Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- VII EXAMINATION-SUMMER 2023

Subject Code: 3170515 Date: 17/06/2023

Subject Name: Piping Design

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Question No. 1 is compulsory. Attempt any four out of remaining Six questions.**
1. **Make suitable assumptions wherever necessary.**
2. **Figures to the right indicate full marks.**
3. **Simple and non-programmable scientific calculators are allowed.**

Q.1 Objective Question (MCQ) **Mark**

(a) **07**

1. What is the allowable internal pressure P for Schedule 40 mild steel pipe having ultimate tensile strength (S value) of 65,300 psi.
(a) 1632500 psi
(b) 2,61200 psi
(c) 1632.5 psi
(d) 2,612 psi

2. What is equivalent length of pipe for fittings and valves?
(a) It is the length of fittings of lower size as the pipe creating the same friction loss
(b) It is the length of straight pipe of same size as the fittings creating the same friction loss
(c) It is the length of pipe of same size as the fittings creating the higher friction loss
(d) It is the length of fittings of larger size as the pipe creating the less friction loss

3. Match the following flanges with their proper uses.

1. Tee	A. To connect two pipes with different diameters
2. Reducer	B. Used for closing a pipeline which has an internal thread
3. Pipe nipples	C. To Branch off a pipe at right angles from the supply line
4. Plug	D. To connect two or more pipes of different sizes

(a) 1-B, 2-D, 3-A & 4-C
(b)1-A, 2-D, 3-C & 4-B
(c)1-C, 2-A, 3-D & 4-B
(d)1-B, 2-A, 3-C & 4-D

4. A thin cylindrical shell with internal diameter 125 mm and wall thickness 12 mm is subjected to a steam pressure 10 N/mm². Find circumferential stress in the shell material.
(a) 52.08 N/mm^2
(b) 26.04 N/mm^2

(c) 20.09 N/mm^2
(d) 56.04 N/mm^2

5. A PFD should include
(a) Process Piping
(b) Major equipment symbols, names and identification numbers
(c) Control, valves and valves that affect operation of the system
(d) All of the above

6. Wall thickness of schedule 40 pipe as compared to that of schedule 80 pipe is
(a) More
(b) Less
(c) Same
(d) either more or less

7. Gate valve is used in pipe line to let water flow in ?
(a) one direction
(b) both directions
(c) any direction
(d) none of the above

(b) **07**

1. Which one of the following mechanical properties enables a metal to be made into thin sheets?
(a) Hardness
(b) Toughness
(c) Malleability
(d) Ductility

2. What is the optimum pipe diameter for a flow of dry chlorine gas of 1000 kg/hr having 17.71 kg/m^3 density at 20˚C?
(a) 176.86 mm
(b) 176.86 m
(c) 199.88 mm
(d) 199.88 m

3. Which of the following valve is known as non-return valve?
(a) Check valve
(b) Needle valve
(c) Diaphragm Valve
(d) Plug valve

4. Design pressure is not _____ than the working pressure.
(a) lower
(b) higher
(c) either higher or lower
(d) none of the above

5. Dead load means
(a) the structure's self-weight
(b) traffic loads
(c) soil and Fluid Pressure
(d) flood Loads

6. Hoop Stress is also known as _____
(a) Circumferential stress
(b) Tangential Stress
(c) Allowable Stress
(d) All of the above

7. Pick out the incorrect statements from the following options.
1. The rate of thermal expansion usually depends on pipe material and length of pipe.
2. Bridge Expansion Joints use to prevent harmful effects due to concrete movement.
3. PFD is a detailed form of P&ID.

(a) Only 1

(b) Only 3
(c) Both 1 and 2
(d) All 1, 2, and 3

Q.2	**(a)**	Write the importance of Piping Design in chemical engineering.	**03**
	(b)	Discuss the various locations for pressure taps in orifice meter.	**04**
	(c)	List out and explain various types of flanges.	**07**
Q.3	**(a)**	What is operating pressure and operating temperature for Piping Systems?	**03**
	(b)	Explain different types of piping support in detail.	**04**
	(c)	Briefly explain classification of pipe.	**07**
Q.4	**(a)**	Define Equivalent length of pipe and NPSH.	**03**
	(b)	Explain advantages and disadvantages of the inverted bucket steam trap.	**04**
	(c)	Define: longitudinal and hoop stress. Explain Design equation of longitudinal and hoop stress and Derive relation between hoop stress & longitudinal stress.	**07**
Q.5	**(a)**	Discuss different types of expansion joints and their applications.	**03**
	(b)	Write a short note on pipe Fabrication.	**04**
	(c)	Calculate the pipe size in mm based on following data. Fluid flowing through pipe is carbon monoxide. Discharge pressure of carbon monoxide required from the pipe is atmospheric. Available pressure at inlet of pipe = 50 kPa g, Length of pipe = 4 km, Flow rate of CO = 1500 kg/hr, Temperature of gas = 50˚C, No. of 45˚ elbows = 3, No. of gate valves in pipeline = 2, No. of 90˚ elbows = 6, Viscosity of CO=0.018 mPa-s or cP.	**07**
Q.6	**(a)**	What is water hammer in process plant?	**03**
	(b)	Explain determinations of thickness required by steel pipe for withstanding internal and external pressure.	**04**
	(c)	Compare PFD and P&ID in piping with necessary figure.	**07**
Q.7	**(a)**	Discuss Design Pressure &Design Temperature for Piping Systems.	**03**
	(b)	With a neat sketch explain typical P&I diagrams for shell and tube heat exchanger.	**04**
	(c)	What is steam trap? Explain any one types of steam trap in detail.	**07**

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