Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April / May – 2017**

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| **Code :** | **14BT2049** | **Duration :** | **3hrs** |
| **Sub. Name :** | **PROCESS EQUIPMENT DESIGN** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Discuss about the unit operation with symbols (minimum ten). | CO1 | 10 |
| b. | Describe about engineering materials selection for process equipments design. | CO1 | 10 |
| (OR) | | | | |
| 2. | a. | What are the criteria required for selection of plant layout. | CO1 | 10 |
| b. | Discuss about production of ethanol with neat flow sheet. | CO1 | 10 |
| 3. | a. | Write the design procedure of venturimeter with neat sketch. | CO2 | 10 |
|  | b. | Write down the design procedure of fluid flow control equipment with neat block diagram. | CO2 | 10 |
| (OR) | | | | |
| 4. | a. | A properly designed venturimeter has a throat diameter of 30 cm and inlet opening, diameter of 60 cm. If it is inserted in a pipe line of 60cm through which dry chlorine gas is flowing , the reading of the venturimeter connected to a U tube mercury manometer is 1.3 cm of mmHg. Calculate the rate of flow of chlorine gas in kg/ hr. Assume the density of mercury to be 13.6 gm/cc and that of chlorine gas at the conditions involved as 0.009 gm/cc. The co efficient of discharge of venturimeter can be taken as 0.98. | CO2 | 15 |
|  | b. | Distinguish between ventury and orifice meter. | CO2 | 5 |
| 5. | a. | Give the design procedure step by step about the Single effect evaporator . | CO3 | 5 |
|  | b. | A single effect evaporator is fed with 10000 kg/ hr of solution containing 10% solution by weight. Feed temperature is 303K and is to be concentrated to a solution of 20% solute by weight. The evaporator is at atmospheric pressure (101.325 k pa) and area of evaporatoris138m2.Saturated steam is supplied at 143.3 k pa as a heating medium. Calculate steam economy and overall heat transfer coefficient. If the no of tube is 150 , find out the length of tubes. Data: Enthalpy of feed at 303K = 125.79 kJ/ kg,Enthalpy of vapour at 101.325 kpa= 2676.1 kJ/ kg,Enthalpy of saturated steam at 143.325 kpa= 2691.5 kJ/kg, Enthalpy of product= 419.1 kJ/kg, Enthalpy of saturated water at383K= 461.30 kJ/kg, Saturation temperature of steam= 383K Boiling point of solution = boiling point water= 373K | CO3 | 15 |
| (OR) | | | | |
| 6. | a. | Describe in detailed design procedure of 1-1 shell and tube heat exchanger with neat sketch. | CO3 | 5 |
|  | b. | Crude oil flows at the rate of 1000kg/hr through the inside pipe of a double pipe heat exchanger and is heated from 30 ºC to 90 ºC . The heat is supplied by kerosene initially at 200 ºC C flow through the annular space. If the temperature of approach (minimum temperature difference) is 10 ºC, Determine the heat transfer area for co current flow and kerosene flow rate. Data : Specific heat of crude oil= 0.5 kcal/ kg °C, Cp of kerosene is 0.6 kcal/ kg ºC and Uo= 400 kcal/ hr m2 ºC . | CO3 | 15 |
| 7. | a. | It is desired to fractionate a feed mixture of ethanol and propanol containing 65mol%ethanol.To a distillate containing 92mole% ethanol and a residue containing 93mole%propanol.The feed enters as a saturated vapour. i) determine the minimum reflux ratio ii) for a reflux ratio of 4, determine the theoretical number of plates needed and iii)locate the feed plate point at its boiling point.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X | 0 | 0.1 | 0.2 | 0.3 | 0.5 | 0.7 | 0.8 | 0.9 | 1.0 | | Y | 0 | 0.19 | 0.34 | 0.47 | 0. 67 | 0.83 | 0.89 | 0.95 | 1.0 | | CO4 | 15 |
|  | b. | What is gigificance of relative volatility. | CO4 | 5 |
| (OR) | | | | |
| 8. |  | 1000 kg moles/hr of an ethanol propanol mixture containing 65moles% is to separated in a continuous plate column operating at 1 atmosphere total pressure. The desired terminal composition in units of mole fraction of ethanol are XD=0.92, Xw=0.07.The feed is a saturated vapour and total condenser is used. When the reflux flow rate is four times the amount of top product, find the number of theoretical plates required for the separation. Findout the no of stages for total reflux ratio .(Relative volatility=2.10.) | CO4 | 20 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Write down the designing procedure step by step of an ideal batch reactor? | CO5 | 10 |
|  | b. | Describe about the ideal batch reactor. | CO5 | 10 |