rogramme	B.Tech	Semester	Winter Semester 2021-22
Course Title	ENGINEERING CHEMISTRY	Course Code	BCHY101L
		Slot	A1+TA1
Faculty Name	Prof. Jayanta Parui	Class Nbr	CH2021222300157
Time	3 Hours	Max. Marks	100

Section A (10 X 10 Marks)
Answer any 10 questions

1. a.) Describe the reasons that enhance the entropy of a system which has temperature more than 0K. Also write the expression of entropy as a function of microstates of a system. **[10]**

   b.) With the help of a reaction, define and write down the mathematical expressions of i. Rate law, ii. Rate constant, iii. Order of reaction and iv. Molecularity.

2. a.) Describe crystal field theory (CFT) explaining the loss of d orbital degeneracy for an octahedral complex. **[10]**

   b.) Write down the chemical aspects for the presence of Mg ion in chlorophyll.

3. Write the factors that influence the stability of the reaction intermediate carbocation. Also write down the respective examples with proper structural formulas. **[10]**

4. a.) Describe the chemistry of Li ion rechargable battery with relevant chemical reactions. Explain the intercalation of Li in an electrode for such battery. **[10]**

   b.) Explain with the drawing of the structure and bonding of Si where on increasing temperature conductivity of semiconductor increases.

5. a.) Draw any of the crystal structure of a compound that belongs to AB type distinguishing the position of cations and anions in it. **[10]**

   b.) Differentiate nano and bulk materials. Describe a top down technique to produce nanoparticle with the related drawings.

6. a.) Diagrammatically draw the maximum possibility of the electronic transitions in a molecule like aniline when interacts with the electromagnetic radiation ranging the wavelength in UV-Visible spectrum. **[10]**

   b.) Draw two different XRD patterns in terms of Intensity vs. 2θ so that they can be identified for crystalline and amorphous material. Also label them appropriately.

7. a.) Write down a working formula and technique that estimate the calorific value of a solid fuel made of hydrocarbon. Also write down at least three distinguishable features of NCV and GCV for such fuel. **[10]**

   b.) Describe a physical vapour deposition (PVD) method with drawings for metal coating on a substrate.

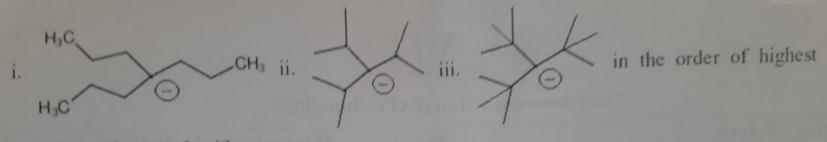8. a.) Draw the structural formulas of the following compounds: **[10]**

   $$Fe(CO)_3(\eta^4 - C_4H_4) \ \& \ Co_2(\mu - CO)_2(CO)_6$$

   b.) 3 mol of an ideal gas expands isothermally and reversibly at 50 °C from a volume of 15 dm^3 to a volume of 30 dm^3. Calculate the work done by the gas in Joules. Also, calculate the change in entropy for the process.

9. a.) Describe a solid oxide fuel cell. Also draw its construction along with related reactions. **[10]**

   b.) Arrange the intermediates

i. (structure with H₃C groups and CH₃) ii. (structure) iii. (structure) in the order of highest

stability to lowest. Justify your answer.

10. a.) Describe water purification through zeolite along with related drawings and chemical [10]
equations. Is this process suitable for the production of deionised water? Justify your answer.

b.) What is OLED? Describe the process of light emission on application electricity across the p-
n junction. [10]

11. a.) Write down the differences between thermosetting and thermoplastic polymers.

b.) Estimate the particle size in nm of the given nanomaterial using p-XRD data:

Peak position $2\theta = 44.88$ degree, FWHM of sample $= 3.1$ degree, $k = 0.9$ and $\lambda = 1.5406$ Å

(degree to radian=Degree×π/180).

12. a.) What is scanning electron microscopy (SEM)? Draw the stages of electron beam [10]
convergences in SEM.

b.) Write down the names of different carbon nanomaterials? Why is it important to disperse
them in liquid phase?