

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

CHE3CJ201 – Theoretical Chemistry I: Basic Quantum Chemistry

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries **Three** mark.

Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Define photoelectric effect. Calculate the minimum energy that the photon must possess to eject an electron from potassium metal. The threshold frequency of potassium = $5 \times 10^{14} \text{ s}^{-1}$, $h = 6.626 \times 10^{-34} \text{ Js}$.	CO1	Ap	3
2	Write the postulates of Bohr theory of atom.	CO1	R	3
3	State de Broglie's relation. Explain how the wavelength of a moving object depends on its mass.	CO1	U	3
4	Write the Schrödinger wave equation for the hydrogen atom in spherical polar coordinates and state what each term represents.	CO2	U	3
5	What is meant by degeneracy of energy states in a particle confined in a cubic box?	CO2	U	3
6	State Heisenberg uncertainty principle. Calculate the uncertainty in the position of a particle whose uncertainty in momentum is $3.3 \times 10^{-3} \text{ kgms}^{-1}$.	CO2	U	3
7	Calculate the average value of position of a particle in a 1D box with infinite potential walls.	CO2	Ap	3
8	Explain the hybridization of IF_7 and depict its molecular geometry.	CO4	Ap	3
9	Differentiate between a sigma (σ) bond and a pi (π) bond.	CO3	U	3
10	Write the expressions, in terms of linear combinations of atomic wave functions, for the three sp^2 hybrid orbitals of boron in the BH_3 molecule. Depict the molecular structure.	CO4	U	3

PART – B

All questions can be attended.
Each question carries six marks.

Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Discuss black body spectra and explain how its study led to the development of quantum theory.	CO1	An	6
12	Explain the Davisson–Germer experiment and discuss how its results provided evidence for the wave–particle dual nature of the electron.	CO1	An	6
13	Explain the phenomenon of quantum tunneling. How is this principle applied in the working of the Scanning Tunneling Microscope (STM)?	CO2	Ap	6
14	Describe the four quantum numbers, stating their significance in defining the state of an electron in an atom.	CO2	U	6
15	With reference to the H ₂ molecule, compare and contrast the Valence Bond Theory (VBT) and the Molecular Orbital Theory (MOT) in explaining chemical bonding.	CO3	An	6
16	Discuss the Born-Oppenheimer approximation with reference to the H ₂ molecule.	CO3	U	6
17	Construct the MO energy level diagrams for O ₂ and CO. Based on these diagrams, discuss their bond order, stability, and magnetic behaviour.	CO3	An	6
18	What is the geometry of BeH ₂ molecule? How will you explain this geometry on the basis of hybridization? Write the expressions in terms of the linear combination of wave functions for the hybrid orbitals of Be in the molecule.	CO4	Ap	6

PART - C

Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	Outline and explain the key postulates of quantum mechanics.	CO2	U	10
20	Formulate and solve the Schrödinger wave equation for a particle in a 1D box, and derive the allowed energy levels. Briefly discuss one practical use of this concept.	CO2	U	10

1 x 10 = 10 Marks

1B3N25333

(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

CHE3CJ202 – Organic Chemistry I

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries Three mark.
Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Explain metamerism with example	1	U	3
2	State and explain Huckel's rule	1	R	3
3	Alcohol is soluble in water, but alkyl halides are insoluble. Why?	1	Ap	3
4	Illustrate electromeric effect.	2	U	3
5	What are pericyclic reaction? Name three types.	3	R	3
6	Which is more stable, but-2-ene or but-1-ene? Substantiate your answer.	2	U	3
7	Draw the two extreme conformation of ethane. Compare their stability.	4	U	3
8	Draw the geometrical isomers of but-2-enal.	4	U	3
9	What is R _f value? How is it useful in the characterisation of a compound?	6	U	3
10	Explain the Principle of sublimation.	6	R	3

PART – B

All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Explain the structure and hybridization of Ethylene molecule based on hybridisation	1	U	6
12	What is hydrogen bonding? Explain the type of hydrogen bonding in organic molecules?	1	U	6
13	Write short note on mesomeric effect.	2	R	6
14	Which is esterified easily with alcohol; benzoic acid or 2,4,6 trimethyl benzoic acid? Explain.	2	Ap	6
15	Explain conformation of Butane with PE diagram.	4	U	6
16	What are the main postulates of Bayers stain theory?	4	R	6
17	Discuss the relative stability of methyl cyclohexane.	4	U	6
18	Distinguish between conformation and configuration.	4	R	6

PART - C

Answer any *one* questions.
Each question carries Ten marks.

		COs	Knowledge Level(KL)	Marks
19	a) Discuss the bonding in 1,3-Butadiene on the basis of MO theory	1	U	5
	b) Explain the structure and stability of carabocation.	3	U	5
20	Write note on principle, process and applications of HPLC.	6	U	10

1 x 10 = 10 Marks

26

1B3N25334

(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

CHE3MN201 – Organic Chemistry & Polymers

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.

Each question carries Three mark.

Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	Differentiate between electrophiles and nucleophiles with an examples each.	1	U	3
2	Draw the resonance structures of nitrobenzene.	1	U	3
3	Classify the following reactions as addition, elimination, substitution, rearrangement, or redox. (a) $\text{CH}_3\text{Br} + \text{OH}^- \rightarrow \text{CH}_3\text{OH} + \text{Br}^-$ (b) $\text{CH}_3-\text{CH}=\text{CH}_2 + \text{HBr} \rightarrow \text{CH}_3-\text{CHBr}-\text{CH}_3$ (c) $\text{CH}_3-\text{CH}_2-\text{Br} \rightarrow \text{CH}_2=\text{CH}_2 + \text{HBr}$	2	Ap	3
4	How is phenol prepared from chlorobenzene? Write the reaction.	3	U	3
5	How are alkyl halides prepared from alkanes and alkenes? Give suitable chemical equations.	3	U	3
6	What is meant by Diazotisation?	3	U	3
7	Write an equation for the preparation of acetaldehydes.	3	U	3
8	Write the preparation and one use of methyl orange.	3	U	3
9	How does tacticity influence the physical properties of a polymer?	4	Ap	3
10	What are elastomers? Mention a unique property of elastomers.	5	Ap	3

PART – B

All questions can be attended.
Each question carries six marks.

Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Explain steric effect and how does it influence the reactivity of organic compounds?	1	U	6
12	Compare the stability of But-1-ene and But-2-ene using hyperconjugation.	2	Ap	6
13	Explain the relative reactivities of primary, secondary and tertiary alkyl halides in S _N 2 reaction.	3	U	6
14	Compare the acidity of phenol and p-nitrophenol. Justify your answer based on electronic effects.	3	U	6
15	What is Lucas test? How can it be used to distinguish between primary, secondary, and tertiary alcohols?	3	U	6
16	Differentiate between Clemmensen and Wolff-Kishner reductions.	3	U	6
17	With the help of an example, explain why aldehydes are more reactive than ketones toward nucleophilic addition.	3	U	6
18	Differentiate the two types of polymers classified based on intermolecular forces.	4	Ap	6

PART - C

Answer any *one* questions.
Each question carries **Ten** marks.

		COs	Knowledge Level(KL)	Marks
19	Compare the structure, shape, and stability of carbocations, carbanions, and free radicals.	2	Ap	10
20	a) Draw the structure of i) BUNA-S ii) BUNA-N iii) Nylon 6 iv) Nylon 66 Mention the applications of each. (8 marks) b) Mention any two uses of Kevlar. (2 marks)	5	U	10

1 x 10 = 10 Marks

1B3N25335

(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

CHE3MN202 – Bioorganic Chemistry

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries Three mark.
Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	What are electrophiles? Give two examples.	1	Understand	3
2	Which is a weaker acid: acetic acid or chloroacetic acid? Justify your answer.	1	Apply	3
3	What is mesomeric effect? Name two groups that show +M effect.	1	Understand	3
4	Define nucleoside with example.	5	Understand	3
5	What are reducing sugars? Give example.	4	Understand	3
6	Name the purine and pyrimidine bases found in DNA.	4	Understand	3
7	What are free radicals? How are they formed?	2	Understand	3
8	Write any two biological functions of progesterone.	5	Analyse	3
9	What are hydrolysable lipids?	5	Understand	3
10	Define isoelectric point.	4	Understand	3

PART – B

**All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks**

		COs	Knowledge Level(KL)	Marks
11	Explain any three synthetic applications of benzene diazonium chloride.	3	Understand	6
12	Explain the xanthoproteic test for proteins.	4	Analyse	6
13	Differentiate between amylose and amylopectin.	5	Analyse	6
14	Draw the Haworth projections of cyclic structure of glucose.	4	Understand	6
15	Explain Hofmann's bromamide reaction.	3	Understand	6
16	Differentiate between essential and non-essential amino acids.	4	Analyse	6
17	Compare the reactivity of aldehyde and ketone.	3	Analyse	6
18	Discuss the differences between DNA and RNA.	5	Understand	6

PART - C

**Answer any *one* questions.
Each question carries Ten marks.**

		COs	Knowledge Level(KL)	Marks
19	Discuss the different levels of protein structure.	4	Understand	10
20	What is DNA fingerprinting? Explain its process and applications.	5	Understand	10

1 x 10 = 10 Marks

28

1B3N25336

(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2025

CHE3MN203 – Organic and Phytochemistry

(FYUGP 2024 Admission onwards)

Time: 2 hours

Max. Marks : 70

PART – A

All questions can be attended.
Each question carries three marks.

Ceiling -24 Marks

		COs	Knowledge Level(KL)	Marks
1	What is meant by inductive effect? Name one group that shows -I effect.	CO1	Understanding	3
2	Distinguish between mesomeric effect and inductive effect	CO1	Understanding	3
3	Which is more stable, But-1-ene or But-2-ene? Why?	CO1	Apply	3
4	Differentiate between rectified spirit and absolute alcohol	CO3	Understanding	3
5	What is haloform reaction? Give an example	CO3	Understanding	3
6	Illustrate Kolbe electrolysis	CO3	Apply	3
7	How benzenediazonium chloride is prepared?	CO3	Apply	3
8	Give two methods for the preparation of acetaldehyde	CO3	Remember	3
9	What is meant by mutarotation?	CO4	Understanding	3
10	Draw the geometrical isomers of citral	CO5	Apply	3

PART – B
All questions can be attended.
Each question carries six marks.
Ceiling -36 Marks

		COs	Knowledge Level(KL)	Marks
11	Explain the role of steric effect in determining the order of basicity of methylamine, dimethyl amine and trimethylamine.	CO1	Apply	6
12	Categorize the different types of substitution reactions with suitable examples.	CO2	Analyze	6
13	Explain with suitable examples how 1° and 2° alcohols react with alk-KMnO ₄ .	CO3	Apply	6
14	Evaluate the harmful effects of ethanol consumption to human body.	CO3	Apply	6
15	Describe S _N 2 reaction with suitable example with special mention to its mechanism.	CO3	Understanding	6
16	Give two methods of preparation of aldehydes. Explain each with suitable methods.	CO3	Understanding	6
17	Arrange the ammonia, methylamine and aniline in the increasing order of basicity. Justify your answer.	CO3	Apply	6
18	Explain the chemical classification of carbohydrates with suitable examples.	CO4	Understanding	6

PART - C
Answer any *one* questions.
Each question carries ten marks.

		COs	Knowledge Level(KL)	Marks
19	Arrange the following in the increasing order of stability and justify your answer. <i>t</i> -butyl cation, isopropyl cation, ethyl cation and methyl cation	CO2	Apply	10
20	Explain the 1°, 2°, 3° and quaternary structures of protein.	CO5	Understanding	10

1 x 10 = 10 Marks