Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech (minor) Degree Examination December 2020

Course Code: CHT281

Course Name: INTRODUCTION TO CHEMICAL ENGINEERING

Max. Marks: 100   Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks   Marks

1	List any three chemical industries in India	(3)
2	The weight of an object is 300 N at a location where the acceleration due to gravity is 9.81 m/s^2. Express the mass in the FPS system.	(3)
3	Define (a) Normality (b) Molarity (c) Molality.	(3)
4	Distinguish between unit operations and unit processes with suitable examples.	(3)
5	Identify the phases involved in absorption, drying and leaching operations.	(3)
6	Define (a) Mesh number (b) Saponification number.	(3)
7	Define Reynolds number. Explain how to identify the flow regime using Reynolds number.	(3)
8	Distinguish between homogeneous and heterogeneous reactions.	(3)
9	List any three significant causes of industrial accidents.	(3)
10	There are various solid waste disposal and management methods. List any three methods.	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11	a	Describe the roles of chemical engineers in the industry.	(7)
	b	List any seven major chemical industries. Specify the processes for each of these industries.	(7)
12	a	Write the history and evolution of chemical engineering as a profession.	(7)
	b	Discuss the role of chemical engineers in process development and design.	(7)

Module 2

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13	a	A wet stock of sodium carbonate (Na_2CO_3) containing 18%(wt) water on a dry basis is sent to a drier. The material leaving the dryer contains 1.75%(wt)	(6)

moisture on a dry basis. Determine the percentage (wt %) of water removed in the drying operation.

b Distinguish between vapour pressure and partial pressure. (3)

c Calculate the pressure developed by 1kmol gaseous ammonia contained in a vessel of 0.6 m^3 capacity at a constant temperature of 473 K by the following methods. (5)

     i.   Using the ideal gas equation

     ii.   Using the Vander Waals equation

     (a =0.4233 N m^4/mol^2 ; b = 3.73 x 10^{-5} m^3/mol)

14 a State Dalton's law. (3)

b Pure water and ethanol (C_2H_5OH) are mixed to get a 60% (weight) alcohol solution. The densities of water, alcohol and the solution may be taken to be 998, 798 and 895, respectively, at 293 K. Calculate the following (6)

     i.   The volume percentage of ethanol in the solution at 293 K

     ii.   The molality

     iii.   The molarity

c Thermal conductivity of pure iron is 39 Btu/(ft h ^{0}F), and that of steel containing 1% C is 39 kcal /(m h ^{0}C). Which one is a good conductor of heat, iron or steel? (5)

Module 3

15 a List three size reduction equipments with their mechanism. (3)

b A mixture of benzene and toluene containing 10% by mole benzene is continuously distilled at a rate of 1000 kmol/h in a distillation column. 95% of the benzene in the feed is recovered as a distillate product which contains 98% benzene and 2% toluene. Calculate the moles of the bottom product. (5)

c Explain the types of polymerization reactions. (6)

16 a Differentiate between evaporation and drying. (3)

b A wet paper pulp containing 70% water is dried to remove 60% of the water present. Determine the following (6)

     i. The mass of water removed per 100 kg of wet pulp

     ii. The composition of dried pulp

c Explain the different stages of bio-diesel production. (5)

Module 4

17	a	Explain different modes of heat transfer with the governing equations	(6)
	b	What are elementary reactions? If the following stoichiometric equation represents an elementary reaction, what is the order of the reaction	(3)

$$A + 2B \rightarrow D + 2E$$
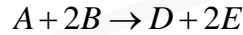
	c	Explain the elements of a feedback control loop.	(5)
18	a	With a neat sketch, explain the working principle of a U-tube manometer.	(6)
	b	Distinguish between yield and conversion.	(3)
	c	Explain the different types of flow diagrams.	(5)

Module 5

19	a	Write down the possible causes of the Bhopal gas tragedy.	(3)
	b	Describe a typical wastewater treatment system.	(6)
	c	Classify solid wastes with suitable examples.	(5)
20	a	Explain the major air pollutants and their effects on human beings, plants and animals.	(7)
	b	Describe the effects of aerial spraying of Endosulfan on residents of Kasargod, Kerala.	(7)

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