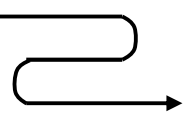
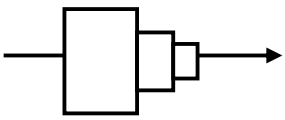
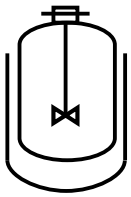
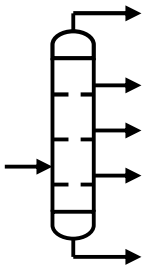
Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: ChE III (Process Technology) – CHCE3028 **Semester: V**
Programme: BTech (FSE) **Time: 03 hrs.**
Max. Marks: 100

Instructions: All questions in Section A, B and C are compulsory. Question no. 9 in section B has an internal choice. Question no. 11 in section C has an internal choice. Give to the point answer.

SECTION A (Maximum marks 20)

S. No.		Marks	COs
Q 1	Give Full forms of (a) P&ID (b) SSP (c) FCC (d) BFD	**4**	CO1
Q2	Identify the following symbols used in P&ID. (a)  (b)  (c)  (d) 	**4**	**CO5**
Q3	Name any four properties that determine the routine mechanical working and joining operations in a process.	**4**	**CO1**
Q4	Name the four processes used for manufacture of soda ash. Which of the processes is the cheapest?	**4**	**CO4**
Q5	In the manufacture of sulphuric acid using contact process, what is the effect of temperature and pressure on the yield of SO_3?	**4**	**CO4**

SECTION B (Maximum marks 40)

Q6	Renewable energy is perceived to provide a sustainable alternative to fossil fuel. What sources of energy qualifies as a renewable energy sources? Explain the advantage and disadvantage of renewable energy sources, in terms of their environmental impact, with the help of example of any two renewable energy sources.	**10**	**CO3**
Q7	What is corrosion? Why corrosion is harmful? Describe the various methods used of prevention of corrosion.	**10**	**CO4**
Q8	In a furnace, while excess air is required to ensure complete combustion, the amount of excess air used has high implication of the efficiency of the furnace. Discuss the effect of amount of excess air used on the efficiency of a furnace. Also, explain the various modes of heat recovery.	**10**	**CO3**

Q9	Explain various elements in a basic control loop with the help of a diagram. What are the various types of process control loops? **OR** Ethanol is feed to continuous reactor in the presence of Sulphuric Acid catalyzer to produce ethylene. Distillation process is then applied to separate ethylene-H_2O mixture. Ethylene as a top product is then cooled with a condenser to produced liquid ethylene. Hydrogenation (addition of H_2) of ethylene is done in another reactor in the presence of Nickel catalyzer to produce ethane as a final product. Develop BFD for this process.	**10**	**CO5**
	SECTION-C (Maximum marks 20) - Question 12 has an internal choice		
Q10	One method of preparing acetaldehyde is by the direct oxidation of ethylene. The process employs a catalytic solution of copper chloride containing small quantities of palladium chloride. The reactions may be summarized as follows: $C_2H_4 + 2CuCl_2 + H_2O \xrightarrow{PdCl_2} CH_3CHO + 2HCl + 2CuCl$ $2CuCl + 2HCl + ½O_2 \rightarrow 2CuCl_2 + H_2O$ In the reaction, $PdCl_2$ is reduced to elemental palladium and HCl, and is reoxidized by $CuCl_2$. During catalyst regeneration the CuCl is reoxidized with oxygen. The reaction and regeneration steps can be conducted separately or together. In the process, 99.8 percent ethylene, 99.5 percent oxygen, and recycle gas are directed to a vertical reactor and are contacted with the catalyst solution under slight pressure. The water evaporated during the reaction absorbs the exothermic heat evolved, and make-up water is fed as necessary to maintain the catalytic solution concentration. The reacted gases are water-scrubbed and the resulting acetaldehyde solution is fed to a distillation column. The tail gas from the scrubber is recycled to the reactor. Inerts are eliminated from the recycle gas in a bleed stream which flows to an auxiliary reactor for additional ethylene conversion. Prepare, in the form of a flow sheet, the sequence of steps in the development of a plant to produce acetaldehyde by this process. An analysis of the points to be considered at each step should be included. List the additional information that will be needed to complete the preliminary design evaluation.		**CO1**
Q11	(a) What are the steps involved in a biological process? Describe briefly. (b) At room temperature sucrose is hydrolyzed by the enzyme sucrase as follows $Sucrose \xrightarrow{Sucrase} Products$ Starting with sucrose (C_{A0} =1 mol/m^3) and sucrase (C_{E0} = 0.01 mol/m^3) the following data are obtained in a batch reactor (concentrations are calculated from optical rotation measurements) C_A, mol/m^3 | 0.68 | 0.16 | 0.006 t, hr | 2 | 6 | 10 Find a rate equation to represent the kinetics of this reaction. **OR**	**20**	**CO2** **CO4**

	What is the role of fertilizer in agriculture industry? Describe in detail the process used for manufacture of Urea. Additionally, describe the various organic alternatives available for fertilizers.		