

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

Course Code : GE 2103

Course Name : Engineering Chemistry

Time : 3 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, is permitted.

1. Solve **A OR B** :— (CO1)

(A1) A water sample has the following analysis :— $\text{Ca}(\text{HCO}_3)_2 = 81 \text{ ppm}$, $\text{Mg}(\text{HCO}_3)_2 = 14.6 \text{ ppm}$, $\text{CaCl}_2 = 55.5 \text{ ppm}$. $\text{MgCl}_2 = 9.5 \text{ ppm}$. $\text{CaSO}_4 = 68 \text{ ppm}$. Calculate :

- (i) Temporary and permanent hardness of water.
- (ii) Amounts of Lime (86% pure) and Soda (90% pure) required to soften one million liters of above water if aluminium sulphate is used as coagulant @ of 57 ppm.

(A2) An exhausted Zeolite softener was regenerated by passing 150 litres of NaCl solution having the strength 100 g/lit of NaCl . How many litres of hard water sample having the hardness of 520 ppm can be softened by this softener ?

(A3) What is caustic embrittlement ? 5+3+2

OR

(B1) Explain briefly the principle, advantages and limitations of deionization process.

(B2) Write principle of Reverse osmosis process and give its applications.

(B3) Give one chemical treatment for removal of dissolved CO_2 . 5+3+2

2. Solve **A** or **B** :— (CO2)

- (A1) Describe the construction and working of H_2 - O_2 fuel cell with diagram, also write the advantages, limitations and applications of it.
- (A2) Give construction and working of Ni-metal hydride battery.
- (A3) What is the difference between primary and secondary batteries ? (Any Two Points). 5+3+2

OR

- (B1) Discuss electrochemistry, characteristics and limitations of Li-ion battery.
- (B2) State and explain Faraday's laws of electrolysis.
- (B3) Define Energy storage density and Power density. 5+3+2

3. Solve **A** or **B** :— (CO2)

- (A1) How does design and material selection help corrosion control ?
- (A2) Explain the H_2 evolution mechanism of electrochemical corrosion.
- (A3) Write an explanatory note on 'Waterline corrosion'. 5+3+2

OR

- (B1) What is cathodic protection ? How is it achieved using sacrificial anode and impressed current ?
- (B2) State various types of films formed during dry corrosion and explain any one of them.
- (B3) Differentiate between Galvanizing and tinning. (Any 4 points) 5+3+2

4. Solve **A** or **B** :— (CO3)

- (A1) Describe any two mechanisms of lubrication.
- (A2) Define flash and Fire point, Acid value and Saponification number.
- (A3) An oil sample under test has a Saybolt universal viscosity same as that of standard Gulf oil and Pennsylvanian oil at 210^0 F. Their Saybolt universal viscosities at 100^0 F are 675, 820 and 540 respectively. Calculate the viscosity index of the sample oil. 5+3+2

OR

- (B1) Under what conditions greases are used as lubricants ? Describe how consistency of grease is measured with penetrometer ?
- (B2) Define following properties of lubricants and discuss the significance of each (any **Two**) :—
- (i) Aniline point
 - (ii) Cloud and pour point
 - (iii) Steam emulsification number.
- (B3) Give the operating conditions, properties required and suitable lubricants for the following machines (any **Two**) :—
- (i) Sewing machine
 - (ii) Transformers
 - (iii) Gears
 - (iv) IC engines. 5+3+2

5. Solve **A** or **B** :— (CO3)

- (A1) The % analysis of a solid fuel is : C = 79% , S = 2.7% , H₂ = 4% and N₂ = 7% , O₂ = 1.6% and rest is ash.
Calculate :
- (i) Minimum weight and volume of air required for complete combustion of unit mass of the fuel.
 - (ii) The % analysis of dry flue gas by volume if 30% excess air is supplied for combustion.
- (A2) Write informative notes on the following (Any **Two**) :—
- (1) CNG
 - (2) Aviation fuels
 - (3) Bio–diesel.
- (A3) Give advantages of CNG. What are its major constituents ? 5+3+2

OR

- (B1) Define octane number. How is it related to chemical structure of petrol ? Name any two doping agents to improve octane number.
- (B2) Explain the significance of following constituents present in coal (Any **Three**) :—
- (1) Moisture
 - (2) Volatile Matter
 - (3) Carbon
 - (4) Ash
 - (5) Sulphur.
- (B3) The Gross Calorific Value of a solid fuel containing 3.5% Hydrogen is 5575 K.Cal/Kg. Find out its Net calorific value. 5+3+2

6. Solve **A** or **B** :— (CO4)

- (A1) Describe manufacturing of ordinary Portland cement and write chemical reactions taking place in rotary kiln.
- (A2) (i) What are 'Smart materials' ? Describe two outstanding properties of Shape Memory Alloys (SMA) as compared to ordinary alloys.
- (A3) Differentiate between Single Walled and Multiwalled carbon Nano tubes. (any 4 points). 5+3+2

OR

- (B1) Define liquid crystals. Give the broad classification of the phases of thermotropic liquid crystals and describe any one of these.
- (B2) What are the microscopic constituents of Portland cement ? Give their properties.
- (B3) Describe setting and hardening of portland cement with the help of chemical reactions. 5+3+2