Roll No.:...............

National Institute of Technology, Hamirpur (HP)

Name of the Examination: B.Tech. End-Semester Examination, February 2023

B.Tech	: 1st Year	**Semester**	: 1st
Title of the Course	: Engineering Chemistry	**Course Code**	: CY-101
Time: 3 hours		**Maximum Marks: 50**	

Note: **All questions are compulsory.**

Q 1.   How can nanomaterials be classified based on their dimensions ? Discuss in brief with example.   3

Q 2.   What are IR selection rules? Arrange the following molecules in the increasing order of their $>C=O$ vibrational frequencies in IR spectra: HCHO, CH_3CHO, CH_3COCH_3 with proper justification.   3

Q 3.   Write the necessary conditions for electrochemical corrosion to be occurred.   3

Q 4.   Why antioxidants and detergents are added in the lubricating oils? Explain their functioning.   3

Q 5.   What does happen when a molecule absorbs UV-visible radiation ? Explain why does aniline absorb at 230 nm in neutral and 203 nm in acidic medium ?   3

Q 6.   What is oxidation corrosion ? Explain how corrosion can be controlled by proper designing.   3

Q 7.   Discuss the formation of smog describing the photochemical smog in detail. How does it affect the environment ?   3

Q 8.   Differentiate between the viscosity and viscosity index. If a lubricating oil has viscosity index 90 then what does it mean ?.   3

Q 9.   Differentiate between thick and thin layer lubrication mechanisms.   3

Q 10.   What is softening of water ? Discuss the soda lime method of softening of water in details.   3

Q 11.   (a) What is DSC ? Discuss its working principle with the help of block diagram.

(b) Write short notes on-

(i) BOD   (ii) Carbon credit   (iii) Carbon nanotubes   2+3

Q 12.   What is AFM ? Discuss its detailed working principle. How it is different from SEM ?   5

Q 13.   a) Calculate the amount of lime (92% pure) and soda (98% pure) required for the treatment of the hardness of 30,000 litres of water whose analysis is as follows: $Ca(HCO_3)_2$ = 40.5 mg/L; $Mg(HCO_3)_2$ = 36.5 mg/L; $MgSO_4$ = 30 mg/L; $CaSO_4$ = 34 mg/L, $CaCl_2$ = 27.75 mg/L; NaCl = 10 mg/L

b) 50 ml of a water sample contains 840 ppm of dissolved oxygen. Five days later, the dissolved oxygen value becomes 230 ppm after the sample has been diluted to 80 ml. Calculate the BOD of the water sample.   3+2

Q 14.   (a) What is stress corrosion? Explain caustic embrittlement in boilers.

(b) What do you mean by degree of hardness ? What is the temporary, permanent and total hardness of a 1L of water sample containing 12.2 mg of $Ca(HCO_3)_2$ and 5.6 mg of $MgSO_4$?   2+3