Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME- SEMESTER II– EXAMINATION – SUMMER 2015

Subject Code: 2723014 **Date: 01/06/2015**

Subject Name: Process Auxiliaries and utilities

Time: 2:30 PM – 5:00 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)	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
	(b)	Describe the characteristics curves of a typical centrifugal pump. List the advantages and disadvantages of centrifugal pump.	07
Q.2	(a)	Discuss primary, secondary and tertiary treatment methods for waste water. State critically their relative merits and demerits.	07
	(b)	Write a short note on (i) Piping Material (ii) Piping insulation	07
		OR	
	(b)	A hydraulic pump delivers oil at 60 bar, 120 l/min into a circuit laid on a horizontal plane. There are four elbows (K = 0.75), one globe valve fully open (K=10) and a direction control valve (pressure drop = 3 bar) with the inside diameter of the pipe as 30 mm. The total length of the straight run pipe is 20m and the specific gravity of the oil is 0.9. The kinematic viscosity of the oil is 0.0001 m^2/s Determine the pressure at the exit point of the pipe.	07
Q.3	(a)	State and explain various types of vacuum pumps and their uses.	07
	(b)	What are the selection criteria of valves? State different types of valves with their uses.	07
		OR	
Q.3	(a)	State and explain different types of flow diagrams for process plants. A process for making a single product involves reacting two liquids in a continuously agitated reactor and distilling the resulting mixture. Unused reactants are recovered as overhead and are recycled. The product is obtained in sufficiently pure form as bottoms from the distillation tower. Prepare a qualitative flow sheet for the process, showing all pieces of equipments. With cross reference to qualitative flow sheet, list each piece of equipment and tabulate for each the information needed concerning chemicals and the process in order to design the equipment.	07
	(b)	Discuss various methods of vacuum development and their limitations.	07

Q.4 (a) What are the general problems that are encountered during the operation of a centrifugal pump? **14**

A tanker carrying toluene is unloaded, using the ship's pumps, to an on-shore storage tank. The pipeline is 225 mm internal diameter and 900 m long. Miscellaneous losses due to fittings, valves, etc. amount 600 equivalent pipe diameters. The maximum liquid level in the storage tank is 30 m above the lowest level of the ship's tank. The ship's tanks are nitrogen blanketed and maintained at a pressure of 1.05 bar. The storage tank has a floating roof, which exerts a pressure of 1.1 bar on the liquid.

The ship must unload 1000 tonne within 5 hrs to avoid demurrage charge. Estimate the power required by the pump. Take pump efficiency 70%. Density of toluene 874 kg/m^3; viscosity 0.62 $mNm^{-2}s$. Friction factor f = 0.0019

OR

(b) Discuss the benefits of nitrogen blanketing in chemical process industries. State with schematic diagrams various design options for nitrogen blanketing in fixed and floating roof tanks. **14**

Write a brief note on nitrogen purging.

Q.5 (a) Discuss major operational problems and treatment methods for the presence of phosphate, silica and dissolved gases in process water as boiler feed. Compare between mechanical and chemical deaeration. **07**

(b) With chemical reaction discuss ion exchange process for water softening. List out advantages of ion exchange process over lime soda process. **07**

OR

Q.5 (a) Discuss major operational problem and treatment methods for cooling towers. **07**

(b) Write short note on (i) steam traps (ii) Vapor compression refrigeration. **07**

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