University of Mumbai

Bachelor of Science (Yearly Pattern) 2010 - 2011 March

Semester 5 (TYBSc)

Organic Chemistry

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(3 Hours) [Total Marks : 100

N.B. : (1) **All** questions are **compulsory**.
(2) **Figures** to the **right** indicate **full** marks.
(3) Use of **Logtables/Non-programmable** calculator is **allowed**.

1. (a) Explain the mechanism of radical polymerisation. 3

OR

(a) Explain condensation polymerisation with one example. 3

(b) Discuss the stereochemistry of biphenyls. 3

OR

(b) Explain the stereochemistry of SN^1 reaction with one example. 3

(c) What are polysaccharides ? What is the action of following reagents on D(+) glucose :– 3

(i) $NaBH_4$ (ii) Periodic acid.

OR

(c) Explain mutarotation with its mechanism. 3

(d) Discuss the mechanism of E_2 reaction with suitable example. 3

OR

(d) Give the mechanism of acid catalysed esterification of carboxylic acid. 3

(e) What are organometallic compounds ? Give the preparation of iodomethylzinc iodide. 2

OR

(e) Write any two methods for the preparation of organolithium compounds. 2

(f) What is green chemistry ? Explain any one principle of it. 2

OR

(f) Calculate the percentage atom economy of following reaction :– 2

$$CH_3CH_2Br + KOH \xrightarrow[\Delta]{H_2O} CH_3CH_2OH + KBr.$$

(At. Wt. C = 12, H = 1, Br = 80, K = 39, O = 16)

(g) What are the different types of electronic transitions possible in a molecule during uv-spectroscopy ? 2

OR

(g) How are the following compounds distinguished by IR spectroscopy. 2

i) CH_3CH_2OH and $CH_3-\overset{O}{\overset{\|}{C}}-C_2H_5$

ii) CH_3-O-CH_3 and CH_3CH_2OH

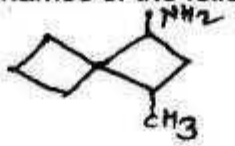
(h) What are Vitamins ? Write the structure of Vitamin A. 2

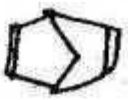
OR

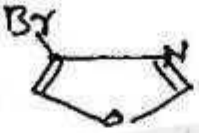
(h) Explain gem-dialkyl rule. 2

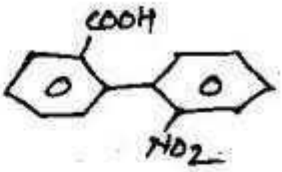
[TURN OVER

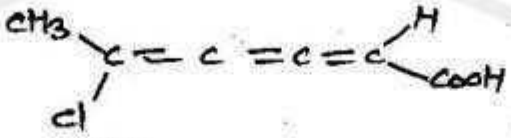
2. (a) Give IUPAC names of the following :– 5

i) 

ii) 

iii) 

iv) 

v) 

OR

(a) (i) Give the structural formulae of the following – 5

(1) 2–Chlorobicyclo [3·2·1] octane

(2) Spiro [4 · 5] dec–2–ene

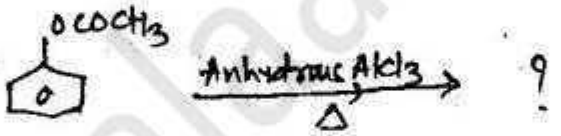
(3) 2–chloro–1,3–diazine.

(ii) Give the reaction of following reagents on acetaldehyde –

(1) Hydroxylamine (2) Phenylhydrazine.

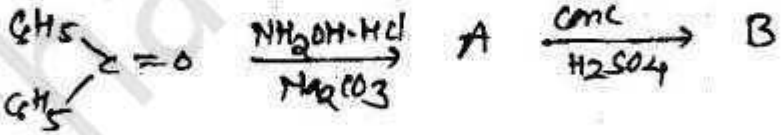
(b) (i) What is pinacol - pinacolone rearrangement ? Give its mechanism 5

(ii) Complete the reaction –



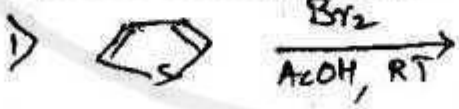
OR

(i) Discuss the mechanism of Lossen rearrangement reaction 5

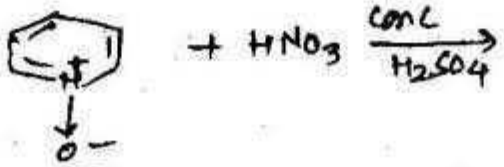
(ii) 

(c) (i) 'Pyridine–N–Oxide undergoes electrophilic substitution at 2,4,6 positions'. Explain. 5

(ii) Complete the following reactions –

1) 

2) 

3) 

OR

(c) (i) Write two methods for preparation of thiophene 5
(ii) How will you convert –
(1) Furan to furan–2–sulphonic acid
(2) Thiophene to 2–acetylthiophene
(3) 4–picoline to isonicotinic acid ?

(d) (i) Write the synthesis of nephedipin. 5
(ii) Explain aromacity of furan.

OR

(d) (i) Write the synthesis of H acid 5
(ii) How will you convert acetylene to thiophene ?

3. (a) (i) Draw the conformations of cyclohexane. 'Chair form of cyclohexane is more stable than boat form'. Explain. 5
(ii) Explain : Steric strain.

(b) (i) Give analytical evidence for the presence of following in tropine. 5
(1) Secondary alcoholic group (2) >N–CH_3 group.
(ii) Distinguish between thermal and photochemical reactions.

(c) What are stereospecific reactions ? Explain the mechanism and stereochemistry of addition of bromine to 2–butene. 5

(d) How will you prove the following – 5
(i) Tropic acid contains a benzene ring with one side chain.
(ii) Atropine is an ester.
(iii) α– pinene is bicyclic.
(iv) Tropinone contains $-CH_2-\overset{\overset{O}{\|}}{C}-CH_2-$ group
(v) Presence of olefinic double bond in α–pinene.

OR

3. (p) (i) Explain regioselectivity using the addition of HBr to 1,3–butadiene. 5
(ii) Define the following –
(1) Plane of Symmetry
(2) Centre of Symmetry.

(q) (i) Write the structure of camphor and vitamin C 5
(ii) Give the synthesis of tropine from succinaldehyde.

(r) What are stereoselective reactions ? Complete the following reactions and explain their mechanism with stereochemistry. 5

i) Cis-2-butene $\xrightarrow[KMnO_4]{\text{alkaline}}$ A

ii) Trans-2,3-dimethyl oxirane $\xrightarrow[\text{Hydrolysis}]{\text{Acid}}$ B

(s) (i) Explain photochemical reduction of benzophenone to benzpinacol. 5
(ii) Explain Norrish type-I reaction.

4. (a) (i) Describe preparation and uses of phenol-formaldehyde resin. 5
(ii) Write complete reactions to represent the polymerization of –
(1) Vinyl chloride (2) Styrene

OR

(a) (i) Describe the preparation and uses of terylene. 5

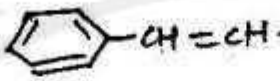
(ii) Give the structure and use of –

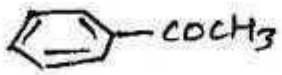
(1) PAN (2) Polyurethan.

(b) (i) Explain with example the use stabilizers in the manufacture of polymers. 5

(ii) Complete the following reactions :–

1)  MnO_2 → A

2)  $NaBH_4$ · B

3)  i) NH_2NH_2, ii) KOH, Δ → C

OR

(b) (i) Explain the uses mCPBA and LAH in synthetic organic chemistry. 5

(ii) Explain Oppenaur oxidation with suitable example.

(c) (i) Explain magnetic anisotropic effect on aromatic proton.

(ii) What is 'base ion peak' in mass spectrum ? Give the fragmentation pattern of ethyl methyl ketone. 5

OR

(c) (i) Give the number of signals and splitting pattern in PMR spectra of – 5

(1) 2, 2– dichlorobutane

(2) Ethyl propionate.

(ii) Explain the importance of D_2O exchange.

(d) Define : Chromophore

An organic compound having M.F. C_4H_8O showed the following spectral data – 5

IR (cm^{-1}) — 1740 cm^{-1}

PMR (δ, ppm) - 1·1 (d,6H) ; 2·3 (m, 1H) ;
9·4 (d, 1H).

Assign the structure to the compound and justify your answer.

OR

(d) Define : Hyperchromic effect. 5

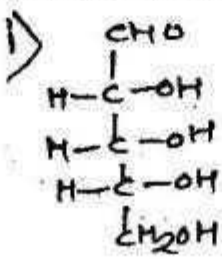
An organic compound having M.F. $C_5H_{10}O$

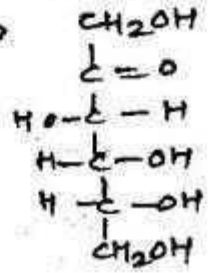
Showed the following spectral data –

IR (cm^{-1}) : 1720

PMR δ (ppm) : 1·2 (d,6H) ; 2·2 (s,3H) ;
2·8 (m, 1H).

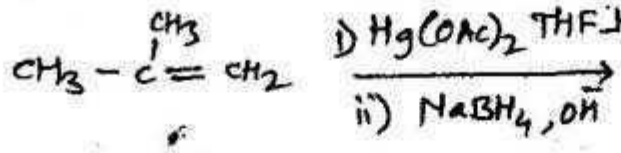
5. (a) (i) Convert the following open chain structure to Haworth pyranose (β-form) structure :– 5

1) 

ii) 

(ii) How is D(+) glucose converted into D(–)fructose ?

(b) (i) Complete the following reaction and give its mechanism. 5



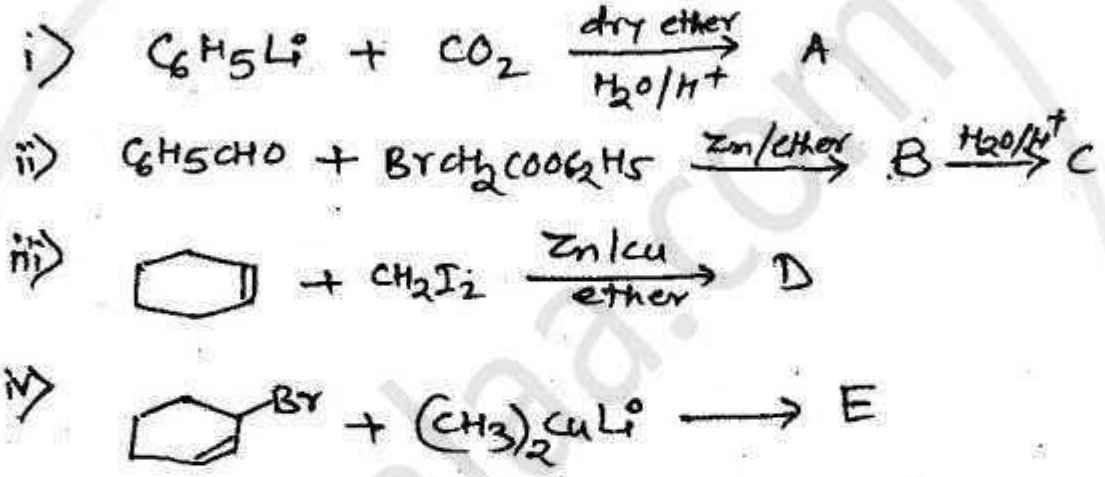
(ii) Give the structure of sugar and pyrimidines which constitute DNA molecule.

(c) Write the synthesis of α-amino acid by – 5

(1) Gabriel's phthalimide method

(2) Erlenmeyer method.

(d) Complete the following reactions – 5



OR

5. (p) (i) Explain Kiliani Fischer synthesis of D(+) glucose. 5

(ii) What is disaccharide ? Give the structure of maltose.

(q) What are nucleic acids ? Write stepwise hydrolysis of nucleic acid. Give the name and structure of any nucleoside. 5

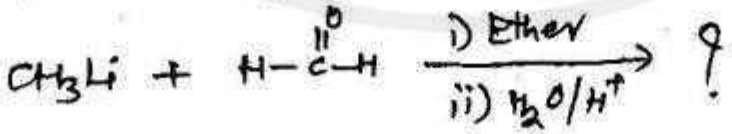
(r) (i) What is Zwitter ion ? 5

(ii) Give Fischer's synthesis of polypeptide.

(s) (i) Give the preparation of phenyllithium 5

(ii) Write the mechanism of Refortmasky reaction.

(iii) Complete the following reaction :–



(REVISED COURSE)

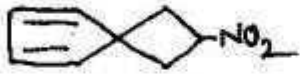
(3 Hours) [Total Marks : 100

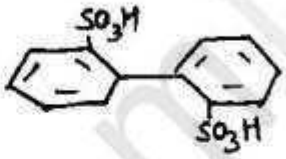
N.B. : (1) **All** questions are **compulsory**.
(2) **Figures** to the **right** indicate **full** marks.
(3) Use of **Logtables/Non-programmable** calculator is **allowed**.

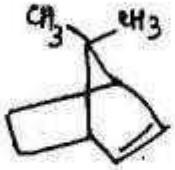
1. (a) Discuss mechanism of E_2 reaction with a suitable example. 3

OR

(a) Write IUPAC names of the following – 3

i) 

ii) 

iii) 

(b) Discuss stereochemistry of spirans. 3

OR

(b) Explain the use of microwave assisted organic reaction with two examples. 3

(c) Give the number of signals and splitting pattern expected in PMR spectra of : 3
(i) 2–propanol (ii) Butanone.

(d) How is alpha amino acid prepared by strecker synthesis ? 3

(e) How is lithium diethyl cuprate prepared ? What is its action on phenyl-iodide ? 2

(f) Explain linear synthesis with a suitable example. 2

(g) Write the structure and use of – 2
(1) Polystyrene (2) Polycarbonate.

OR

(g) Explain the mechanism of free radical addition polymerisation. 2

(h) What are Vitamins ? Write the structure of Vitamin A. 2

OR

(h) Explain the terms : 2
(1) Iodine value (2) Transesterification.

2. (a) What is benzilic acid rearrangement ? Explain its mechanism. 5

OR

(a) What is Michael addition reaction ? Explain its mechanism with one application. 5

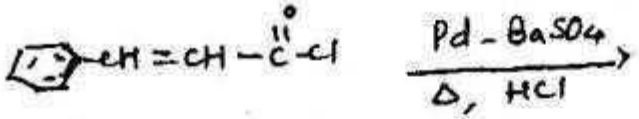
Attempt any **three** from the following –

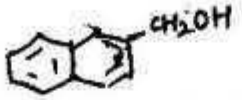
(b) (i) Write the structural formula for each of the following compound : 3
(1) 2,5–Dibromo hepta – 2,3,4–triene
(2) 1,4–Dioxadiene
(3) 2 Nitro bicyclo [2·2·2] octane

(ii) Explain the use of Lindlar catalyst with a suitable example. 2

(c) (i) Complete the following reactions : 3

i) $CH_3CH_2-\overset{O}{\overset{\|}{C}}-NH_2 \xrightarrow{LiAlH_4} ?$

ii)  $\xrightarrow[\Delta,\ HCl]{Pd-BaSO_4} ?$

iii)  $\xrightarrow[NaBrO_3]{CAN} ?$

(ii) Explain allylic and benzylic bromination using NBS. 2

(d) (i) Write the mechanism of Reformatsky reaction. 3

(ii) Starting with Grignard reagent, how will you prepare : 2

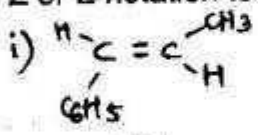
(1) Secondary alcohol (2) Ketone ?

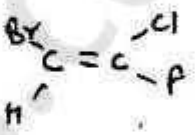
(e) (i) What are kinetically and thermodynamically controlled reactions ? Explain with a suitable example. 3

(ii) Explain the mechanism for the formation of ketals. 2

3. (a) (i) Draw various conformations of cyclohexane. "Chair form of cyclohexane is more stable than boat form". Explain. 3

(ii) Assign Z or E notation to the following – 2

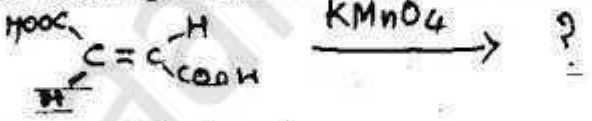
i) 

ii) 

OR

(a) (i) Explain the stereochemistry of SN^1 reaction with a suitable example. 3

(ii) Complete the following reaction and explain its mechanism. 2



Attempt any **three** from the following –

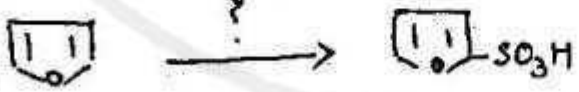
(b) (i) Explain aromaticity in furan. 3

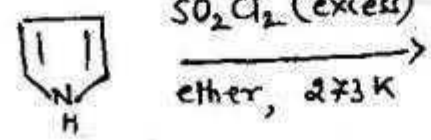
(ii) Discuss sulphonation of pyridine with and without catalyst. 2

(c) Write the synthesis of the following compounds – 5

(i) Paracetamol (Green Synthesis) (ii) Indigo.

(d) (I) Complete the following reactions – 3

i) 

ii) 

iii) 

(II) 'Electrophilic substitution in thiophene takes place of position 2 or 5'. Explain on the basis of stability of intermediate. 2

[TURN OVER

(e) (I) Explain the following :– 3
(i) Enantiotopic ligands (ii) Enantiomeric excess reaction.
(II) Explain the following terms – 2
(i) Angle strain (ii) Plane of symmetry.

4. (a) Define : Chromophore – 5
An organic compound has molecular formula C_4H_9NO. Find the hydrogen deficiency index and assign the structure to the compound, showing following spectral data –
I R : 3500 – 3400 cm^{-1}, 1680 cm^{-1}, 1610 cm^{-1}
1390 – 1380 cm^{-1}.
PMR:δ (ppm) 1·1(d), 2·1(m), 8·1 (s, D_2O exchangable).

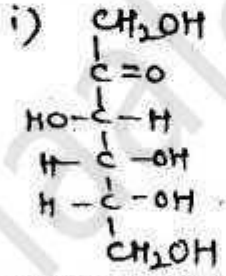
OR

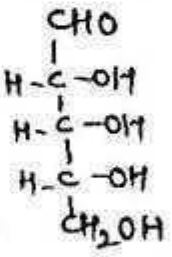
(a) (i) Explain different types of electronic transitions possible in a molecule in UV-spectroscopy. 3
(ii) Explain anisotropic effect on aldehydic proton. 2

Attempt any **three** from the following –

(b) (i) What is diene polymerisation ? Explain 1,2 and 1,4 addition polymerisation. 3
(ii) Explain with example, the use of plasticizer in manufacture of polymers. 2
(c) (i) Give one example each of Norrish type I and Norrish type II cleavage of ketones. 3
(ii) What is di-π-methane rearrangement ? Explain its mechanism with an example 2
(d) (i) Write the structure and use of – 3
(1) PHA (2) TPA.
(ii) Describe the preparation and use of epoxy resin. 2
(e) (i) Explain the principle of mass spectroscopy. 3
(ii) Discuss various modes of vibrations in IR spectroscopy. 2

5. (a) (I) Convert the following open chain formulae to Haworth pyranose (α form) formulae : 3

i)


ii)


(II) Explain α – helical structure of proteins. 2

OR

(a) (i) Write analytical evidence to prove – 3
(1) Citral is an aldehyde
(2) Nicotine contains pyridine nucleus
(3) Citral contains isopropylidene group.
(ii) Explain Hofmann exhaustive methylation and elimination with a suitable example. 2

Attempt any **three** from the following –

(b) (i) Assuming the configuration of D(+) glucose, how is the configuration of D(–) fructose determined ? 3
(ii) What are anomers and polysaccharides ? 2
(c) Explain the importance of Pinner's work in the determination of structure of nicotine. Write the synthesis of nerol from citral. 5
(d) How will you convert D (–) fructose into D(+) glucose ? Write the structures of – 5
(i) Sucrose (ii) Maltose.
(e) (i) Describe Merrifield solid phase synthesis for dipeptides. 3
(ii) Distinguish between DNA and RNA. 2