Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

Total No. of Questions : 08

B.Tech. (Agriculture Engineering / Artificial Intelligence & Machine Learning / Artificial Intelligence (AI) and Data Science / Artificial Intelligence / Automation & Robotics / Automobile Engineering / BT / Civil Engineering / Computer Engineering / Electrical & Electronics Engineering / Electrical Engineering / ECE / Electronics & Electrical Engineering / Food Technology / IT / Mechanical Engineering)

B.Tech. (CSE) / (CSE) (Artificial Intelligence & Machine Learning / Cyber Security / Data Science / Internet of Things and Cyber Security including Block Chain Technology)

PIT B.Tech Computer Engg. / PIT B.Tech CSE / PIT B.Tech ECE (Sem.–1, 2)

CHEMISTRY-I

Subject Code : BTCH-101-18
M.Code : 75343
Date of Examination : 10-02-22

Time : 2 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
 1.   **Attempt any FIVE question(s), each question carries 12 marks.**

1.   a)   Explain quantum mechanical expression for the motion of a particle in a 1-D box. Also give important results from the treatment.

     b)   Describe and compare the splitting of d-orbitals under the influence of octahedral and tetrahedral ligand fields. Calculate CFSE value for d8 low spin octahedral and d8 high spin octahedral system.

2.   a)   Discuss the role of doping on the band structure of solids.

     b)   On the basis of MO theory, compare the relative stability of the following species and Indicate their magnetic properties: O_2, O_2 – (Superoxide) and peroxide.

3.   a)   What is the essential condition for a molecule to be IR active? Find the normal modes of vibrations for a molecule of CO_2. Explain UV-transitions.

     b)   What type of nuclei show NMR spectra? How shielded and deshielded protons are represented on TMS scale? Give high resolution HNMR spectrum of ethanol.

4.   a)   What are the reasons for the deviation of real gases from ideal gas behavior? How were they modified in vander Waal's equation?

     b)   Write a detailed note on potential energy surface. Also discuss its application.

5. a) Write short note on :

    i) Electrochemical Corrosion

    ii) Hot soda lime method

    iii) Significance of Ellingham diagram

    b) Explain the Nernst equation & calculate the *e.m.f* of the following cell at 298K :

    $Cu(s)|Cu\,2+\,(0.130M)||Ag + (1.0 \times 10^{-4}\,M)|Ag(s)$

    Also calculate the equilibrium constant for the reaction.

    $Cu(s) + 2\,Ag + (aq) \rightarrow Cu\,2+ (aq) + 2\,Ag(s)$

6. a) Suppose in an atom electrons are present in three different orbitals 3p, 5d and 5s. Arrange these electrons in there orbitals in increasing order of effective nuclear charge.

    b) Give the significance of the following :

    i) Fazan's Rules

    ii) HSAB principle

    iii) Electron affinity

7. a) Explain the terms :

    i) Enantiomerism

    ii) Mesocompounds

    iii) Optical activity

    b) How do you assign the configuration of a chirality center using R, S system? Explain with the help of Tartaric acid.

8. a) Discuss the synthesis of a commonly used drug molecule by taking suitable example.

    b) Write short notes on the following organic reactions :

    i) Hydration of alkene

    ii) Ring opening reactions