

Name:  
Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, December 2018**

**Course: ChE III (Process Technology)**  
**Programme: BTech (FSE)**  
**Time: 03 hrs.**

**Semester: V**  
**Max. Marks: 100**

**Instructions:**

**SECTION A (Maximum marks 20)**

S. No.		Marks	COs
Q 1	Balance the following equations and indicate the correct phase of the chemicals. i) $\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{HCl}$ ii) $\text{CaO} + \text{NH}_4^+ \rightarrow \text{NH}_3 + \text{Ca}_2^+ + \text{H}_2\text{O}(l)$ iii) $\text{Na/Hg} + \text{H}_2\text{O} \rightarrow \text{Na}^+ + \text{OH}^- + \text{H}_2 + \text{Hg}$ iv) $\text{Fe}_3\text{O}_4(s) + \text{CO} \rightarrow \text{Fe}(l) + \text{CO}_2$	4	CO4
Q2	An aqueous solution of sodium hydroxide contains 20% NaOH by mass. It is desired to produce an 8% NaOH solution by diluting a stream of the 20% solution with a stream of pure water. i) Calculate the ratios (g H <sub>2</sub> O/g feed solution) and (g product solution/g feed solution). ii) Determine the feed rates of 20% solution and diluting water needed to produce 2310 lb <sub>m</sub> /min of the 8% solution.	4	CO1
Q3	Describe various type of process designs, depending on the accuracy and details required, for carrying out a plant design project?	4	CO1
Q4	Explain the chemical and mechanical pulping process in pulp and paper making process.	4	CO4
Q5	What are the methods used for removal of oils from plant tissues by three methods?	4	CO4
<b>SECTION B (Maximum marks 40) Question 10 has an internal choice</b>			
Q6	Give complete classification of various types of furnaces. What is the role of excess air in furnaces?	8	CO3
Q7	List the main source of raw material for sugar industry. What are the steps involved in manufacture of sugar?	8	CO4
Q8	What are the various environmental impacts of chlor-alkali industry? What can be done to minimize its impact?	8	CO2,4
Q9	Describe in detail various methods used in the manufacture of Chlorine.	8	CO1,4
Q10	What are the steps involved in extraction of Iron using blast furnace? How do we improve the purity of Iron?  <b>Or</b> What is the role of position of an element in the reactivity series on the choice of method used for its manufacture/purification? Describe the problems associated with traditional copper mining and the remedial methods.	8	CO4

**SECTION-C (Maximum marks 40) - Question 12 has an internal choice**

Q11

In a number of separate runs different concentrations of substrate and enzyme are introduced into a batch reactor and allowed to react. After a certain time the reaction is quenched and the vessel contents analyzed. From the results found below find a rate equation to represent the action of enzyme on substrate.

<i>Run</i>	$C_{E0}, \text{mol/m}^3$	$C_{A0}, \text{mol/m}^3$	$C_A, \text{mol/m}^3$	$t, \text{hr}$
1	3	400	10	1
2	2	200	5	1
3	1	20	1	1

**20**

**CO2**

Q12


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.

**OR**

Name the various process used for manufacture of soda ash. Which process is the most economical and why? Explain Solvey Process with the help of a neat diagram. What are the uses of sodium carbonate?

**20**

**CO4**

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**Instructions:**

**SECTION A (Maximum marks 20)**

S. No.		Marks	COs
Q 1	Fertilizers are used to compensate for the absence or shortage of which nutrients?  Write the full form of: (a) TSP (b) SSP	4	CO4
Q2	Anaerobic digestion happens in the absence of _____ (Choose all the correct options) i) Oxygen ii) Molecular oxygen iii) Air iv) Nitrogen  List any two aspects as to why anaerobic digestion is better choice for wastewater treatment compared to aerobic digestion.	4	CO2
Q3	Describe various type of process designs, depending on the accuracy and details required, for carrying out a plant design project?	4	CO1
Q4	What is the use of instrumentation in chemical industry? How it enhances process safety?	4	CO1, 5
Q5	What are the methods used for removal of oils from plant tissues by three methods?	4	CO4

**SECTION B (Maximum marks 40) –Q10 has an internal choice.**

Q6	Give complete classification of various types of furnaces. What is the role of excess air in furnaces?	8	CO1,3
Q7	List the main source of raw material for sugar industry. What are the steps involved in manufacture of sugar?	8	CO4
Q8	What are the various environmental impacts of chlor-alkali industry? What can be done to minimize its impact?	8	CO4
Q9	Describe in detail various methods used in the manufacture of Chlorine.	8	CO1,4
Q10	What are the steps involved in extraction of Iron using blast furnace? How do we improve the purity of Iron?  <b>Or</b> What is the role of position of an element in the reactivity series on the choice of method used for its manufacture/purification? Describe the problems associated with traditional copper mining and the remedial methods.	8	CO4

**SECTION-C (Maximum marks 40) Question 12 has an internal choice**

Q11	Synthesis gas may be prepared by a continuous, noncatalytic conversion of any	20	CO1,
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	<p>hydrocarbon by means of controlled partial combustion in a fire-brick lined reactor. In the basic form of this process, the hydrocarbon and oxidant (oxygen or air) are separately preheated and charged to the reactor. Before entering the reaction zone, the two feed stocks are intimately mixed in a combustion chamber. The heat produced by combustion of part of the hydrocarbon pyrolyzes the remaining hydrocarbons into gas and a small amount of carbon in the reaction zone. The reactor effluent then passes through a waste-heat boiler, a water-wash carbon-removal unit, and a water cooler-scrubber. Carbon is recovered in equipment of simple design in a form which can be used as fuel or in ordinary carbon products. Prepare a simplified equipment flow sheet for the process, with temperatures and pressure conditions at each piece of equipment.</p> <p>Make a material balance and a qualitative flow sheet for the synthesis gas process described above. Assume an operating factor of 95 percent and a feed stock with an analysis of 84.6 percent C, 11.3 percent H<sub>2</sub>, 3.5 percent S, 0.13 percent O<sub>2</sub> 0.4 percent N<sub>2</sub> and 0.07 percent ash (all on a weight basis). The oxidant in this process will be oxygen having a purity of 95 percent. Production is to be 8.2 m<sup>3</sup>/s.</p>		<b>CO5</b>
Q12	<p>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.</p> <p style="text-align: center;"><b>OR</b></p> <p>Name the various process used for manufacture of soda ash. Which process is the most economical and why? Explain Solvey Process with the help of a neat diagram. What are the uses of sodium carbonate?</p>	<b>20</b>	<b>CO4</b>