(2 Hours) **[Total Marks: 60]**

N.B. (1) Question No.1 is compulsory.
(2) Answer any three questions from the remaining five.
(3) All questions carry equal marks.

Atomic Weights: Ca=40, Mg=24, H=1, C=12, O=16,Cl=35.5,S=32,Na=23,Fe=55.8

Q. 1. Solve any Five: **(15)**

a) Define Phase with example.
b) Distinguish between COD and BOD.
c) Give the preparation, properties and uses of Kevlar.
d) Find the Saponification value of an oil weighing 1.7 gm, reflux with 35 ml of 0.4 N KOH, required 25 ml of 0.4 N HCl for titration. The Blank reading was 35ml of 0.4N HCl.
e) What are the good characteristics of refractories?
f) Explain conducting polymer.
g) Calculate temporary and total hardness of a sample of water containing following impurities;
$Ca(HCO_3)_2$ =162 mg/L,$MgCl_2$=23 mg/L, NaCl=58.5 mg/L,
$Mg(HCO_3)_2$=155 mg/L, $CaCl_2$=111mg/L.

Q.2. **(a)** Calculate the amount of lime and soda (100% pure) required for softening 50,000 liters of hard water containing $CaCO_3$=25ppm, $MgCO_3$=144ppm, $CaCl_2$=111ppm, $MgCl_2$ =95ppm, Na_2SO_4 =15ppm and Fe_2SO_4=25ppm. **(6)**
(b) Explain one component water system with phase diagram. **(5)**
(c) Write any two properties and application of CNT. **(4)**

Q.3. **(a)** Explain any two of the following properties for lubricant with their significance **(6)**
i. Cloud point and Pour point
ii. Flash point and Fire point
iii. Emulsification

(b) Why there is need of vulcanization of rubber? Give the application of Buna S rubber. **(5)**

(c) How many degrees of freedom are present in the following systems: **(4)**

i. $I_2(s) \rightleftharpoons I_2(g)$

ii. $NH_4Cl(s) \rightleftharpoons NH_3(g)+HCl(g)$

iii. Two partially miscible liquids in absence of vapour .

iv. Ag (s) $\rightleftharpoons$ Ag-Pb solution (l) + Pb –Ag Vapour (g)

Q.4. **(a)** What do you mean compounding of plastic? Explain the role of each constituent with example. **(6)**

(b) Explain following **(5)**

i. Explain role of chlorine in disinfection of water.

ii. Explain reverse osmosis and give its application.

(c) 4.6 gm of vegetable oil required 2ml of N/100 KOH during lubrication .From acid Value state whether the oil is useful for lubrication or not. **(4)**

Q.5. (a) Write a note on (any two) **(6)**

i. concrete

ii. silicon carbide

iii. Setting and hardening of cement

(b) Give preparation properties and uses of PMMA and Phenol formaldehyde resin **(5)**

(c) The hardness of 30,000 liters of a sample of water was completely removed by passing it through a zeolite softener .The softener then required 1500 liters of sodium chloride solution containing 234 gm/liter of NaCl for regeneration. Calculate the hardness of the water sample. **(4)**

Q.6. **(a)** Explain following **(6)**

i. Explain principle involve in EDTA method

ii. Draw neat and labeled diagram for ion exchange process

(b) Define fabrication .Explain compression moulding with labeled diagram. **(5)**

(c) Distinguish between Boundary film lubrication and Thick film lubrication **(4)**

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