

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2021

Subject Code: 3170626

Date: 17/12/2021

Subject Name: Design of Industrial Structures

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Permit use of IS 456: 2000, IS 13920: 2016, IS 800:2007, IS 4995 Part 1,2, SP-16, Steel Table

- Q.1**
- |     |  |   |
|-----|--|---|
| (a) | Give the classification of industrial chimneys.  | 3 |
| (b) | Differentiate between Bunker and Silos   | 4 |
| (c) | How the total height of a transmission line tower is calculated? Explain in brief the factors governing the height of transmission line tower. | 7 |

A roof truss is having the following data:

- Span of the truss : 18m
- C/c spacing of truss: 3.5m
- Column Height : 8m
- Location of building : Jaipur
- Allowable SBC of soil: 170 kN/m<sup>2</sup>

- Q.2**
- |     |   |   |
|-----|---|---|
| (a) | Fix the configuration of a roof truss for span 18 m for an industrial building. | 3 |
| (b) | Compute nodal forces due to dead load, live load and wind load as per IS: 875.  | 4 |
| (c) | Analyze and Design purlin for the above data.                                   | 7 |

**OR**

- Q.2**
- |     |   |   |
|-----|---|---|
| (c) | Analyze truss and design main tie for the above data. | 7 |
|-----|---|---|

- Q.3**
- |     |   |   |
|-----|---|---|
| (a) | Explain various types of loads acting on the transmission line towers. Under What circumstances torsional load occur on them? | 4 |
|-----|---|---|

- Q.3**
- |     |  |    |
|-----|--|----|
| (b) | Design a circular bunker to store 20 tonnes of coal. Density of coal is 9 kN/m <sup>3</sup> and angle of repose is 30 degree. Use limit state method of design and adopt grades M20 and Fe 415. Show reinforcement detailing with neat sketch. | 10 |
|-----|--|----|

**OR**

- Q.3**
- |     |  |   |
|-----|--|---|
| (a) | Enlist the different types of communication towers based on their structural action. | 4 |
|-----|--|---|

- Q.3**
- |     |   |    |
|-----|---|----|
| (b) | A cylindrical silo has an internal diameter of 6 m and 20 m deep (cylindrical portion) with a conical hopper bottom. The material stored is wheat with density of 8 kN/m <sup>3</sup> . The coefficient of friction between wall and material is 0.444. The ratio of horizontal to vertical pressure is 0.40. Angle of repose is 25 degree. Design the reinforcements in the walls of silo. Adopt M20 and Fe415 grades. Adopt Janssen's theory for pressure calculations. | 10 |
|-----|---|----|

- Q.4**
- |     |  |      |
|-----|--|------|
| (a) | Design a gantry girder for the following data: | 14   |
|     | Capacity W (kN)                                | 170  |
|     | Weight of crane girder (kN)                    | 120  |
|     | Wheel spacing (mm)                             | 2400 |
|     | Weight of rail (kN/m)                          | 0.65 |

Weight of crab (EOT) (kN)	50
Edge distance (mm)	1100
Span of gantry girder (L m)	8.0
Span of crane (m)	15

**OR**

**Q.4 (a)** Design a chimney of height 100 m and check the stresses at base in bars. Data given: **14**

- a) External diameter at top = 1.7 m
- b) External diameter at base = 6.0 m
- c) Shell thickness at top = 200 mm
- d) Shell thickness at base = 500 mm
- e) Wind Intensity =  $1.8 \text{ kN/m}^2$  throughout
- f) Thickness of fire brick lining = 100 mm
- g) Air Gap = 100 mm
- h) Temperature difference =  $70^\circ\text{C}$
- i) Coefficient of thermal expansion =  $11 \times 10^{-6} / ^\circ\text{C}$
- j)  $E_s = 210 \times 10^3 \text{ N/mm}^2$
- k) Density of brick lining =  $20 \text{ kN/m}^3$
- l) M35 grade of concrete and Fe 415 grade steel

**Q.5 (a)** What are the checks to be carried out for stability analysis of foundation of a chimney? Explain any one in detail. **4**

**(b)** A reinforced concrete chimney 50 m high above ground has an outside diameter of 4 m. The thickness of the shell is 20 cm throughout. Vertical steel is taken as 1 % of the cross sectional area throughout. The total wind load above the base may be taken as 200 kN. Find the stresses developed due to wind and dead load at the base of chimney. Assume modular ratio = 13. **10**

**OR**

**Q.5 (a)** Explain the differences in analysis of bunker wall and silo wall. **4**

**(b)** A grid floor has 120 mm thick slab, floor finish =  $1.2 \text{ kN/m}^2$ , live load  $3.8 \text{ kN/m}^2$  is provided for a hall with overall dimensions of 24 m x 24 m c/c with wall on outer periphery only and 5 interior beams in both direction forming a slab panel of size 4m x 4m. Assume all beams of size 300 x 1200mm (including slab thickness). Design and detail reinforcement in central beam of 24 m long. Use Rankine Grashoff Method. **10**

\*\*\*\*\*

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3170626

Date:14/06/2022

Subject Name:Design of Industrial Structures

Time:02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.
5. Permit use of IS 456: 2000, IS 13920: 2016, IS 800:2007, IS 4995 Part1, 2, SP-16, Steel Table, IS 875 Part3 2015.

MARKS

- Q.1**
- |     |  |           |
|-----|--|-----------|
| (a) | Explain various forces to be considered in design of Gantry Girder | <b>03</b> |
| (b) | Draw the various Roofing system Provided for industrial building   | <b>04</b> |
| (c) | Explain briefly the factor influencing the height of chimney       | <b>07</b> |

- Q.2**
- |     |  |           |
|-----|--|-----------|
| (a) | Write the various loads and load combinations to be taken for design of steel structures as per codal provisions | <b>03</b> |
| (b) | Explain the differences in analysis of bunker wall and silo wall   | <b>04</b> |
| (c) | Why it is necessary to design Truss member for both compression and shear forces                                 | <b>07</b> |

**OR**

- |     |   |           |
|-----|---|-----------|
| (c) | Write down the design procedure adopted for the foundation of chimney | <b>07</b> |
|-----|---|-----------|

- Q.3**
- |     |  |           |
|-----|--|-----------|
| (a) | Explain different types of transmission tower as per structural action.  | <b>04</b> |
| (b) | Design a circular bunker for storing 22Tonnes of coal if the density of coal is 8.5 kN/m <sup>3</sup> . Consider angle of repose = 30° . Design supporting columns and draw reinforcement detailing. Use M-25 grade concrete and Fe-415 grade steel. | <b>10</b> |

**OR**

- Q.3**
- |     |   |           |
|-----|---|-----------|
| (a) | Explain in details about transmission line tower with neat Sketches.  | <b>04</b> |
| (b) | A Reinforced Concrete Grid Floor for a hall has a size of 12 m x 18 m. The spacing of ribs is 1.5 m centre to centre in mutually perpendicular directions. The live load on the floor is 3 kN/m <sup>2</sup> . Analyze the grid floor by Use Rankine Grashoff or IS method. For moments and shears. | <b>10</b> |

- Q.4**
- |     |  |           |
|-----|--|-----------|
| (a) | Design a simply supported gantry girder to be used in an Industrial building for the following data: Crane Capacity = 120 kN Weight of crab = 40 kN Weight of crane (excluding crab) = 165 kN Minimum clearance between crane hook and gantry girder = 1.5 m Wheel base = 3 m Distance between centre to centre of gentries = 25 m Distance between centre to centre of gantry columns = 6 m Crane type = M.O.T. | <b>14</b> |
|-----|--|-----------|

**OR**

- Q.4**
- |     |  |           |
|-----|--|-----------|
| (a) | Calculate Dead load, Live load & Wind load per panel point for a steel roof truss to be provided for factory at Bhuj with the help of following data:<br>1. Spacing and height of truss = 3.5 m and 12 m respectively. | <b>14</b> |
|-----|--|-----------|

2. Span and rise of truss = 12 m and 2.5 m respectively.
3. Nos. of purlins including Ridge and eaves = 10 Nos.
4. Length of shed = 30 m.
5. Roof covering material = A.C. Sheet
6. Probable life of Structure = 25 years.
7. Terrain category and class = Category-II and Class-A
8. Topography of ground = Slope less than 3 degree.
9. Opening of Building = 25% of wall area.

**Q.5 (a) What are the parameters which influence the Design of Bunkers? 04**

**(b) 10**  
A reinforced concrete chimney 90 m high above ground has an outside diameter of 5.5 m. The thickness of the shell is 25 cm throughout. Vertical steel is taken as 1.15 % of the cross sectional area throughout. The total wind load above the base may be taken as 300 kN. Find the stresses developed due to wind and dead load at the base of chimney. Use M25 concrete and Fe500 steel.

**OR**

**Q.5 (a) Distinguish between Bunker and Silos. 04**

**(b) 10**  
A cylindrical silo has an internal diameter of 7 m and 20 m deep (cylindrical portion) with a conical hopper bottom. The material stored is wheat with density of 8.5 kN/m<sup>3</sup>. The coefficient of friction between wall and material is 0.444. The ratio of horizontal to vertical pressure is 0.40. Angle of repose is 25 degree. Design the reinforcements in the walls of silo. Adopt M20 and Fe415 grades. Adopt Janssen's theory for pressure calculations.

\*\*\*\*\*