2063
B.E., First Semester
ASC-X01: Applied Chemistry
(Common with CSE, MEC, ECE, EEE, IT & Civil)

Time allowed: 3 Hours

Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. I which is compulsory and selecting two questions from each Section.*
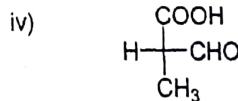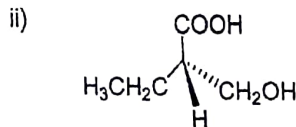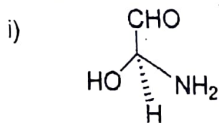
x-x-x

1. (a) Why the addition of hydrogen molecule in the Willkinson's catalyst is known as oxidative addition?

(b) What is optical rotation? Give one example of a molecule that can show optical rotation without having a chiral carbon.

(c) Define the following terms in the context of infrared (IR) spectroscopy.

  i) Fundamental vibrations   ii) Hot bands

(d) How 'nylon 6' can be obtained by the ring opening polymerization?

(e) State the conditions when ΔH becomes equal to ΔE for a chemical reaction.

$2 \times 5 = 10$

SECTION-A

2. (a) Discuss the chemical resolution to separate a racemic mixture of 2-butanol.   4

(b) Assign R/S or cis/trans-configuration (wherever applicable) to the following;   6

i)
$$CHO$$
$$HO \cdots C \cdots NH_2$$
$$H$$

ii)
$$COOH$$
$$H_3CH_2C \cdots C \cdots{}^{''}CH_2OH$$
$$H$$

iii)
$$HO \text{—⬡—} OH$$

iv)
$$COOH$$
$$H \text{—}C\text{—}CHO$$
$$CH_3$$

3. (a) Discuss the crystal field splitting in the case of tetrahedral metal-ligand complexes.

6

(b) Explain the geometry, hybridization and magnetic behavior of $[Ni(CN)_4]^{2-}$ complex on the basis of valence bond theory.   4

P.T.O.

4. (a) How primary, secondary and tertiary amines can be distinguished on the basis of IR spectroscopy?   3

(b) How many modes of vibrations are possible in the case of CO_2 molecule? Draw their diagrams and explain which vibrations will be IR active and inactive?   3

(c) Calculate λ_{max} value for the following dienes;   4

i)

ii)
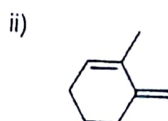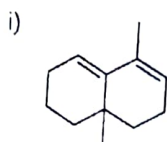
SECTION-B

5. (a) Calculate the value of w, ΔE and ΔH in the isothermal and reversible expansion of 64 grams of oxygen at 410 K from an initial volume of 20 litres to a final volume of 60 litres. Assume oxygen behaves ideally.   5

(b) State the Carnot Theorem. How it led to the concept of entropy? Show that ΔS_{system} + $\Delta S_{surrounding} \geq 0$.   5

6. (a) Explain the mechanism of Monsanto process in detail.   4

(b) What is enzyme catalysis? Derive the Michaelis-Menten equation. Under what conditions, the rate of enzyme catalyzed reactions becomes half of the maximum rate.

6

7. (a) How polymers can be classified based on their stereochemistry?   3

(b) Explain the mechanism for the free radical polymerization of propene?   7

x-x-x