Q.P. Code: 24527

(3 Hours) **80 Marks**

N.B
1. Question number **one** is compulsory.
2. Attempt any three of the remaining questions.
3. Each question carries equal marks.
4. Figures to the right indicate marks.
5. Make suitable assumptions when required.

1	(a)	Define the following (i) Equivalent weight of the substance (ii) Normality (iii) Molarity (iv) Maolality (v) Excess Reactant	**10**
	(b)	How many kilogram of C2H6 will contain 4 katom of carbon	**05**
	(c)	Five litre solution is prepared by adding 1500 g of sulphuric acid to water. Find (i) Normality (ii) Molarity	**05**
2	(a)	A gas container filled with nitrogen at NTP has a mass of 37.289 g. the same container filled with carbon dioxide at NTP has a mass of 37.440 g. when filled with an unknown gas at NTP, the container mass is 37.0624 g. calculate the molecular weight of the unknown gas and then state its most likely identity.	**10**
	(b)	Benzene and toluene are to be separated, 50,000 kmol/hr of feed is fed to the rectifier. Feed has 45% by wt benzene. Overhead stream has 98% benzene by wt and 8% benzene by wt was found in bottom product. Calculate overhead product rate and % recovery of benzene.	**10**
3	(a)	1000 kg of mixed acid needs to be prepared containing 65% sulfuric acid, 30% nitric acid, and remaining water by blending the following: -11.3% nitric acid, 44.4% sulfuric acid and remaining water. - Aq 90% nitric acid - Aq 98% sulfuric acid Calculate the quantity of each acid required for blending.	**10**
	(b)	Pure sulphur is burnt in a sulphur burner with dry air. Oxygen is used 20% excess above that required for complete combustion of sulphur to sulphur trioxide. The efficiency of burner is such that only 30% of the sulphur burns to sulphur tri oxide and remainder goes to SO2. Calculate: (i) the analysus of the resulting mixture in mole% (ii) the weight of gas per kg of sulphur burnt	**10**
4	(a)	In synthesis of methanol, fresh and feed containing 32% CO, 64% H2 and 4% inerts (by volume) is mixed with recycle feed. Mixed feed entering the reactor results in 20% per pass conversion of CO. the product stream from reactor is fed to condenser where all methanol formed gets condensed and the gases from condenser are recycled. In order to prevent build up of inerts in recycle loop, a small portion of gases leaving the condenser is continuously purged. If mixed feed contains 13 moe% inerts, Calculate: (i) Recycle Ratio (ii) Purge Ratio	**20**

5	(a)	Calculate the heat of formation of ethane gas at 298 K from its elements using Hess Law: Data: Heat of formation of CO2(g) = -393.51 kJ/mol Heat of formation of H2O (l) = -285.83 kJ/mol Heat of combustion of ethane gas at 298 K = - 1560.69 kJ/mol	**10**
	(b)	For an ideal gas mixture prove: pressure% = mole% = Volume %	**10**
6	(a)	Write a short note on (i) Heat of reaction (ii) Heat of formation (iii) Distillation and its applications (iv) Specific Gravity	**20**