MANIPAL UNIVERSITY

FOURTH SEMESTER B.Tech. (CHEMICAL ENGINEERING)
MAKEUP EXAMINATION-MAY 2016
SUBJECT: INTRODUCTION TO CHEMICAL ENGINEERING
Open Elective-I (CHE 3281)
Answer all 5 questions

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

Instructions to candidates:

- **Answer all FIVE FULL 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 and describe any three applications of it in various fields.	8
1B	Calculate the equivalent weights of HNO_3 (MW = 63) and $Ga(OH)_3$(MW = 121) in the following reactions **(a) $3HNO_3 + Ga(OH)_3 \rightarrow 3H_2O + Ga(NO_3)_3$** **(b) $HNO_3 + Ga(OH)_3 \rightarrow H_2O + Ga(OH)_2(NO_3)$** **(c) $2HNO_3 + Ga(OH)_3 \rightarrow 2H_2O + Ga(OH)(NO_3)_2$**	6
1C	Define atomic mass. What is a limiting reagent? How many molecules are there in a 3.46 g sample of hydrogen chloride, HCl? How many moles of HNO_3 are there in28.5 gms of it? How many moles of CH_4 is required to produce 22g of CO_2 after combustion?	6

2A	Define Boyle's, Charle's, and Gay-lussac's laws and provide the relationship between three properties of state as stated in the laws.	6
2B	Calculate the moles of CO_2 formed when 4.30 moles of C_3H_8 reacts with (the required) 21.5 moles of O_2 by balancing the equation. $C_3H_8(g) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$	8
2C	Briefly describe the development of Chemical industries in India.	6
3A	Explain any seven contributions of chemical engineers to the society.	7
3B	Calculate the mass of lithium nitride formed from 56.0 g of nitrogen gas and 56.0 g of lithium metal by find out the limiting reactant in the reaction below. $Li(s) + N_2(g) \rightarrow Li_3N(s)$	8
3C	What are the various types of biomass? With the help of a neat diagram explain about updraft and downdraft gasifiers.	5
4A	Explain about levels of structure(length wise) for the development of materials	6
4B	Solve the following: (a) Convert the length 56.43 ft to its equivalent in units of meters. (b) A particularly fine variety of cheese is sold for \$1.47 per ounce. What is this price in dollars per kilogram?	8
4C	Given the equation $MgCO_{3(s)} + H_2SO_{4(aq)} ==> MgSO_{4(aq)} + H_2O_{(l)} + CO_{2(g)}$. What mass of magnesium carbonate is needed to make 6 dm^3 of carbon dioxide? [A_r's: Mg = 24, C = 12, O = 16, H =1 and S = 32]	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	A gas consists of 70% propane (C_3H_8) and 30% butane (C_4H_{10}) by volume. Find: (a) The stoichiometric air-to-fuel ratio (b) The percentage excess air present if a dry analysis of the combustion products shows 9% CO_2 (assume complete combustion).	7