Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3170626 Date:16-01-2023

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 Part1,2, SP-16, And Steel Table.**

Q.1	**(a)**	Give the difference between a Bunker and a Silo.	**03**
	(b)	Describe the importance of Bracings in industrial structures.	**04**
	(c)	Write a brief note on loads acting on Transmission Line Towers.	**07**
Q.2	**(a)**	Enlist structural uses of steel towers.	**03**
	(b)	Draw appropriate figure of square or rectangular bunker and show various structural elements.	**04**
	(c)	Design circular cylindrical bunker to store a weight of 205 kN. The density of stored material is 8.7 kN/m^3. Angle of repose is 30^o. Use M20 grade concrete and Fe 415 steel.	**07**
		OR	
	(c)	Design an angle section for a continuous purlin having a segment span of 3m. It is subjected to UDL of 2 kN/m. Take angle of roof truss is 27^o.	**07**
Q.3		An electrically operated gantry girder has following technical data: Span of crane girder = 15 m, Span of gantry girder = 6.5 m, Crane capacity = 210 kN, Self weight of crane girder = 150 kN, Self weight of trolley = 40kN, Distance between crane hook and the gantry girder = 1.2 m, Wheel base = 3 m, Self weight of rail section = 300 N/m.	
	(a)	Decide preliminary section and check adequacy of the same in bending	**07**
	(b)	Apply checks for shear and deflection	**07**
		OR	
Q.3		A cylindrical silo has an internal diameter of 6 m and 20 m depth (cylindrical portion) with a conical hopper bottom having depth 2.5m and opening of 1m at bottom. The material stored is wheat with density of 7.5 kN/m^3 . The coefficient of friction between wall and material is 0.45. The ratio of horizontal to vertical pressure is 0.40. Angle of repose is 25 degree. Materials are M20 grade concrete and Fe415 grade steel. Adopting Janssen's theory for pressure calculations carryout following	
	(a)	Design cylindrical wall	**07**
	(b)	Design hopper bottom	**07**

Q.4 A square bunker having size 3.1m X 3.1m is to be used to store 300 kN coal. Density of coal is 9.5 kN/m^3 and angle of repose is 30^o. Considering grade of concrete and steel as M20 and Fe 415 respectively, design and detail the following.

(a) Side walls **07**

(b) Hopper bottom **07**

OR

Q.4 **(a)** Write requirements for analysis of Insitu Ribbed Slab (Grid Slab) for using IS 456-2000 method. **4**

(b) A grid floor has following data 1) 100 mm thick slab, 2) floor finish =1.5 kN/m^2, 3) live load 3 kN/m^2 4) overall dimensions of 20 m x 20 m c/c 5) 230mm wall is provided on outer periphery only and 6) 4 interior beams in both direction forming a slab panel of size 4m x 4m. Assume rib size of all beams as 300 x1100mm. Design and detail reinforcement in central beam of 20 m length. Use Rankine-Grashoff theory. **10**

Q.5 Design a chimney for height of 90 m and check the stresses at base in bars. Data given: a) External diameter at top = 3.8 m b) External diameter at base = 5.0 m c) Shell thickness at top = 200 mm d) Shell thickness at base = 400 mm e) Wind Intensity= 2 kN/m^2 throughout f) Thickness of fire brick lining = 100 mm g) Temperature difference = 75 °C h) Coefficient of thermal expansion = 12 x 10^{-6} / °C i) Es=200 GPa j) Density of brick lining = 20 kN/m^3 k) M25 grade of concrete and Fe 415 grade steel **14**

OR

Q.5 An industrial building of size 15 m x 44 m is situated in Ahmedabad. It is on the ground having terrain category 3 and class A. Spacing between two trusses is 5 m c/c. Rise of truss is 3.75 m. Consider 10% wall openings. The truss has total 10 segments. Roofing material is Corrugated GI Sheets with weight 120 N/m^2. Height of eaves above ground level is 18 m. Assuming required suitable data (if necessary) carryout the following.

(a) Fix the configuration of the truss and Calculate Dead Load, Live Load & Wind Load per panel point **07**

(b) Design members meeting at support **07**

****