

B.TECH.
(SEM I) THEORY EXAMINATION 2022-23
ENGINEERING CHEMISTRY

Time: 3 Hours**Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

- (a) Define pour point and cloud point of lubricant.
- (b) A water sample contains 408 mg of CaSO_4 per litre. Calculate the hardness in terms of CaCO_3 equivalent.
- (c) Why TMS is used as standard reference in NMR spectroscopy?
- (d) Define the term mesophase.
- (e) How many phases are present in a system with decomposition of CaCO_3 .
- (f) Give the composition of bio-gas. Write any five raw materials used for biogas production.
- (g) Define optical isomerism with suitable example.
- (h) Classify polymer on the basis of molecular forces.
- (i) Define Chemical Shift.
- (j) Define the term functionality.

SECTION B**2. Attempt any three of the following:****10x3=30**

- (a) Summarize the electrochemical theory of corrosion on the basis of Hydrogen evolution and oxygen absorption mechanism. How corrosion can be prevented by using sacrificial cathodic protection and impressed current cathodic protection.
- (b) What is lubricant? Giving suitable examples classify them and explain the mechanism of lubrication.
- (c) i. Outline the process of Reverse osmosis for the desalination of water.
ii. Calculate the weight and volume of air required for complete combustion of 5 kg of coal.
- (d) Define phase rule. Apply phase rule to water system.
- (e) A sample of water is found to contain the following $\text{Ca}(\text{HCO}_3)_2 = 12.5 \text{ mg/lit}$, $\text{MgSO}_4 = 8.2 \text{ mg/lit}$, $\text{CaCl}_2 = 2.6 \text{ mg/lit}$. Calculate the temporary, permanent and total hardness in ppm, degree clark and degree French.

SECTION C**3. Attempt any one part of the following:****10x1=10**

- (a) A compound having the molecular formula $\text{C}_{10}\text{H}_{13}\text{Cl}$ gave the following ^1H NMR data- δ 1.57 (6H, singlet), δ 3.07 (2H, Singlet), 7.27(5H, singlet). Identify the compound based on proper explanation.
- (b) Discuss the stereochemical implications of SN^1 & SN^2 reaction.

4. Attempt any one part of the following: 10x1=10

- (a) Define the term Chromophore and Auxochrome in UV spectroscopy. An organic compound having molecular formula C_7H_6O shows absorption peaks at 3010, 2700, 1600, 1580, 1520, 1480 and 1270 cm^{-1} in its IR spectrum. Suggest its structure.
- (b) What are ion exchange resins? Discuss their role in ion exchange process of water softening with the help of neat diagram.

5. Attempt any one part of the following: 10x1=10

- (a) With the help of a neat diagram, explain how calorific value is determined by bomb calorimeter. A sample of coal contain C=80%, H=15% and ash=5%. The following data were obtained when the above coal was tested in bomb calorimeter:
Weight of crucible=3.649gm, Weight of crucible+ coal =4.678gm, Weight of water taken= 2200 gm, Water equivalent of bomb & calorimeter = 570 gm, Rise in temperature= 2.3°C , Fuse wire correction= 3.8 Cal, Acid correction= 62.6 Cal, Cooling Correction= 0.0047°C , Cotton thread correction=1.6 Cal.
Calculate gross and net calorific values of the coal, (if the latent heat of steam is 587 cal/g).
- (b) What are conducting polymers? Give their classification. How can we improve the conducting property of a polymer?

6. Attempt any one part of the following: 10x1=10

- (a) Deduce With the help of neat sketch; explain continuous hot Lime soda process for softening of hard water along with its merits and demerits. Calculate the amount of lime and soda required for 125000 lt. of water with following analysis using 10 ppm of NaAlO_2 as coagulant. analysis of raw water = $\text{Ca}^{++} = 95\text{ ppm}$, $\text{Mg}^{2+} = 36\text{ ppm}$, $\text{CO}_2 = 66\text{ ppm}$, $\text{HCO}_3^- = 244\text{ ppm}$, $\text{H}^+ = 2\text{ ppm}$, analysis of treated water $\text{CO}_3^{2-} = 45\text{ ppm}$, $\text{OH}^- = 34\text{ ppm}$.
- (b) What are Organometallic compounds? Give preparation and various application of Grignard reagent.

7. Attempt any one part of the following: 10x1=10

- (a) Comment and explain the composition and various steps involved during Portland cement manufacturing. Also, explain the setting and hardening of cement with relevant chemical reactions involved.
- (b) i. Write preparation, properties and applications of BUNA-S and PMMA
ii. Differentiate between Isotactic, Syndiotactic and Atactic polymer.