Question No. 1  

(23 marks, ∼ 34 min)

(A) The next compound is a peptide containing 4 parts A, B, C and D. Concerning this peptide, answer the next questions:

(7.5 marks)

[Chemical structure image]

1) Is it tripeptide?
2) What do you call parts A, B, C and D?
3) Using the Edman Degradation method, draw the products after the reaction of this peptide with phenylsulfonfyl cyanate.
4) Does this peptide contain hydrophilic amino acid
5) When you replace part C by cysteine, draw the produced peptide and give its name.
6) Give an example for cyclic amino acid?

(B) Write a short account on each of the following (using equations). (8 marks)

1) A lots of nitrosoamine derivatives are considered as carcinogenic agents.
2) Formation of nitrosyl cation.
3) Preparation of CH₃CH₂NH₂ using Gabriel synthesis.
4) When 1,1-dimethylpropylamine is nitrosated it will give the alkyl diazonium ion which upon subsequent hydrolysis it will afford 2-methyl-2-butanol (80%).

(C) Show how the following amines could be prepared from an aldehyde or ketone and ammonia or amine by reduction alkylation / amination: (4.5 marks)
D) The halide anion of quaternary ammonium iodides may be used to give the less substituted alkene. On the light of this statement and considering the next equation as a guide, apply this reaction on sec-butyltrimethylammonium hydroxide.

\[
\begin{array}{c}
\text{CH}_2\text{N(CH}_3)_3\text{I}^- \\
\text{Cyclohexane} \xrightarrow{\text{Ag}_2\text{O}} \text{Cyclohexane} \xrightarrow{160 \degree \text{C}} \\
\text{CH}_2\text{N(CH}_3)_3\text{OH} \\
\end{array}
\]

\[
\begin{array}{c}
\text{1} \quad \text{N(CH}_3)_3 \\
\text{H}_2\text{O} + \text{H}_2\text{O} \\
\end{array}
\]

\[
\text{Question No. 2} 
\]

(A) MCQ:

1. The correct IUPAC name, if any, for the following structure is:

\[
\text{HO} \quad \text{O} \quad \text{COOH}
\]

1- (Z)-6-hydroxy-5-oxohex-3-enoic acid 2- (E)-1-hydroxy-6-carboxy-3-hexen-2-one
3- Hydroxymethyl-4-(but-2-enoic)-ketone 4- 2- (Z)-6-hydroxy-5-oxohex-3-enoic acid

11. The correct structure for 5-formylcyclopent-2-ene carboxylic acid is:

\[
\begin{array}{c}
\text{1} & \text{2} & \text{3} & \text{4} \\
\end{array}
\]

\[
\begin{array}{c}
\text{OHC} \quad \text{COOH} \\
\text{OHC} \\
\text{HOOC} \quad \text{CHO} \\
\end{array}
\]
III- The next structure can be prepared as follows:

1- Starting from 4-methyl-5-oxooctane by aldol condensation
2- Starting from 2,6-dimethylcyclohexanone by bromination followed by dehydrobromination.
3- Starting from 3-hydroxy-2,6-dimethylcyclohexanone by dehydrobromination.
4- Starting from 2,4-dimethyl-3-oxocyclohexanoic acid by decarboxylation.

IV- The next structure satisfies all the following except:

1- $\alpha, \beta$-Keto ester
2- An $\alpha, \beta$-unsaturated carboxylic acid
3- Contain an active $\alpha$-hydrogen atom.
4- Give a unique product when reacted with HCN / NaCN.

V- Which one of the following conversions of compound 1 into 2-5, if any, is false?

1- Conversion of 1 $\longrightarrow$ 2 involve protection of carbonyl with HSCH$_2$CH$_2$SH, then reduction with LiAlH$_4$ and hydrolysis with H$_2$O$^+$
2- Conversion of 1 $\longrightarrow$ 3 involve reduction with NaBH$_4$
3- Conversion of 1 $\longrightarrow$ 4 involve reduction with LiAlH$_4$
4- Conversion of 1 $\longrightarrow$ 5 involve hydrogenation with heat/pressure/Zn/H$_2$
VI- Which one, if any, of the indicated reagent(s) in the following transformations is false:

(B) Discuss the reaction mechanism of aldol condensation followed by dehydration starting from formaldehyde and acetone in NaOH as catalyst. (4 Marks)

(C) Explain by equation or drawing Two only of the following: (4.5 Marks)
1) Reactivity of an enamine.
2) Enol form of 1,3-cyclohexanediione.
3) Loss of chirality in (R) -3-phenyl-2-butanone.

Question No. 3 (16.5 marks, ~24 min)

A) Give the IUPAC Name for each of the following: (4 points)

1) [Image of a chemical structure]

2) [Image of a chemical structure]

3) [Image of a chemical structure]

4) [Image of a chemical structure]
B) Draw the structure of the following abbreviation: (3 points)

1- Pencilline V       2- Cephalexin       3- LTBA

C) Discuss by equation the following statements: (3.5 points)

1- The reaction mechanism of Arndt-Eistert synthesis for conversion of acetyl chloride to amide.
2- Reformatoky reaction for preparation of α,β-unsaturated acid.

D) Complete the following equation and mention name of the reaction 1 & 2: (6 points)

1- \[ \text{C}_{6}H_{5} + \text{C}_{4}H_{6}O_{3} \xrightarrow{\text{AlCl}_3} \text{Product} \]

2- \[ 2\text{CH}_3\text{COOC}_2\text{H}_5 \xrightarrow{1. \text{NaOC}_2\text{H}_5} \xrightarrow{2. \text{H}_2\text{O}^+} \]

3- \[ \text{Phosgene} + \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{} \text{Product} \]

4- \[ \text{H}_2\text{C}==\text{CHCHO} \xrightarrow{\text{HBr}} \xrightarrow{\text{HNO}_3} \text{Product} \]

**Question No. 4** (17 marks, ~ 28 min)

A) Give the structure of the missed product(s) and/or supply the required information about the following reactions: (7 Marks)

1- D-Mannose \[ \xrightarrow{\text{NaBH}_4} \xrightarrow{5\text{HIO}_4} \text{Product} \]

2- \[ \text{HO} \quad \text{HO} \quad \text{HO} \quad \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{CH}_2\text{OH} \xrightarrow{\text{C}_2\text{H}_5\text{OH}/\text{HCl}} \text{Product} \]

Give also the name of this product

3- Glucose + \text{PhNHNH}_2 \xrightarrow{} \text{Product} \xrightarrow{1) \text{HCl}} \xrightarrow{2) \text{Zn/HAc}} \text{Product}

4- Cellulose \xrightarrow{\beta-\text{Amylase}} \text{Product} \text{ give only the name of the produced disaccharide and indicate its glycosidic linkage}
B) Complete each of the following statements by giving only the missed suitable words (a-f):

1- The two anomeric forms of D-glucose are ......(a)...... and ......(b)......, which are interchangeable. This interchange is accompanied by either an ... (c)...... or a ......(d)...... In the specific rotation till an equilibrium is reached, where the more stable ...(e)...... form predominates. This phenomenon is known as ......(f)...... .

2- Galactose and mannose both are ......(a)...... of glucose, but only the latter gives the same ......(b)...... as glucose when treated with phenyldrazine. Also D-glucose and D-mannose are the products of the Killiani-Fischer method when applied on ......(c)...... the reaction conditions of these ascending method is ......(d)...... .

D) An D-aldopentose (A) on oxidation with nitric acid gave an optically inactive aldaric acid (B). Treating (A) with Br₂/H₂O then H₂O₂/FeSO₄ gave another aldose (C) which on reduction with NaBH₄ an optically inactive alditol (D) is obtained. Show by equations the structures of A, B, C, and D. (3 Marks)

***** GOOD LUCK *****