Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2723014 **Date: 31/05/2016**

Subject Name: Process Auxiliaries and utilities

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.**

Q.1	(a)	What is instrument air? Discuss with a PFD how instrument air system is operated and treated in a chemical plant.	**07**
	(b)	What are the advantages of handling of materials under vacuum? Give examples of materials which are conveniently transported under vacuum and name some of the vacuum transportation devices.	**07**
Q.2	(a)	What are the functions of insulation? Discuss desirable criteria of insulating materials.	**07**
	(b)	Discuss various factors for pipe selection. What are the criteria of piping layout? State and explain the principle of important pipe fittings with rough sketches.	**07**
		OR	
	(b)	Explain the lubrication requirement in different types of compressors.	**07**
Q.3	(a)	Discuss the basic parts of a centrifugal pump stating their functions. Draw and explain the characteristic curves of centrifugal pumps.	**07**
	(b)	State and explain primary secondary and tertiary treatment methods for waste water. State critically their relative advantages and disadvantages.	**07**
		OR	
Q.3	(a)	State and explain different types of pressure relief devices used in industrial operation. A pressure-relief valve has a pressure setting of 200 bar. Determine the power loss across the valve if all the pump flow of 120 L/min flows back to the reservoir through this valve.	**07**
	(b)	Enlist different types of vacuum pumps with salient features of the major types.	**07**
Q.4	(a)	What is the need to treat water in cooling tower? Discuss treatment operations for water used in cooling tower.	**07**
	(b)	Chlorine is transferred from a storage tank to a reactor via a vaporizer. The vaporizer may be heated by hot water, by steam or by closed circuit heating g using a heat transfer fluid that is inert to chlorine. The vaporizer may be a coil immersed in a heating bath, a vertical tube bundle, a concentric tube unit, or an evaporator. Indicate the relative merits of these different systems and select one method. Develop a piping and instrumentation diagram for the system selected making certain that all temperature, pressure, liquid level and flow control systems and alarms are included for safe operation.	**07**
		OR	
Q.4	(a)	Discuss types, characteristics and application of steam traps.	**07**
	(b)	Mention different steam generation and distribution methods.	**07**

State the selection criteria of valve. List out important valves and state their salient features.

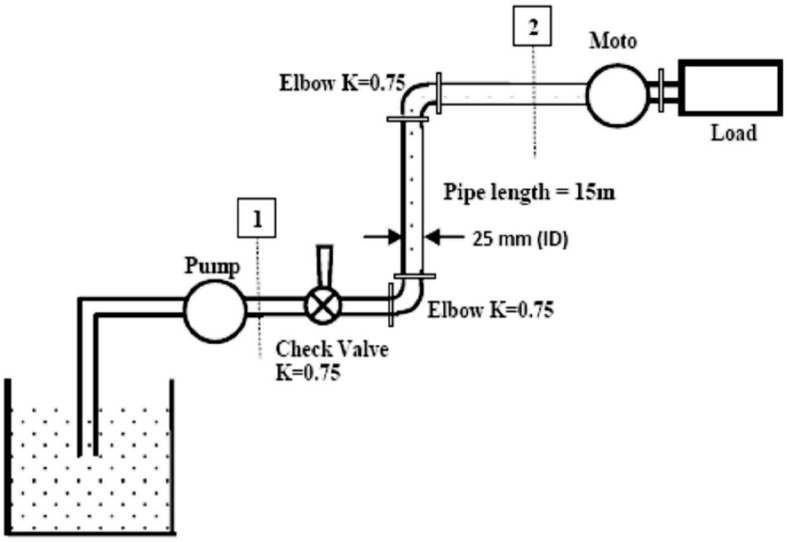
Oil (specific gravity = 0.9 and kinematic viscosity = 0.0001 m^2/s) flows at a rate of 0.002 m^3/s through a 20 mm diameter commercial steel pipe. What is the equivalent length of a 20 mm wide open gate valve placed in the line?

Q.5 (a) Enlist the benefits of nitrogen blanketing. Explain with a diagram how blanketing is done in a storage tank. Explain nitrogen purging. **07**

(b) Discuss major operational problems and treatment methods for the presence of phosphate, silica and dissolved gases in process water for boiler feed. Compare between mechanical and chemical deaeration. List out advantages of ion exchange process over lime soda process for water softening. **07**

OR

Q.5 (a) **07**



The system as shown in the figure contains a pump delivering high pressure oil of specific gravity 0.9 and kinematic viscosity 1.25×10^{-4} m^2/s, to a hydraulic motor. A pipe connects the pump and motor has an inner diameter of 25 mm and length 15 m. The pipe has two elbow fittings (K = 0.75) and one check in valve (K= 4.0). The motor is placed 6m above the pump. The inlet pressure to the motor is 34 bar. Determine the pump discharge pressure, if the discharge from the pump is 150 l/min.

(b) Write a short note on (Any two) **07**

(i) Vapor compression refrigeration (ii) Piping materials (iii) waste heat utilization

****