**PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR**

Even Semester Session 2021-22 CT -I

B. Tech. Second Semester

**Engineering Chemistry (KAS 202T)**

| CO Number | Course Outcome |
|---|---|
| CO1 | To define (Remember L-1) and to cite (Remember L-1) general definitions, terms and laws in engineering chemistry. |
| CO2 | To describe (Understand L-2) principle and working of different apparatuses and chemical processes used in engineering. |
| CO3 | To apply (Application L-3) different chemical formulae in order to calculate (Application L-3) the amount or volume of materials required in various chemical processes and to solve (Application L-3) related numerical problems competently by identifying the essential part of a problem and formulating a strategy for solving the problem. |
| CO4 | To analyze (Analysis L-4) different chemistry topics and their relevancy in the engineering field and to differentiate (Analysis L-4) the relative terms used in chemistry. |

Time: 1.5 Hrs. M. M. 15

## Section -A

**Q1. Attempt all questions:** **(1X3 = 3 Marks)**

a) Describe why graphite acts as a lubricant? CO1

b) Calculate the temporary hardness of water which contains 250 ppm of $Ca(HCO_3)_2$ in °Fr and in mg/L. CO3

c) Discuss the type of defect which cause decrease in the density of NaCl. CO2

## Section-B

**Q2. Attempt all questions:** **(2X4 = 8 Marks)**

a i) Compare and arrange the following in increasing order of their bond dissociation energies: $H_2$, $N_2$ and $C_2$ CO1

**Or**

ii) Compare and arrange the following in increasing order of their bond lengths: $O_2$, $O_2$+ and $O_2^-$ CO1

B i) Discuss the band theory of metals by taking example of Na and also explain different types of materials on the basis of band theory. CO2

**Or**

ii) Discuss the structure, property and application of an allotrope of carbon having truncated icosahedrons geometry. CO2

c i) Explain the formation of HF by drawing suitable molecular orbital diagram. CO2

**Or**

ii) Explain the following: (a) scale & sludge (b) Priming and foaming CO2

d i) Illustrate the process of reverse osmosis along with its advantages and disadvantages. CO3

**Or**

ii) Illustrate the working of zeolite softner along with its merits and demerits. CO3

## Section -C

**(4X1 = 4 Marks)**

**Q3**

i) Outline molecular orbital diagram of CO and $N_2^-$ molecular species. Calculate their bond order and predict their magnetic behaviour. CO4

**Or**

ii) Interpret the reactions involved in lime-soda process of softening of water .The water from the ganga barrage Kanpur has the following the salts after its analysis $Ca(HCO_3)_2$ 100 mg/l; $Mg(HCO_3)_2$ 250 mg/l; $CaCl_2$ 100 mg/l; $MgCl_2$ 150 mg/l; $CaSO_4$ 50 mg/l; NaCl 100 mg/l. Calculate the amount of lime and soda in softening this water. CO4