MANIPAL UNIVERSITY

FOURTH SEMESTER B.Tech. (CHEMICAL ENGINEERING)
REGULAR EXAMINATION-MAY 2016
SUBJECT: INTRODUCTION TO CHEMICAL ENGINEERING
Open Elective-I (CHE 320)
Answer all five questions

Time: 3 Hrs **Max. Marks: 100**

Instructions to candidates:

- **Answer ALL the questions.**
- **Atomic Mass- Na- 23, K-39.1, C-12. O-16, H-1**
- **Missing data, if any, may be suitably assumed**

1A	Define Chemical Engineering. What does chemical engineer does for living? Explain.	6
1B	A coal combustion has the following ultimate analysis: % by mass Carbon 90 Hydrogen 3 Oxygen 2.5 Nitrogen 1 Sulfur 0.5 Ash 3 Calculate: (a) the volumetric air supply rate required if 500 kg/h of coal is to be burned at 20% excess air and (b) the resulting % CO_2 (dry) by volume in the combustion products.	8
1C	Explain any six contributions of chemical engineers to the society	6
2A	It is estimated that approximately 1.05 $miles^3$ of rock was blasted into the atmosphere as dust during the major eruption of Mt. St. Helens in May, 1980. To how many truckloads of 12 m^3 each does this volume of rock correspond?	7
2B	(a) If you have 10.0 grams of Br_2 and dissolve it in 1.00 L of cyclohexane, what is the molality of the solution? The density of cyclohexane is 0.779 kg/l at room temperature.(MW=159.8 g/mole) (b) 2.0L of an aqueous solution of potassium chloride contains 45.0g of KCl. What is the weight/volume percentage concentration of this solution in g/100mL?	8
2C	Briefly describe about nanotechnology in daily life	5

3A	Explain clearly the gasification process of biofuels and about the gasifier plant.	7
3B	a) When 1.50 mol of $KClO_3$ decomposes. How many grams of O_2 will be produced? [k = 39, Cl = 35.5, O = 16] b) Calculate the volume of carbon dioxide formed at STP in 'dm^3' by the complete thermal decomposition of 3.125 g of pure calcium carbonate (Relative atomic mass of Ca=40, C=12, O=16)	8
3C	Define the terms unit operation and unit process. Write down the classification of unit operations.	5
4A	Calculate the equivalent weights of HCl (MW = 36.5) and $Sr(OH)_2$(MW = 122) in the following reactions: (a) $HCl + Sr(OH)_2 \rightarrow H_2O + Sr(OH)Cl$ (b) $2HCl + Sr(OH)_2 \rightarrow 2H_2O + SrCl_2$	8
4B	What is the mole fraction of each component in a solution made by mixing 300 g of ethanol (C_2H_5OH) and 500 g water?	6
4C	A small teaspoon of sodium hydrogen carbonate (baking soda) weighs 4.2 g. Calculate the moles, mass and volume of carbon dioxide formed when it is thermally decomposed in the oven. $2NaHCO_{3(s)} ==> Na_2CO_{3(s)} + H_2O_{(g)} + CO_{2(g)}$	6
5A	Define Material Balance and with the help of a neat diagram explain the basic principles in material balance using law of conservation of mass.	8
5B	Define a process. Write about process classification.	5
5C	If 35,000kg of whole milk containing 4% fat is to be separated in a 6 hour period into skim milk with 0.45% fat and cream with 45% fat, what are the flow rates of the two output streams from a continuous centrifuge which accomplishes this separation?	7
