Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3170626 **Date: 20/05/2026**

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.**

Q.1	**(a)**	Distinguish between Bunkers and Silos with a neat sketch.	**03**
	(b)	Explain various types of loads acting on the transmission line towers. Under what circumstances torsional load occur on them?	**04**
	(c)	Derive the expressions for finding horizontal and vertical pressure exerted by stored material of height 'h' in a Silo using Janssen's theory.	**07**
Q.2	**(a)**	Explain in details about transmission line tower with neat sketches.	**03**
	(b)	Briefly explain the procedure adopted in the design of chimneys and draw typical cross section showing details of reinforcements (Vertical and horizontal).	**04**
	(c)	Briefly explain the approximate analysis of Grid Floors according to IS: 456:2000.	**07**
		OR	
Q.2	**(c)**	Briefly explain the approximate analysis of Grid Floors according to Rankine Grashoff Method.	**07**
Q.3	**(a)**	What are the assumptions made in Janssen's Theory for finding lateral pressures in the silos.	**03**
	(b)	A Silo with diameter 5.0 m, height of cylindrical portion 20 m and central opening of 0.5 m is to be designed to store grains using M25 grade concrete and Fe500 steel. Given the following: Unit weight of grains = 9 kN/m^3 Angle of Internal friction, ϕ = 33° Angle of wall friction = 0.75 ϕ (while filling); 0.6 ϕ (while emptying) Pressure Ratio (p_h / p_V) = 0.5 (while filing) Use Janssen's Theory for pressure calculations. Design the side walls.	**04**
	(c)	Design the hopper bottom of a silo for the data given in previous question [Q.3 (b)]. Show reinforcement detailing with a neat sketch.	**07**
		OR	
Q.3	**(a)**	What are bins? What is the purpose of constructing bins? Give classifications of bins.	**03**
	(b)	Carry out preliminary dimensioning of a rectangular Bunker of capacity 320 kN used to Coal, given: Unit weight of Coal = 8 kN/m^3 Angle of Repose = 35° Use M25 grade concrete and Fe500 steel. Prepare a neat sketch of bunker dimensions.	**04**

(c) Design the side walls and bottom hopper of a rectangular Bunker for the data given in previous question [Q.3 (b) OR]. Show reinforcement detailing with a neat sketch. **07**

Q.4 **(a)** Give the classification of industrial chimneys. **03**

(b) Calculate the load and eccentricity at base section of a R.C. chimney of height 60 m. Given: **04**
External Diameter of Chimney at top = 4.0 m,
Internal Diameter of Chimney at base = 4.8 m,
Shell thickness at top = 200 mm,
Shell thickness at base = 400 mm,
wind intensity = 1.8 kN/m^2 (uniform throughout),
Thickness of fire brick lining = 100 mm,
Air gap = 100 mm,
Temperature difference = 80 °C,
Coefficient of thermal expansion = 11 x 10^{-6} /°C.
Take unit weight of brick lining = 20 kN/m^3 and Modulus of elasticity of steel, Es = 210 x 10^3 N/mm^2. Use M25 grade concrete and Fe415 steel.

(c) Design a R.C. chimney and check the stresses in bars for the data given in previous question [Q.4 (a)]. Show reinforcement detailing at base section of a chimney with a neat sketch. **07**

OR

Q.4 **(a)** Prepare sketches for different types of roof trusses and briefly outline their suitability for different spans. **03**

(b) A roof truss for an industrial building with 15 m span and 120 m length is to be proposed. The roofing is galvanized iron sheeting and terrain is open industrial area and building is class A. The clear height of building at the eaves level is 9 m. Assume appropriate data as per Indian Standard. Fix the configuration of the roof truss. **04**

(c) Compute the member forces and design the members for the governing forces. Prepare a neat sketch of detailing. **07**

Q.5 **(a)** Briefly outline the structural uses of steel towers. **03**

(b) A Reinforced Concrete Grid Floor is to be designed to cover a floor area of 12 m x 16 m. The spacing of the ribs in mutually perpendicular directions is 2.0 m c/c. Live Load on floor is 2 kN/m^2. Adopt M25 grade concrete and Fe500 steel. Assume ends are simply supported. Analyse the Grid Floor by IS: 456:2000 Method. Design the topping slab. **04**

(c) Design the Ribs of a Grid Floor for the data given in previous question [Q.5 (b)]. Show the complete reinforcement detailing of grid floor with a neat sketch. **07**

OR

Q.5 **(a)** Enlist various loads considered in the design of Gantry Girder. **03**

(b) A simply supported Gantry Girder is to be designed to support an electric operated overhead travelling crane considering following data: **04**
Crane capacity = 250 kN,
self-weight of crane girder excluding trolley = 200 kN,
self-weight of trolley = 50 kN
Min. Hook approach (i.e. distance between crane hook and gantry girder) = 1.2 m,
wheel base (i.e. distance between wheels) = 3.2 m,
span of crane girder (i.e. c/c distance between gantry rails) = 16 m,
span of gantry girder = 8 m,
self-weight of rail section = 0.5 kN/m,
Minimum Spacing between cranes = 2 m
Fix the preliminary dimensioning of a gantry section.

(c) Design the Gantry Girder for the data given in previous question [Q.5 (b) OR]. **07**
Checks for buckling and deflections are required.

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