Q.1. Select the best option/answer and fill in the appropriate box on the Answer Sheet. (20)

(i) The orbitals providing the most efficient overlap are:
   (a) s–s  (b) p–p  (c) sp–sp  (d) sp²–sp²

(ii) Nylon is a copolymer of:
   (a) Urea and Formaldehyde  (b) Phenol and Formaldehyde
   (c) Hexamethylenediamine and adipic acid  (d) Vinyl Chloride and Vinylalcohol

(iii) Which of the following would react with one mole of Grignard’s reagent to yield a ketone?
   (a) RCONR’ R”  (b) RCONHR’  (c) RCONH₂  (d) RCOOH

(iv) Glyceraldehyde has one of the following properties:
   (a) One asymmetric carbon atom  (b) Two asymmetric carbon atoms
   (c) A meso compound  (d) Four asymmetric carbon atoms

(v) The antifreeze compound ethylene glycol has the formula:
   (a) C₂H₅OH  (b) CH₃OH  (c) C₂H₄(OH)₂  (d) C₃H₅(OH)₃

(vi) Distillation is the best method for separating the two substances in which of the following:
   (a) Water and salt dissolved  (b) Water and a substance which does not dissolve in it
   (c) Two liquids that have different boiling points  (d) Two solids that have different melting points.

(vii) Which of the following describes “Amino” group as a substituent in electrophilic aromatic substitution.
   (a) Weakly activating and O/P – directing  (b) Strongly activating and O/P – directing
   (c) Weakly deactivating, meta-directing  (d) Strongly activating, meta-directing

(viii) Which would be the best solvent to conduct this reaction.
   \[ \text{CH}_3\text{CH}_2\text{Br} + \text{Mg} \rightarrow \text{BrMgCH}_2\text{CH}_3 \]
   (a) Acetone  (b) Acetonitrile  (c) Diethylether  (d) Ethylacetate

(ix) If \( K_1 < K_2 \) which of the following rate laws is consistent with the mechanism proposed for the conversion of \( \text{NO}_3^+ + \text{NO} \rightarrow 2\text{NO}_2^- \)?
   \[
   \text{NO}_3^- + \text{NO}_3^- \xrightarrow{K_1} \text{N}_2\text{O}_5^- \\
   \text{NO} + \text{N}_2\text{O}_3^- \xrightarrow{K_2} 3\text{NO}_3^- \\
   \]
   (a) \( \frac{d[\text{NO}_3^-]}{dt} = K_1K_2[\text{NO}_2^-][\text{NO}_3^-] \)  (b) \( \frac{d[\text{NO}_3^-]}{dt} = -K_1K_2[\text{NO}_2^-][\text{NO}_3^-] \)
   (c) \( \frac{d[\text{NO}_3^-]}{dt} = -K_1K_2[\text{NO}_2^-][\text{NO}] \)  (d) \( \frac{d[\text{NO}_3^-]}{dt} = -K_1[\text{NO}_2^-][\text{NO}_3^-] \)

(x) Which of the following is the best description of the geometry of \( \text{PCl}_5 \)?
   (a) Tetrahedral  (b) Trigonal Pyramid  (c) Trigonal bipyramid  (d) Square pyramid.

(xi) This reaction could successfully be performed using which one of the following reagents.
   (a) \( \text{Ph}_3\text{PCH}_2 \)  (b) \( \text{CH}_3\text{OCOCH}_2\text{COOCH}_3 \)  (c) \( \text{CH}_2\text{Br}_2 \)  (d) \( \text{PCC} \)
Q.2. (a) Explain the structure of Grignard’s reagent. (6)
(b) Explain how aldehydes, ketones, carboxylic acids, hydrocarbons and alcohols can be synthesized from Grignard’s reagent. (10)
(c) Complete the following reaction.

\[
\begin{array}{c}
\text{Br} \\
\text{Mg/Ether}
\end{array}
\xrightarrow{?} \begin{array}{c}
\text{Chloranil} \\
? \begin{array}{c}
\text{O}
\end{array}
\end{array}
\]

Q.3. (a) How will you synthesize the following starting from benzene. (2+5+3)
(i) Acetophenone (ii) 1,3,5-tribromobenzene (iii) n-propyl benzene
(b) Explain in electrophilic aromatic substitution “Halogens” are deactivating but O, p–directing. Explain. (5)
(c) Sulphonation is reversible reaction at high temperature. Discuss its merits.. (5)

Q.4. (a) Describe various methods to determine the order of reaction. (9)
(b) What is the third order reaction. Give examples. (4)
(c) Derive the Kinetic equation for 3rd order reaction. (7)

Q.5. (a) Can we prepare the Aliphatic diazonium salt. If yes, give examples. (3)
(b) How can the following prepared from benzene diazonium salt. (3+5+4)
(i) Benzene (ii) m-nitrophenol (iii) Biphenyl
(c) Write a note on Sandmeyer reaction. (5)

Q.6. (a) Describe the exact source of raw material used in Petrochemicals. (3)
(b) Give Industrial synthesis of vinylacetate. (10)
(c) Describe the production of Vitamin-C from Glucose. (7)

Q.7. (a) Describe the synthesis of streptomycin. (6)
(b) Discuss the role of Fermentation in Organic Synthesis. (4)
(c) Give synthesis of polypropylene and its uses. (10)

Q.8. (a) What is Margarine? How it is manufactured industrially? (10)
(b) Nicotine on Oxidation with KMnO4 gave. Nicotinic acid. Write structures of nicotine, nicotinic acid and two other isomer of nicotinic acid. (6)
(c) Write a note on epimerization. (4)