Question Paper

Exam Date & Time: 30-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH (CIVIL ENGINEERING)
END SEMESTER EXAMINATION, MAY/JUNE 2023

DESIGN OF REINFORCED CONCRETE STRUCTURES [CIE 4063]

Marks: 50 **Duration: 180 mins.**

Descriptive questions

Answer all the questions.

Instructions to the Candidates:
1. Answer all questions.
2. Any missing data may be suitably assumed.
3. Use of IS 456:2000 code is permitted.

1) A) Details of an interior panel of a flat slab with drop and column head are given below: (5)

Panel size = 7m × 6m.

Size of drops = 3.5m × 3.5m

Live load and floor finishes on the slab = 3.2kN/m^2 and 1kN/m^2 respectively

Diameter of the supported columns = 500mm

Diameter of column head = 1.3m

Width of column strip along longer and shorter spans = 3.5m

Thickness of solid slab and drops provided = 250mm and 100mm respectively

Effective cover for slab = 30mm

Grade of concrete and steel = M25 and Fe415

Check the slab for shear at critical locations.

B) Details of an interior panel of a flat slab with drop and column head are given below: (5)

Panel size = 7m × 6m.

Size of drops = 3.5m × 3.5m

Live load and floor finishes on the slab = 3.2kN/m^2 and 1kN/m^2 respectively

Diameter of the supported columns = 500mm

Diameter of column head = 1.3m

Width of column strip along longer span = 3m

Width of column strip along longer span = 3.5m

Thickness of solid slab and drops provided = 250mm and 100mm respectively

Effective cover for slab = 30mm

Grade of concrete and steel = M25 and Fe415

Calculate
1. Strip bending moments.
2. Column strip hogging (negative) reinforcement along longer span.

2) Details of a cantilever type retaining wall (with sloping face towards the earth retained) and related data are given below: (8)

A)

Height of the wall = 6 m

Angle of repose = 35^0

Coefficient of friction between concrete and soil = 0.45

Density of soil = 16 kN/m^3

Thickness of stem varies from 180mm at the top to 500mm at the junction of stem and base slab.

Thickness and width of base slab = 450mm and 3.1m respectively

Width of toe slab = 0.8m

Effective cover for all elements = 50mm

SBC of soil = 200kN/m^2

Grade of concrete and steel = M30 and Fe415

Check the stability of the retaining wall for overturning and net upward earth pressure at the base.

B) Details of a cantilever type retaining wall (with sloping face towards the earth retained) and related data are given below: (2)

Height of the wall = 6 m

Angle of repose = 35^0

Coefficient of friction between concrete and soil = 0.45

Density of soil = 16 kN/m^3

Thickness of stem varies from 180mm at the top to 500mm at the junction of stem and base slab.

Thickness and width of base slab = 450mm and 3.1m respectively

Width of toe slab = 0.8m

Effective cover for all elements = 50mm

SBC of soil = 200kN/m^2

Grade of concrete and steel = M30 and Fe415

Check if the thickness of the stem provided is sufficient.

3) Details of slab and beam type combined footing provided for 2 columns are given below: (5)

A)

Load on column 1 of size 350mm × 350mm = 700kN

Load on column 2 of size 300mm × 300mm = 500kN

Spacing of columns = 3m c/c

Width of the footing = 2.5m

Length of the footing = 4.4m

Width of the beam = 350mm

Effective cover = 50mm

Grade of concrete and steel = M35 and Fe415

Boundary line is at 450mm from the centre of column 2.

Calculate

1.Thickness of footing slab.
2. Reinforcement required for footing slab.

B) Details of counterfort retaining wall and related data are given below: (5)

Height of the wall = 8m

Base slab thickness = 650mm

Angle of repose = 32^0

Soil density = 16 kN/m^3

Spacing of counterforts = 3.1m c/c

Grade of concrete and steel = M30 and Fe415

Upward net soil pressure variation at the base of the wall = 117.2 kN/m^2 at toe to 96.5 kN/m^2 at heel.

Calculate

1. Minimum thickness of the stem to be provided.

2. Design bending moment for heel slab.

4) The roof of a hall is to be supported on single bay and single storey portal frames spaced at 3.5m c/c. The data is given below. (5)

A)

Height of the portal frames = 4m

Bay width = 7m

Thickness of the slab = 150mm

Effective cover to the reinforcements = 25mm

Live load on the roof = 2 kN/m^2

Roof and ceiling finishes = 0.5 kN/m^2

Size of the beam = 300mm × 400mm

Effective cover for beam = 40mm

Grade of concrete and steel = M25 and Fe500

Design the slab.

B) The roof of a hall is to be supported on single bay and single storey portal frames spaced at 3.5m c/c. The data is given below. (5)

Height of the portal frames = 4m

Bay width = 7m

Thickness of the slab = 150mm

Effective cover to the reinforcements = 25mm

Live load on the roof = 2 kN/m^2

Roof and ceiling finishes = 0.5 kN/m^2

Size of the beam = 300mm × 400mm

Effective cover for beam = 40mm

Grade of concrete and steel = M25 and Fe500

1. Calculate shear reinforcement for beams if tensional steel provided in the beam is 815mm^2. Use 8mm diameter 2LVS.

2. Check if the neutral axis of T-beam lies within the flange if the maximum design bending moment of the beam is 250kNm.

5) A (3.5m × 3.5m × 4.5m) square bunker with hopper bottom of height 1.2m and opening (0.5m × 0.5m) is proposed to store food grains of density 7.5 kN/m^3 and angle of repose 25^0. (5)

A)

Thickness of vertical wall and hopper bottom wall = 200mm

Effective cover = 30mm

Calculate
1. Total capacity of the bunker
2. Reinforcement for hopper bottom required to resist direct tension using Fe500 steel.

B) A (3.5m × 3.5m × 4.5m) square bunker with hopper bottom of height 1.2m and opening (0.5m × 0.5m) is proposed to store food grains of density 7.5 kN/m^3 and angle of repose 25^0. (5)

Thickness of vertical wall and hopper bottom wall = 200mm

Effective cover = 30mm

Calculate net design bending moments.

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