
1.60	0.1959	0.2018	−0.2077	−0.0059
1.70	0.1576	0.1812	−0.2047	−0.0235
1.80	0.1234	0.1610	−0.1985	−0.0376
1.90	0.0932	0.1415	−0.1899	−0.0484
2.00	0.0667	0.1231	−0.1794	−0.0563
2.20	0.0244	0.0896	−0.1548	−0.0652
$3\pi/4$	0	0.0670	−0.1340	−0.0670
2.40	−0.0056	0.0613	−0.1282	−0.0669
2.60	−0.0254	0.0383	−0.1019	−0.0636
2.80	−0.0369	0.0204	−0.0777	−0.0573
3.00	−0.0423	0.0070	−0.0563	−0.0493
π	−0.0432	0	−0.0432	−0.0432
3.20	−0.0431	−0.0024	−0.0383	−0.0407
3.40	−0.0408	−0.0085	−0.0237	−0.0323
3.60	−0.0366	−0.0121	−0.0124	−0.0245
3.80	−0.0314	−0.0137	−0.0040	−0.0177
$5\pi/4$	−0.0279	−0.0139	0	−0.0139
4.00	−0.0258	−0.0139	0.0019	−0.0120
$3\pi/2$	−0.0090	−0.0090	0.0090	0
2π	0.0019	0	0.0019	0.0019

[Turn over

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M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025

Advanced Structural Design (SE)

Time: Three Hours | Full Marks 100

[IS 456 is allowed in the examination hall. Assume any other suitable values, Consider Fe500 steel and M25 grade of concrete if not mentioned]

<table>
<tr><th>No. of questions</th><th>Part II (Answer Any two of the following questions.)</th><th>Marks (2X20=40)</th></tr>
<tr><td>1
(a)</td><td>Write a short note of reinforced concrete grids.</td><td>3</td></tr>
<tr><td>(b)</td><td>A reinforced concrete grid floor is to be designed to cover a floor area of size 8mX12m. The spacing of the ribs in perpendicular direction is 2m c/c and live load 6 kN/m^2. Analyze the grid floor by plate theory.
<table>
<tr><td>a/b</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Torsion Constant</td><td>0.14</td><td>0.196</td><td>0.229</td><td>0.249</td><td>0.263</td><td>0.281</td><td>0.291</td><td>0.299</td></tr>
</table>
*a and b are the long and short side respectively</td><td>17</td></tr>
<tr><td>2)
a)</td><td>Derive the membrane forces due to self-weight of a circular cylindrical shells.</td><td>12</td></tr>
<tr><td>b)</td><td>A reinforced concrete shell having semicircular directrix is freely supported at the ends. The radius of shell =8m, length of shell @L)=50m, thickness of shell =100mm. Calculate the membrane forces at x=0,10,20 m at 0°, 45° and 90° under its own self weight.</td><td>8</td></tr>
<tr><td>3)
a)</td><td>Derive the equation of three shears in a folded plate.</td><td>10</td></tr>
<tr><td>b)</td><td>A folded plate with two folds AB and BC having thickness 100 mm and depth (h) of each 3m subjected to moments of 500 KNm in the plane of the plates. Using the following data, calculate the stress in the folded plate.</td><td>10</td></tr>
<tr><td>4)</td><td>Design an interior panel of flat slab floor system for a ware house 20mX20m divided into 4mX4m. Loading class=5 kN/m2, Materials=M25 grade of concrete and Fe 500 HYSD bar, circular column=500mm dia.</td><td>20</td></tr>
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