Master of Civil Engineering examination , 2017
(1st year, 1st semester)
ADVANCED STRUCTURAL DESIGN

Time: 3 hours | The figures in the margin indicate full marks | Full marks : 100

All the Questions carry equal marks
Assume reasonable value of any data if required
IS 456 and SP 16 and papers containing formulae duly signed by concerned teacher , are allowed in the examination hall
Answer any *three* questions

1. Design an exterior panel (6m x 7m–next to corner) of a flat slab system. Column size 500 mm x 500 mm . Live load=5 KN/m^2 . Grade of concrete M20 and Grade of steel Fe 415.
2. Design a RCC Grid floor 0f size 16m x 18m against a live load of 4 KN/m^2 .Spacing of rib beams in mutually perpendicular direction is 2m. Grade of concrete – M25, Grade of steel - Fe 415 . Analyse the Grid floor by using "Plate theory".
3. A beam on elastic foundation with given loading is shown in Fig. 1. Find the bending moment, shear force and deflection at the ends and midpoint of the beam. The beam has square cross section of dimension 150mm. Modulus of elasticity of beam material and modulus of foundation (k_0)are *2000GPa* and *0.25N/mm^2/mm* .

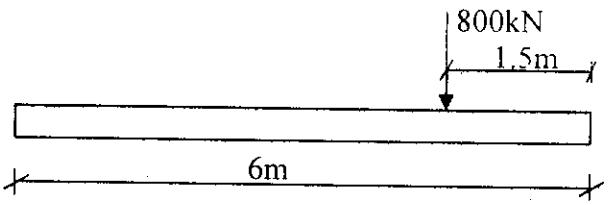

Fig. 1

4. Design the side walls and hopper bottom of a 3.5m by 3.5m square bunker to store 35 tonnes of coal. Density of coal=9 kN/$m^3$and angle of repose=30^0. Adopt M20 grade of concrete.

Annexure I

Equations for Vertical deflection, Bending Moment and Shear Force of a beam with infinite length.

For concentrated Force

$$W(x) = \frac{b\,p_0}{2k} A_{bx}$$

$$M = \frac{p_0}{4b} C_{bx}$$

$$V = -\frac{p_0}{2} D_{bx}$$

For concentrated Moment

$$W(x) = \frac{b^2 M_0}{k} B_{bx}$$

$$M = \frac{M_0}{2} D_{bx}$$

$$V = -\frac{b\,M_0}{2} A_{bx}$$

β_{kl}	A_{kl}	B_{kl}	C_{kl}	D_{kl}
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	0.9653	0.1627	0.6398	0.8024
0.30	0.9267	0.2189	0.4808	0.7037
0.40	0.8784	0.2610	0.3364	0.6174
0.50	0.8231	0.2908	0.2115	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	0.0893	0.3131
0.90	0.5712	0.3185	−0.0655	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	0.1570	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
$5\pi/4$	0	0.0630	−0.1260	−0.0630
2.40	−0.0096	0.0413	−0.1082	−0.0669
2.60	−0.0254	0.0253	−0.1019	−0.0636
2.80	−0.0306	0.0264	−0.0921	−0.0573
3.00	−0.0423	0.0070	−0.0563	−0.0493
π	−0.0432	0	−0.0432	−0.0432
3.20	−0.0443	−0.0024	−0.0383	−0.0407
3.40	−0.0408	−0.0085	−0.0237	−0.0323
3.60	−0.0306	−0.0121	−0.0124	−0.0245
3.80	−0.0214	0.0137	−0.0040	−0.0171
$5\pi/4$	0.0279	−0.0139	0	−0.0139
4.00	−0.0258	−0.0139	0.0019	−0.0120
$3\pi/2$	−0.0080	−0.0090	0.0090	0
2π	0.0019	0	0.0019	0.0019