# B. E. First Semester (All) / SoE – 2018-19 Examination

**Course Code : GE 2103** **Course Name : Engineering Chemistry**

Time : 3 Hours / 4 Hours ] [ Max. Marks : 60

**Instructions to Candidates :—**

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Due credit will be given to neatness and adequate dimensions.
(4) Assume suitable data wherever necessary.
(5) Diagrams and chemical equations should be given wherever necessary.
(6) Illustrate your answers wherever necessary with the help of neat sketches.
(7) Use of Logarithmic tables, non programmable calculator, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. Solve any **One** (A **or** B) :— (CO 1)

(A) (A1) The following data was obtained when a water sample was analyzed :

$Ca(HCO_3)_2$ = 16·2 ppm, $Mg(HCO_3)_2$ = 73 ppm, $MgSO_4$ = 120 ppm,

$HCl$ = 7·3, $MgCl_2$ = 9·5 ppm, $CaCl_2$ = 11·1 ppm, $SiO_2$ = 5 ppm

Calculate :

(i) Carbonate and non – carbonate hardness.

(ii) The quantity of lime (90% pure) and soda (86% pure) required to soften two lakh liters of this water sample using Sodium aluminate as a coagulant at the rate of 8·2 ppm. 5

(A2) Mention the chemical reactions occurring during boiling of water containing temporary hardness. 1

(A3) Describe break point chlorination graphically and write its advantages. 4

(B) (B1) Write short note on : Reverse osmosis process and caustic embrittlement. 5 (CO 1)

(B2) The hardness of 40000 liters of a water sample was completely removed by a zeolite softener. The zeolite then required 117 liters of NaC*l* solution containing 120 g/liter of NaC*l* for complete regeneration. Calculate the hardness of the water sample. 2

(B3) Explain briefly the principle, advantages and limitations of zeolite process. 3

2. Solve any **One** (A **or** B) :— (CO 2)

(A) (A1) What is the difference between primary and secondary batteries ? Define Power density and Energy density. 4

(A2) Write brief note on fuel cell. 4

(A3) State and explain Faraday's first law of electrolysis. 2

(B) (B1) Describe reactions, advantages, disadvantages and applications of Ni – metal hydride battery. 4 (CO 2)

(B2) Define the following terms :—

(i) Energy efficiency.

(ii) Faraday's second law of electrolysis.

(iii) Shelf life.

(iv) Entropy. 4

(B3) Discuss advantages and disadvantages of Li – ion battery. 2

3. Solve any **One** (A **or** B) :— (CO 2)

(A) (A1) Give reasons for :

(i) Rusting of iron is quicker in saline water.

(ii) Copper equipment should not possess small steel bolt. 3

(A2) What is cathodic protection ? How is it achieved using sacrificial anode and impressed current ? 5

(A3) Differentiate between Galvanizing and Tinning. 2

(B) (B1) How does design and material selection help corrosion control ? 3 (CO 2)

(B2) Write an explanatory note on 'Waterline corrosion'. 3

(B3) Explain mechanisms of electrochemical corrosion :

(1) $H_2$ evolution.

(2) $O_2$ absorption. 4

4. Solve any **One** (A **or** B) :— (CO 3)

(A) (A1) Under which conditions solid lubricants are used ? Discuss how graphite works as a solid lubricant. 5

(A2) An oil sample under test has a Saybolt Universal Viscosity (SUV) of 60 seconds at 210 $^0$F and 600 seconds at 100 $^0$F. A standard Gulf oil has a SUV of 60 seconds at 210 $^0$F and 800 seconds at 100 $^0$F. A Pennsylvanian oil having viscosity of 60 seconds at 210 $^0$F has a SUV of 410 seconds at 100 $^0$F. Calculate the viscosity index of the sample oil. 2

(A3) Define following properties of lubricants with significance :

(i) Flash and fire point. 3

(ii) Saponification value. 3

(B) (B1) Explain any one mechanism of lubrication. 3 (CO 3)

(B2) Define drop point. Give its significance. Describe Drop point test. 4

(B3) Define the following with significance :

(i) Consistency of grease.

(ii) Aniline point. 3

5. Solve any **One** (A **or** B) :— (CO 3)

(A) (A1) The % analysis of coal used for firing a furnace is : C = 82 %, $H_2$ = 4%, S = 4%, $N_2$ = 2·8% and $O_2$ = 3·2%.

Calculate :

(i) Minimum weight and volume of air required for complete combustion of 1 kg of coal.

(ii) The % analysis of dry flue gas by volume if 40% excess air is supplied for combustion. 5

(A2) How is calorific value of a gaseous fuel determined by Boy's gas calorimeter ? 4

(A3) What is proximate analysis of coal ? 1

(B) (B1) The Higher Calorific Value of a gaseous fuel as found out by Boy's calorimeter is 6500 K.Cal./$m^3$. Find out its Net calorific value if the mass of water condensed per $m^3$ of the fuel is 0·2 Kg. 2 (CO 3)

(B2) Differentiate between : (i) Octane number and Cetane number. 3

(B3) Draw a neat and labeled diagram of fixed–bed catalytic cracking process and mention the advantages of catalytic cracking process. 5

6. Solve any **One** (A **or** B) :— (CO 4)

(A) (A1) Describe manufacturing of ordinary Portland cement and write chemical reactions taking place in rotary kiln. 5

(A2) Give the applications of nanomaterial in the field of Medicine. 2

(A3) What are the different types of liquid crystals ? Describe their general properties and applications. 3

(B) (B1) What are the microscopic constituents of Portland cement ? Give their properties. 4 (CO 4)

(B2) Differentiate between Single Walled and Multiple walled carbon Nano tubes. 3

(B3) State and explain AntiMarkovnikov's rule. 3