

***SCHEME OF EXAMINATION
AND
SYLLABUS***

(for Academic Session 2022-2023)

**B.Sc. Chemistry
First & Second Semester Examination**

**This syllabus is only for the B.Sc. Course
running under Semester Scheme
at the University campus**

**Bachelor of Science (B.Sc.)
Chemistry**

Faculty of Science



UNIVERSITY OF KOTA

MBS Marg, KOTA (Rajasthan)-324 005

INDIA

CONTENTS

S. No.	Particulars	Page No.
1.	Scheme of Examination B.Sc. (Pass Course) Mathematics Group <i>with Chemistry, Mathematics, Physics</i> <ul style="list-style-type: none"> • B.Sc. I & II Sem. (Pass Course) Mathematics Group • B.Sc. II & III Sem. (Pass Course) Mathematics Group • B.Sc. V & VI Sem. (Pass Course) Mathematics Group B.Sc. (Pass Course) Biology Group <i>with Chemistry, Botany, Zoology</i> <ul style="list-style-type: none"> • B.Sc. I & II Sem. (Pass Course) Biology Group • B.Sc. II & III Sem. (Pass Course) Biology Group • B.Sc. V & VI Sem. (Pass Course) Biology Group B.Sc. (Pass Course) Chemistry: <i>Consolidated Scheme of Chemistry Paper Only</i>	3 4 5 6 7 8 9
2.	Objectives of the Course	10
3.	Duration of the Course	10
4.	Eligibility for Admission	10
6.	Minimum Marks required in the Qualifying Examination	10
7.	Structure of the Programme	10
8.	Course Number, Course Code or ID and Nomenclature	10
9.	Maximum Marks and Credit Points	11
10.	Attendance	11
11.	Teaching Methodologies	11
12.	Assessment Pattern <ul style="list-style-type: none"> • Mid-Term / Internal / Continuous Assessment • End-Term / External / Semester Assessment 	11 13
13.	Question Paper Pattern <ul style="list-style-type: none"> • Mid-Term / Internal / Continuous Assessment <ul style="list-style-type: none"> ▪ Mid-Term / Internal / Continuous Assessment-I ▪ Mid-Term / Internal / Continuous Assessment-II • End-Term / External / Semester Assessment 	13 13 13 14
14.	Practical Examinations <ul style="list-style-type: none"> • Duration of Examination • Distribution of Maximum Marks 	15 15
15.	Minimum Pass Marks and Rules regarding Determination of Results	15
16.	Classification of Successful Candidates	16
17.	Syllabus <ul style="list-style-type: none"> • B.Sc. First Semester (Pass Course) Chemistry • B.Sc. Second Semester (Pass Course) Chemistry 	17 22

Bachelor of Science (B.Sc.): Mathematics Group

Subject Combination: Chemistry, Mathematics, Physics (CMP)

B.Sc. First and Second Semesters Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points			Distribution of Assessment Marks				Total Marks	
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)			
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks
1st Year	Paper-1.1	HIND-111	General Hindi	2	2	-	2	-	-	50	20	50	20
	Paper-1.2	ECA-112	Elementary Computer Applications	2	2	-	2	-	-	50	20	50	20
I Semester	Paper-1.3	CHEM-111	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.4	CHEM-112	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.5	CHEM-113	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.6	CHEM-114	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.7	MATH-111	Mathematics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-1.8	MATH-112	Mathematics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-1.9	MATH-113	Mathematics: Paper-III: Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.10	PHY-111	Physics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-1.11	PHY-112	Physics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-1.12	PHY-113	Physics: paper-III: Physics Practical	6	-	4	2	--	--	50	25	50	25
Total (I Semester)				39+4	30+4	24+4	90	36	510+100	219+40	600+100	195+40	
1st Year	Paper-2.1	ENG-121	General English	2	2	-	2	-	-	50	20	50	20
	Paper-2.2	EVS-122	Environmental Studies	2	2	-	2	-	-	50	20	50	20
II Semester	Paper-2.3	CHEM-121	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.4	CHEM-122	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.5	CHEM-123	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.6	CHEM-124	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.7	MATH-121	Mathematics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-2.8	MATH-122	Mathematics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-2.9	MATH-123	Mathematics: Paper-III: Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.10	PHY-121	Physics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-2.11	PHY-122	Physics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-2.12	PHY-123	Physics: paper-III: Physics Practical	6	-	4	2	--	--	50	25	50	25
Total (II Semester)				39+4	30+4	24+4	90	36	510+100	219+40	600+100	195+40	

Bachelor of Science (B.Sc.): Mathematics Group

Subject Combination: Chemistry, Mathematics, Physics (CMP)

B.Sc. Third and Fourth Semesters Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points		Distribution of Assessment Marks				Total Marks		
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)			
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks
2nd Year III Semester	Paper-3.1	CHEM-231	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.2	CHEM-232	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.3	CHEM-233	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.4	CHEM-234	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.5	MATH-231	Mathematics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-3.6	MATH-232	Mathematics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-3.7	MATH-233	Mathematics: Paper-III: Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.8	PHY-231	Physics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-3.9	PHY-232	Physics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-3.10	PHY-233	Physics: paper-III: Physics Practical	6	-	4	2	--	--	50	25	50	25
Total (III Semester)				39	30	24	90	36	510	219	600	195	
2nd Year IV Semester	Paper-4.1	CHEM-241	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.2	CHEM-242	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.3	CHEM-243	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.4	CHEM-244	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.5	MATH-241	Mathematics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-4.6	MATH-242	Mathematics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-4.7	MATH-243	Mathematics: Paper-III: Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.8	PHY-241	Physics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-4.9	PHY-242	Physics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-4.10	PHY-243	Physics: paper-III: Physics Practical	6	-	4	2	--	--	50	25	50	25
Total (IV Semester)				39	30	24	90	36	510	219	600	195	

Bachelor of Science (B.Sc.): Mathematics Group

Subject Combination: Chemistry, Mathematics, Physics (CMP)

B.Sc. Fifth and Sixth Semesters Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points		Distribution of Assessment Marks				Total Marks		
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)		Max. Marks	Min. Pass Marks
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks		
3rd Year	Paper-5.1	CHEM-351	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
V Semester	Paper-5.2	CHEM-352	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.3	CHEM-353	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.4	CHEM-354	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.5	MATH-351	Mathematics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-5.6	MATH-352	Mathematics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-5.7	MATH-353	Mathematics: Paper-III: Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.8	PHY-351	Physics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-5.9	PHY-352	Physics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-5.10	PHY-353	Physics: paper-III: Physics Practical	6	-	4	2	--	--	50	25	50	25
	Total (V Semester)				36	30	24	90	36	510	219	600	195
3rd Year	Paper-6.1	CHEM-361	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
VI Semester	Paper-6.2	CHEM-362	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.3	CHEM-363	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.4	CHEM-364	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.5	MATH-361	Mathematics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-6.6	MATH-362	Mathematics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-6.7	MATH-363	Mathematics: Paper-III: Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.8	PHY-361	Physics: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-6.9	PHY-362	Physics: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-6.10	PHY-363	Physics: paper-III: Physics Practical	6	-	4	2	--	--	50	25	50	25
	Total (VI Semester)				36	30	24	90	36	510	219	600	195

Bachelor of Science (B.Sc.): Biology Group

Subject Combination: Chemistry, Botany, Zoology (CBZ)

B.Sc. First and Second Semesters

Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points			Distribution of Assessment Marks				Total Marks	
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)			
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks
1st Year	Paper-1.1	HIND-111	General Hindi	2	2	-	2	-	-	50	20	50	20
	Paper-1.2	ECA-112	Elementary Computer Applications	2	2	-	2	-	-	50	20	50	20
I Semester	Paper-1.3	CHEM-111	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.4	CHEM-112	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.5	CHEM-113	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.6	CHEM-114	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.7	BOT-111	Botany: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-1.8	BOT-112	Botany: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-1.9	BOT-113	Botany: Paper-III: Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.10	ZOO-111	Zoology: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-1.11	ZOO-112	Zoology: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-1.12	ZOO-113	Zoology: Paper-III: Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (I Semester)				39+4	30+4	24+4	90	36	510+100	219+40	600+100	195+40
	1st Year	Paper-2.1	ENG-121	General English	2	2	-	2	-	-	50	20	50
Paper-2.2		EVS-122	Environmental Studies	2	2	-	2	-	-	50	20	50	20
II Semester	Paper-2.3	CHEM-121	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.4	CHEM-122	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.5	CHEM-123	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.6	CHEM-124	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.7	BOT-121	Botany: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-2.8	BOT-122	Botany: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-2.9	BOT-123	Botany: Paper-III: Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.10	ZOO-121	Zoology: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-2.11	ZOO-122	Zoology: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-2.12	ZOO-123	Zoology: Paper-III: Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (II Semester)				39+4	30+4	24+4	90	36	510+100	219+40	600+100	195+40

Bachelor of Science (B.Sc.): Biology Group

Subject Combination: Chemistry, Botany, Zoology (CBZ)

B.Sc. Third and Fourth Semesters Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points		Distribution of Assessment Marks				Total Marks		
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)			
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks
2nd Year III Semester	Paper-3.1	CHEM-231	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.2	CHEM-232	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.3	CHEM-233	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.4	CHEM-234	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.5	BOT-231	Botany: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-3.6	BOT-232	Botany: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-3.7	BOT-233	Botany: Paper-III: Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.8	ZOO-231	Zoology: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-3.9	ZOO-232	Zoology: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-3.10	ZOO-233	Zoology: Paper-III: Zoology Practical	6	-	4	2	--	--	50	25	50	25
Total (III Semester)				39	30	24	90	36	510	219	600	195	
2nd Year IV Semester	Paper-4.1	CHEM-241	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.2	CHEM-242	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.3	CHEM-243	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.4	CHEM-244	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.5	BOT-241	Botany: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-4.6	BOT-242	Botany: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-4.7	BOT-243	Botany: Paper-III: Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.8	ZOO-241	Zoology: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-4.9	ZOO-242	Zoology: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-3.10	ZOO-243	Zoology: Paper-III: Zoology Practical	6	-	4	2	--	--	50	25	50	25
Total (IV Semester)				39	30	24	90	36	510	219	600	195	

Bachelor of Science (B.Sc.): Biology Group

Subject Combination: Chemistry, Botany, Zoology (CBZ)

B.Sc. Fifth and Sixth Semesters Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points		Distribution of Assessment Marks				Total Marks		
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)		Max. Marks	Min. Pass Marks
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks		
3rd Year	Paper-5.1	CHEM-351	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
V Semester	Paper-5.2	CHEM-352	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.3	CHEM-353	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.4	CHEM-354	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.5	BOT-351	Botany: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-5.6	BOT-352	Botany: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-5.7	BOT-353	Botany: Paper-III: Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.8	ZOO-351	Zoology: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-5.9	ZOO-352	Zoology: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-5.10	ZOO-353	Zoology: Paper-III: Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (V Semester)				39	30	24	90	36	510	219	600	195
3rd Year	Paper-6.1	CHEM-361	Chemistry: Paper-I: Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
VI Semester	Paper-6.2	CHEM-362	Chemistry: Paper-II: Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.3	CHEM-364	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.4	CHEM-364	Chemistry: Paper-IV: Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.5	BOT-361	Botany: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-6.6	BOT-362	Botany: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-6.7	BOT-363	Botany: Paper-III: Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.8	ZOO-361	Zoology: Paper-I:	3	3	-	3	15	06	60	24	75	30
	Paper-6.9	ZOO-362	Zoology: Paper-II:	3	3	-	3	15	06	60	24	75	30
	Paper-6.10	ZOO-363	Zoology: Paper-III: Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (VI Semester)				39	30	24	90	36	510	219	600	195

Bachelor of Science (B.Sc.): CHEMISTRY PAPER ONLY

Subject Combination: Chemistry, Physics, Mathematics (CPM) for Maths. group / Chemistry, Botany, Zoology (CBZ) for Bio. group

Semester Scheme of Examination

Year / Semester	Number, Code or ID and Nomenclature of Paper			Duration of Exam. (in Hrs.)	Teaching Hrs. / Week & Credit Points			Distribution of Assessment Marks				Total Marks	
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	Continuous Assessment (20%)		Semester Assessment (80%)			
								Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks
I Semester	Paper-1.3	CHEM-111	Chemistry: Paper-I : Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.4	CHEM-112	Chemistry: Paper-II : Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.5	CHEM-113	Chemistry: Paper-III : Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-1.6	CHEM-114	Chemistry: Paper-IV : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
II Semester	Paper-2.3	CHEM-121	Chemistry: Paper-I : Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.4	CHEM-122	Chemistry: Paper-II : Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.5	CHEM-123	Chemistry: Paper-III : Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-2.6	CHEM-124	Chemistry: Paper-IV : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
III Semester	Paper-3.1	CHEM-231	Chemistry: Paper-I : Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.2	CHEM-232	Chemistry: Paper-II : Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.3	CHEM-233	Chemistry: Paper-III : Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-3.4	CHEM-234	Chemistry: Paper-IV : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
IV Semester	Paper-4.1	CHEM-241	Chemistry: Paper-I : Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.2	CHEM-242	Chemistry: Paper-II : Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.3	CHEM-243	Chemistry: Paper-III : Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-4.4	CHEM-244	Chemistry: Paper-IV : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
V Semester	Paper-5.1	CHEM-351	Chemistry: Paper-I : Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.2	CHEM-352	Chemistry: Paper-II : Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.3	CHEM-353	Chemistry: Paper-III : Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-5.4	CHEM-354	Chemistry: Paper-IV : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
VI Semester	Paper-6.1	CHEM-361	Chemistry: Paper-I : Inorganic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.2	CHEM-362	Chemistry: Paper-II : Organic Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.3	CHEM-363	Chemistry: Paper-III : Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.4	CHEM-364	Chemistry: Paper-IV : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85

Rules & Regulations

Objectives of the Course:

Bachelor of Science (B.Sc.) programme of the university is a pioneering model in science. The course shall provide the thorough knowledge of all the branches of the chemistry. The course also emphasizes on the communication & presentation skills of the students. After completing the course, the students shall be eligible to take admission for higher studies in different branches of the chemical sciences and able to do research in the different areas of chemical sciences or allied fields and shall be placed in different organizations / institutions where skilled chemical science professionals are required.

Duration of the Course:

The course Bachelor of Science (B.Sc.) Pass Course shall consist of three academic years divided in to the six semesters. B.Sc. (Pass Course) degree shall be awarded to the candidates after successful completion of the six-semester programme of study.

Eligibility for Admission:

- **B.Sc. (Pass Course) Biology Group:**

A candidate who has passed qualifying examination *i.e.* 10+2 or equivalent examination with Physics, Chemistry and Biology or Physics, Chemistry and Mathematics with Biology as additional subject from any recognized board shall be permitted to take admission in B.Sc. First Semester to award B.Sc. (Pass Course) degree in Biology group from this University.

- **B.Sc. (Pass Course) Mathematics Group:**

A candidate who has passed qualifying examination *i.e.* 10+2 or equivalent examination with Physics, Chemistry and Mathematics or Physics, Chemistry and Biology with Mathematics as additional subject from any recognized board shall be permitted to take admission in B.Sc. First Semester to award B.Sc. (Pass Course) degree in Mathematics group from this University.

Minimum Marks required in the Qualifying Examination:

- Qualifying examination passed from Rajasthan State or Bonafide Resident of Rajasthan:
 - General Category = 48%.
 - SC / ST / OBC / SBC or MBC = Min. Pass Marks
- Qualifying examination passed from other state than Rajasthan or not a Bonafide Resident of Rajasthan:
 - All Categories = 60%.

Structure of the Programme:

The B.Sc. (Pass Course) programme consists of core and applied courses of theory as well as practical papers which are compulsory for all students.

Course Number, Course Code or ID and Nomenclature:

Number of the Paper has been designated in the Arabic number as Paper-1.1, Paper-1.2, and Paper-1.3 and so on. In the Paper-1.2, 1 represents the semester number and 2 represent the paper number. To give a code to a particular course, following sequence has been adopted:

“Abbreviation of the programme in upper case + n^{th} number of years of study + n^{th} number of semesters of the programme + course number in Arabic number.”

According to the above sequence, code of paper-IV of the first semester of undergraduate Chemistry shall be as "CHEM-114". Nomenclature of the particular course has been given according to the nature or type of contents included in the Unit-I to Unit-V of course of study.

Maximum Marks and Credit Points:

Maximum marks of a theory and practical paper shall be decided on the basis of their contact hours / per week. One teaching hour per week shall equal to one credit and carry 25 maximum marks. Therefore, 3 teaching hours or 3 credit points per week shall carry 75 maximum marks for each theory paper/course. While two contact hours per week for a laboratory or practical work shall be equal to one credit point per week. Therefore, 4 contact hours / week shall equal to 2 credit points per week and shall carry 50 maximum marks.

Attendance:

Every teaching faculty, handling a course, shall be responsible for the maintenance of Attendance Register for candidates who have registered for the course. The teacher of the course must intimate the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students. Each student should earn 75% attendance in the courses of the particular semester failing which he or she will not be permitted to sit in the End-Semester Examinations. However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 75% attendance for valid reasons and such exemptions should not under any circumstance be granted for attendance below 65%.

Teaching Methodologies:

The classroom teaching would be through conventional lectures or use of OHP or power point presentations (PPT). The lecture would be such that the student should participate actively in the discussion. Student seminars would be conducted and scientific discussions would be arranged to improve their communicative skill. In the laboratory, instruction would be given for the experiments followed by demonstration and finally the students have to do the experiments individually. For the students of slow learners, special attention would be given.

Assessment Pattern:

The assessment of the student shall be divided into two parts in which first part is continuous assessment / mid-term assessment / internal assessment (20% weightage of the maximum marks) and second part is semester assessment / end-term assessment / external assessment (80% weightage of the maximum marks).

(i) Mid-Term / Internal / Continuous Assessment:

- (a) The continuous / mid-term / internal assessment (20% weightage of the maximum marks) for each theory paper shall be taken by the faculty members in the Department during each semester. Internal assessment part is further divided in two parts of equal weightage of marks as per the details given below:

S. No.	Internal Assessment	Mode of Internal Assessment	Max. Marks
(i)	Mid-Term / Internal / Continuous Assessment-I	Written Examination.	5 Marks
(ii)	Mid-Term / Internal / Continuous Assessment-II	Seminar / Presentation / Assignment / Dissertation / Quiz / Group Discussion / Viva-voce or any other mode of assessment.	5 Marks

Note: In the Mid-Term/Internal/Continuous Assessment-I, written examination shall be of one hour duration for each theory paper and shall be taken according to the academic calendar which will be notified by the Department / University. Time duration for Mid-Term/Internal/Continuous Assessment-II is not allotted. It will be decided by the faculty member which will be taking internal assessment.

- (b) For practical papers, there will be only one external or semester or end term assessment (100% weightage of maximum marks) and there will be no continuous or internal or midterm assessment.
- (c) A student who remains absent (defaulter) or fails or wants to improve the marks in the internal assessment may be permitted to appear in the desired paper(s) (only one time) in the same semester with the permission of the concern Head of the Department. A defaulter / improvement fee of Rupees 250/- per paper shall be taken from such candidates. Duly forwarded application of such candidates by the teacher concerned shall be submitted to Head of the Department who may permit the candidate to appear in the internal assessment after production of satisfactory evidence about the reason of his/her absence in the test(s) and deposition of the defaulter / improvement fee. A record of such candidates shall be kept in the Department.
- (d) Regular attendance of the student shall be considered in the internal assessment. Marks (equal to 10% of internal assessment) shall be given to the student(s) for regularity who is/are taken classes regularly. If the attendance / regularity factor is similar for all the students, then weightage marks for regularity may be merged in the weightage of second internal assessment (seminar / presentation / assignment / dissertation / quiz / group discussion / viva-voce, etc.).
- (e) Paper wise consolidated marks for each theory paper and dissertation / seminar (*i.e.* total marks obtained during various modes of internal assessment) obtained by the students (out of the 20% weightage of the maximum marks of the each paper) shall be forwarded by the Head of the Department (in two copies) to the Controller of Examinations of the University within a week from the date of last internal assessment test for incorporation in the tabulation register.
- (f) The consolidated marks obtained by the students be also made known to them before being communicated by the concerned Head of the Department to the University for final incorporation in the tabulation register. If any discrepancies are discovered or pointed out by the students, the same shall be looked into by the concerned faculty member and corrections made wherever necessary. The decision of the Head of the Department before the communication of marks to the University shall be final. No corrections shall be made in the internal assessment marks after the declaration of the result by the University.
- (g) Consolidated marks of internal assessment obtained out of the 20% weightage of maximum marks of each theory paper which will be communicated to the University shall be in whole number and not in fraction. Marks awarded for the various internal assessments in each paper shall be added up and then round off to the next whole number to avoid any fraction.
- (h) All test copies and other material related to the internal assessment shall also be sent to the Controller of Examinations of the University to keep in record as per the University guidelines.

- (i) The concerned Head of the Department shall be responsible for proper conduct of internal assessment tests and for communication of the consolidated marks to the University within the prescribed time.
- (j) The Head of the Department shall keep a record of the marks and also notify the same to the candidates immediately so that if any candidate is not satisfied with the award in any test or seasonal work, he / she should represent the matter to the higher authority.

(ii) End-Term / External / Semester Assessment:

- (a) The semester or external or end-term assessment (80% weightage of the maximum marks) shall be three hours duration to each theory paper and six hours duration for each practical paper and shall be taken by the University at the end of each semester.
- (b) The syllabus for each theory paper is divided into five independent units.

Question Paper Pattern:

(A) Mid-Term / Internal / Continuous Assessment:

20% weightage of Maximum Marks (10 Marks out of 50 Maximum Marks).

(i) Mid-Term / Internal / Continuous Assessment-I:

Department of
University / College :
Address

First Internal Assessment Test 20... - 20....
(Written Examination)

Name of Class/Course :	Max. Marks : 5 Marks
Name of Semester :	Duration of Exam. : 1.00 Hr
No. & Name of Paper :	Date of Exam. :

- Q. No. 1.
or
.....
01 Mark
- Q. No. 2.
or
.....
01 Mark
- Q. No. 3.
or
.....
01 Mark
- Q. No. 4.
or
.....
01 Mark
- Q. No. 5.
or
.....
01 Mark

(ii) Mid-Term / Internal / Continuous Assessment-II:

Department of

University / College :

Address

Second Internal Assessment Test 20... - 20....

(Seminar / Presentation / Assignment / Dissertation / Quiz / Group Discussion
/ Viva-voce or any other mode of assessment)

Name of Class/Course :	Max. Marks : 5 Marks
Name of Semester :	Mode of Assessment:
No. & Name of Paper :	Date of Assessment :

Format for

Compilation of Marks/Awards of Internal Assessment-I & II

Department of

University / College :

Address

Name of Class/Course :

Name of Semester :

No. & Name of Paper :

Max. Marks :

S. No.	Name of Student	Father's Name	Marks Obtained			
			Internal Assess. - I	Internal Assess. - II	Total Marks (in Figure)	Total Marks (in Words)

Name & Signature of the Faculty Member

(B) End-Term / External / Semester Assessment:

80% weightage of Maximum Marks (40 Marks out of 50 Maximum Marks).

Duration of Examination: 3 Hours

Max. Marks: 40

Note: There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

	Unit-I	
Q. No. 1		08 Marks
	or	
Q. No. 2		08 Marks
	Unit-II	
Q. No. 3		08 Marks
	or	
Q. No. 4		08 Marks
	Unit-III	
Q. No. 5		08 Marks
	or	
Q. No. 6		08 Marks

	Unit-IV	
Q. No. 7		08 Marks
	or	
Q. No. 8		08 Marks
	Unit-V	
Q. No. 9		08 Marks
	or	
Q. No. 10		08 Marks

Practical Examinations:

Mid-Term / Internal / Continuous Assessment:

Not applicable in Practical Examinations.

End-Term / External / Semester Assessment:

Duration of Exam: 6 Hours

Maximum Marks: 50

Distribution of Maximum Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Inorganic Chemistry	10
2.	Exercise No. 2: Organic Chemistry	10
3.	Exercise No. 3: Physical Chemistry	10
4.	Practical Record	10
5.	Viva-voce	10
Total Marks		50

Minimum Pass Marks and Rules regarding Determination of Results:

Each semester shall be regarded as a unit for working out the result of the candidates. The result of each semester examination shall be worked out separately (even if he/she has appeared at the paper of the lower semester along with the papers of higher semester) in accordance with the following conditions:

- The candidate shall be declared as pass in a semester examination, if he/she secures at least 40% marks in each theory paper separately in external & internal examination and 50% marks in each practical paper / project / dissertation with 40% aggregate marks in that semester.
- A candidate declared as fail/absent in one or more papers at any odd semester examination shall be permitted to take admission in the next higher semester (even semester) of the same academic session.
- A candidate may be promoted in the next academic session (odd semester) if he/she has cleared collectively at least 50% of the papers of both semesters of previous academic session. The candidate who does not fulfill the above condition will remain as an ex-student and will reappear in the due papers along with next odd/even semester exams.
- If any student who is provisionally admitted in higher odd semester but could not secure prescribed minimum marks in previous semesters will be treated as ex-student and his/her admission fee will be carry forwarded to the next odd semester of forthcoming academic session.

- (e) If a candidate, who is declared as pass, wishes to improve his/her performance in the theory papers of previous semester, he/she may re-appear only one time in these papers in next odd/even semester examinations.
- (f) Candidate shall not be permitted to re-appear or improve the marks obtained in the external examination of practical / dissertation in any condition.
- (g) If the number of papers prescribed in a semester examination is an odd number, it shall be increased by one for the purpose of reckoning 50% of the papers for considering the student pass/fail.
- (h) A candidate may be given only two additional chances for passing the semester thus maximum tenure for completing for three years under-graduate programme up to five years and so on.
- (i) The marks secured in the Gen Hindi, Gen English, Elementary Computer applications and Environment studies shall not be counted in awarding the division to a candidate. The candidate shall have to clear the compulsory subjects in the additional three chances and non-appearance or absence in the examination of compulsory subjects shall be counted as chance and shall be declared fail in that examination.
- (j) The grace marks scheme shall be applicable as per the University norms.

Classification of Successful Candidates:

The classification of successful candidates after last semester examination shall be as under:

Description of Marks Obtained	Division / Result
• 75% and above marks in a paper.	Distinction in that paper
• A candidate who has secured aggregate 60% and above marks	First Division
• A candidate who has secured aggregate 50% and above but less than 60% marks	Second Division
• A candidate who has secured aggregate 40% and above but less than 50% marks	Pass

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Syllabus

B.Sc. Chemistry First Semester Examination

Paper-1.3: CHEM-111 Paper-I: Inorganic Chemistry

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 50 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 10 Marks
		Semester Assessment	: 40 Marks

The syllabus is divided into five independent units and There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

Unit-I Development of Chemical Sciences in India:

Alchemical ideas in Vedas, ideas about ayurvedic, transitional, tantric and iatro-chemical periods. constitution and properties of matter, metals and metallurgy, discovery of medicines, food technology, fermentation technology, textile technology, building materials, Indigenous origin of Indian alchemy, some noted Indian alchemists and their works.

Unit-II Atomic Structure:

Review of Bohr's theory and its limitations, atomic spectrum of hydrogen atom, de Broglie concept of dual nature of matter, Heisenberg's uncertainty principle, Schrodinger's wave equation, significance of ψ and ψ^2 , normalized and orthogonal wave functions, Eigen wave functions and eigen values, radial and angular wave functions for hydrogen atom and probability distribution curves, atomic orbitals, quantum numbers and their significance, shapes of s, p, d and f orbitals. nodal planes.

Unit-III Periodic Table:

Mendeleev's periodic law, Mendeleev's periodic table, Mosley's periodic law, modern periodic law, long form of periodic table or modern periodic table, periodicity of property and magnetic numbers.

Unit-IV Electronic Configuration of Elements:

Rules for filling electrons in various orbitals, Aufbau principle, Pauli's exclusion principles, Hund's rule of maximum multiplicity, stability of half-filled and completely filled orbitals, electronic configurations of the elements according to their position in the periods of periodic table, concept of exchange energy, relative energies of atomic orbitals, anomalous electronic configurations, effective nuclear charge.

Unit-V Periodic Properties:

Atomic, ionic and covalent radii, factors affecting and variation of radii, determination of ionic radii, ionization energy, factors affecting and variation of ionization energy, electron affinity, factors affecting and variation of electron affinity, electronegativity-definition, methods of determination, trends in periodic

table and applications in predicting and explaining the chemical behaviour, variation of density, electrode potentials and oxidation states.

Suggested Books:

- *Advanced Inorganic Chemistry, Vol I & II. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan*
- *Principles of Inorganic Chemistry: B. R. Puri and L. R. Sharma*
- *Shriver & Atkins' Inorganic Chemistry*
- *Concise Inorganic Chemistry: J. D. Lee*
- *General Inorganic Chemistry: J. A. Duffy, Longman (2nd Ed.)*
- *Basic Inorganic Chemistry: F. A. Cotton and G. Wilkinson, Wiley Eastern*

Paper-1.4: CHEM-112
Paper-II: Organic Chemistry

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 50 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 10 Marks
		Semester Assessment	: 40 Marks

The syllabus is divided into five independent units and There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

Unit-I Structure and Bonding:

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonds, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, inductive and field effects, hydrogen bonding.

Unit-II Mechanism of Organic Reactions:

Curved arrow notation, drawing electron movements with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles. Types of organic reactions, Energy considerations.

Unit-III Reactive Intermediates:

Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism: product analysis, intermediates, isotope effects. Kinetic and stereochemical studies.

Unit-IV Stereochemistry-I:

Concept of isomerism, types of isomerism. *Optical isomerism*: Elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration: Sequence rules, D&L and R&S systems of nomenclature.

Unit-V Stereochemistry-II

Geometric Isomerism: Determination of configuration of geometric isomers, E & Z systems of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational Isomerism: Conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and sawhorse formulae, Fischer and Flying wedge formulae. Difference between configuration and conformation.

Suggested Books:

- *Structure and Mechanism in Organic Chemistry*, C.K. Ingold, Cornell University Press.
- *Organic Chemistry*, Claydon, Nick Greeves and Stuart Warren, Oxford University Press
- *A Guide Book to Mechanism in Organic Chemistry*, Peter Sykes, Longman.
- *Textbook of Organic Chemistry by P S Kalsi*, New Age International
- *Stereochemistry of Carbon Compounds*, Ernest L. Eliel, Tata McGraw Hill.
- *Stereochemistry of Organic Compounds*, D. Nasipuri, New Age International.
- *Stereochemistry of Organic Compounds*, P.S. Kalsi, New Age International.
- *Organic Chemistry*, R. T. Morrison and R. N. Boyd, Prentice-Hall.
- *Organic Chemistry*, Vol. I, II & III. Jag Mohan, R. Chand & Company
- *Organic Chemistry*, (Vol. I, II & III. S. M. Mukherji, S. P. Singh and R. P. Kapoor
- *A Text Book of Organic Chemistry: B. S. Bahl and Arun Bahl*
- *A Text Book of Organic Chemistry: P. L. Soni & H.M. Chawla*
- *A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal*
- *Modern Principles of Organic Chemistry: M. K. Jain and S. C. Sharma.*

Paper-1.5: CHEM-113
Paper-III: Physical Chemistry

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 50 Marks
Duration of Examination:	3 Hours	Continuous Assessment	: 10 Marks
		Semester Assessment	: 40 Marks

The syllabus is divided into five independent units and There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

Unit-I Mathematical Concepts:

Logarithmic relations, curve sketching, linear graphs and calculations of slopes, differentiation of functions like k_x , e^x , x^n , $\sin x$, $\log x$; maxima and minima, partial differentiation and reciprocity relations, integrations of some useful / relevant functions: Permutations and combinations. Factorials. Probability.

Unit-II Computers:

General introduction to computers, different components of a computer, hardware and software input output devices; binary numbers and arithmetic; introduction to computer languages. Programming, operating systems.

Unit-III Gaseous State:

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of state.

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.

Unit-IV Molecular Velocities:

Root mean square, average and most probable velocities. Qualitative discussions of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).

Unit V Liquid State:

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases.

Liquid Crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholesteric phases. Thermography and seven segment cells.

Suggested Books:

- *Principles of Physical Chemistry: B. R. Puri and L. R. Sharma*
- *A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand*
- *Physical Chemistry, Pt. I & II: C. M. Gupta, J. K. Saxena and M. C. Purohit*
- *Atkins' Physical Chemistry, Oxford University Press.*

Paper-1.6: CHEM-114 Paper-IV: Chemistry Practical

Contact Hours / Week : 4 Hours / Week Maximum Marks : 50 Marks
Duration of Examination : 6 Hours Semester Assessment : 50 Marks

Distribution of Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Inorganic Chemistry	10
2.	Exercise No. 2: Organic Chemistry	10
3.	Exercise No. 3: Physical Chemistry	10
4.	Practical Record	10
5.	Viva-voce	10
Total Marks		50

Inorganic Chemistry:

Semi-micro / macro Analysis:

Anion analysis: 3 radicals.

Cation analysis: Separation and identification of ions from groups I, II, III, IV, V and VI (3 radicals).

Organic Chemistry:

- Determination of melting points:
 - Naphthalene 80-82°C, Benzoic acid 121.5-122°C, Urea 132.5-133°C, Succinic Acid 184.5-185°C, Cinnamic acid 132.5-133°C, Salicylic acid 157.5-158°C, Acetanilide 113.5-114°C, *m*-Dinitrobenzene 90°C, *p*-Dichlorobenzene 52°C, Aspirin 135°C.
- Determination of boiling points:
 - Ethanol 78°C, Cyclohexane 81.4°C, Toluene 110.6°C, Benzene 80°C
- Determination of mixed melting points:
 - Urea-Cinnamic acid mixture of various compositions (1:4,1:1,4:1)

- Distillation:
 - Simple distillation of ethanol-water using water condenser
 - Distillation of nitrobenzene and aniline using air condenser
 - Steam Distillation:
- Separation:
 - Naphthalene from its suspension in water.
 - Clove oil from Clove
 - Separation of o-and p-nitrophenols
- Sublimation (Simple and vacuum)
 - Camphor, Naphthalene, phthalic acid and Succinic acid.
- Crystallization
 - Concept of induction of crystallization.
 - Phthalic acid from hot water (using fluted filter paper and stemless funnel).
 - Acetanilide from boiling water.
 - Naphthalene from Ethanol.
 - Benzoic acid from water.
- Decolorization and crystallization using charcoal
 - Decolorization of brown sugar (sucrose) with animal charcoal using gravity filtration.
 - Crystallization and decolorization of impure naphthalene (100g of naphthalene mixed with 0.3g. of Congo Red using 1.0g decolorizing carbon) from ethanol.

Physical Chemistry:

Viscosity:

- To determine the viscosity of a given liquid.
- To determine the percentage composition of a given binary mixture of liquids (non-interacting systems) by viscosity method.

Surface Tension:

- To determine the surface tension of a given liquid.
- To determine the percentage composition of a given binary mixture of liquids (non-interacting systems) by surface tension method.

Suggested Books:

- *Vogel's Textbook of Practical Organic Chemistry*, A.R. Tatchell, John Wiley.
- *Vogel's Textbook of Quantitative Analysis*, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham
- *Macro scale and Micro scale Organic Experiments*, K.L. Williamson, D.C. Heath
- *Systematic Qualitative Organic Analysis*, H. Middleton, Edward Arnold.
- *Handbook of Organic Analysis: Qualitative and Quantitative*. H. Clark, Edward Arnold.
- *Experiments and Techniques in Organic Chemistry*, D.P. Pasto, Johnson and Miller, Prentice Hall
- *Practical Chemistry: Giri Bajpai and Pandey*, S. Chand & Co. Ltd., New Delhi.
- *Practical Physical Chemistry*, A.M. James and F.E. Prichard, Longman.
- *Findley's Practical Physical Chemistry*, B.P. Levitt, Longman.
- *Experimental Physical Chemistry*, R.C. Das and B. Behera, Tata McGraw Hill.

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Syllabus

B.Sc. Chemistry Second Semester Examination

Paper-2.3: CHEM-121

Paper-I: Inorganic Chemistry

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 50 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 10 Marks
		Semester Assessment	: 40 Marks

The syllabus is divided into five independent units and There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

Unit-I Ionic Bonding:

General characteristics of ionic bonding, energy considerations in ionic bonding, inert pair effect, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds, Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, solvation energy. Covalent character in ionic compounds: polarizing power and polarizability, factors affecting polarizability, Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment, percentage ionic character from dipole moment and electronegativity difference.

Unit-II Covalent Bonding-I:

Covalency and maximum covalency, failure of octet rule, valence bond theory and its limitations, orbital overlapping theory of covalent bond, directional characteristics of covalent bond, shapes of simple inorganic molecules and ions, Valence Shell Electron Pair Repulsion (VSEPR) theory, determination of shape of molecules by taking suitable examples of AB₂ (linear), AB₃ (trigonal planar), AB₄ (square planar and tetrahedral), AB₅ (trigonal bipyramidal), AB₆ (octahedral) and AB₇ (pentagonal bipyramidal) types of species.

Unit-III Covalent Bonding-II:

Hybridization, salient features, rules, different types, concept of resonance and resonating structures in various inorganic and organic compounds, bond length, bond energy, bond angle.

Unit-IV Covalent Bonding-II:

Basic ideas, LCAO method, criteria for forming MO from AOs, bonding and anti-bonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, non-bonding combination of orbitals, MO treatment of homonuclear and heteronuclear (CO and NO) diatomic molecules, comparison of VB and MO approaches, multi-centre bonding in electron deficient molecules, bond order, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Unit-V Metallic Bonding:

Qualitative idea of valence bond and band theories, semiconductors and insulators, defects in solids.

Weak Chemical Forces:

van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Hydrogen bonding: theories of hydrogen bonding, valence bond treatment.

Suggested Books:

- *Advanced Inorganic Chemistry, Vol I & II. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan*
- *Principles of Inorganic Chemistry: B. R. Puri and L. R. Sharma*
- *Shriver & Atkins' Inorganic Chemistry*
- *Concise Inorganic Chemistry: J. D. Lee*
- *General Inorganic Chemistry: J. A. Duffy, Longman (2nd Ed.)*
- *Basic Inorganic Chemistry: F. A. Cotton and G. Wilkinson, Wiley Eastern*

Paper-2.4: CHEM-122 Paper-II: Organic Chemistry

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 50 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 10 Marks
		Semester Assessment	: 40 Marks

The syllabus is divided into five independent units and There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

Unit-I Alkanes:

IUPAC nomenclature of branched and unbranched alkanes, alkyl group, classification of carbon atoms in alkanes, isomerism in alkanes, sources, methods of preparation (with special reference to Wurtz reaction, Kolbe reactions, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reaction of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Unit-II Cycloalkanes:

Nomenclature, methods of preparation, chemical reactions, Baeyer's strain theory and its limitations, Ring strains in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds.

Unit-III Alkenes:

Nomenclature of alkenes, methods of preparation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, the Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-Mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikof's rule, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 , polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Unit-IV Cycloalkenes and Dienes:

Cycloalkenes: Methods of formation, conformation and chemical reactions of cycloalkenes.

Dienes: Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of preparation, polymerization. Chemical reactions: 1,2- and 1,4-additions, Diels-Alder reaction.

Unit-V Alkynes:

Nomenclature, structure and bonding in alkynes. Methods of preparation. Chemical reactions of alkynes, acidity of alkynes. Mechanisms of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reduction, oxidation and polymerization.

Suggested Books:

- *Structure and Mechanism in Organic Chemistry*, C.K. Ingold, Cornell University Press.
- *Organic Chemistry*, Claydon, Nick Greeves and Stuart Warren, Oxford University Press
- *A Guide Book to Mechanism in Organic Chemistry*, Peter Sykes, Longman.
- *Textbook of Organic Chemistry* by P S Kalsi, New Age International
- *Stereochemistry of Carbon Compounds*, Ernest L. Eliel, Tata McGraw Hill.
- *Stereochemistry of Organic Compounds*, D. Nasipuri, New Age International.
- *Stereochemistry of Organic Compounds*, P.S. Kalsi, New Age International.
- *Organic Chemistry*, R. T. Morrison and R. N. Boyd, Prentice-Hall.
- *Organic Chemistry*, Vol. I, II & III. Jag Mohan, R. Chand & Company
- *Organic Chemistry*, (Vol. I, II & III. S. M. Mukherji, S. P. Singh and R. P. Kapoor
- *A Text Book of Organic Chemistry*: B. S. Bahl and Arun Bahl
- *A Text Book of Organic Chemistry*: P. L. Soni & H.M. Chawla
- *A Text Book of Organic Chemistry*: (Vol. I & II) O. P. Agarwal
- *Modern Principles of Organic Chemistry*: M. K. Jain and S. C. Sharma.

Paper-2.5: CHEM-123

Paper-III: Physical Chemistry

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 50 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 10 Marks
		Semester Assessment	: 40 Marks

The syllabus is divided into five independent units and There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type and answer in about 400 words. Students have to attempt 5 questions taking one from each unit. Paper setter shall be advised to frame the two questions from each unit covering all five units. All the questions will carry equal marks.

Unit I Colloidal State:

Definition of colloids, classification of colloids. Solids in liquids (sols): kinetic, optical and electrical properties; stability of colloids. Protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

Unit I Solid State:

Classification of solids, definition of space lattice, lattice points, crystal lattice and unit cell. Seven crystal systems. Symmetry elements in crystals. Laws of crystallography (i) Law of constancy of interfacial angles (ii) Law of rationality of

indices (iii) Law of symmetry. X-ray diffraction by crystals. Derivation of Bragg's equation Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

Unit III Chemical Kinetics:

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction: concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo-order, half-life and mean life. Determination of the order of reaction: differential method, method of integration, method of half-life period and isolation method. Radioactive decay as a first order phenomenon. Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometry.

Unit IV Theories of Chemical Kinetics:

Effect of temperature on rate of reaction, Arrhenius concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis, characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

Unit-V First Law of Thermodynamics:

Definition of thermodynamic terms: System, surroundings, etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process, concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule-Thomson coefficient and inversion temperature. Calculation of w , q , dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Suggested Books:

- *Principles of Physical Chemistry: B. R. Puri and L. R. Sharma*
- *A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand*
- *Physical Chemistry, Pt. I & II: C. M. Gupta, J. K. Saxena and M. C. Purohit*
- *Atkins' Physical Chemistry, Oxford University Press.*

Paper-2.6: CHEM-124 Paper-IV: Chemistry Practical

Contact Hours / Week : 4 Hours / Week Maximum Marks : 50 Marks
Duration of Examination : 6 Hours Semester Assessment : 50 Marks

Distribution of Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Inorganic Chemistry	10
2.	Exercise No. 2: Organic Chemistry	10
3.	Exercise No. 3: Physical Chemistry	10
4.	Practical Record	10
5.	Viva-voce	10
Total Marks		50

Inorganic Chemistry:

Semi-micro / macro Analysis:

Anion analysis: 3 radicals.

Cation analysis: Separation and identification of ions from groups I, II, III, IV, V and VI (3 radicals).

Organic Chemistry:

Qualitative Analysis:

Detection of extra elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, ester, carbohydrates, amine, amide, nitro and anilide) in simple organic compounds.

Physical Chemistry:

Chemical Kinetics

- To determine the specific reaction rate of the hydrolysis of methyl acetate / ethyl acetate catalyzed by hydrogen ions at room temperature.
- To study the effect of acid strength on the hydrolysis of an ester.
- To compare the strengths of HCl and H₂SO₄ by studying the kinetics of hydrolysis of ethyl-acetate.
- To study kinetically the reaction of decomposition of iodide by H₂O₂

Colloids

- To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Suggested Books:

- *Vogel's Textbook of Practical Organic Chemistry*, A.R. Tatchell, John Wiley.
- *Vogel's Textbook of Quantitative Analysis*, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham
- *Macro scale and Micro scale Organic Experiments*, K.L. Williamson, D.C. Heath
- *Systematic Qualitative Organic Analysis*, H. Middleton, Edward Arnold.
- *Handbook of Organic Analysis: Qualitative and Quantitative*. H. Clark, Edward Arnold.
- *Experiments and Techniques in Organic Chemistry*, D.P. Pasto, Johnson and Miller, Prentice Hall
- *Practical Chemistry: Giri Bajpai and Pandey*, S. Chand & Co. Ltd., New Delhi.
- *Practical Physical Chemistry*, A.M. James and F.E. Prichard, Longman.
- *Findley's Practical Physical Chemistry*, B.P. Levitt, Longman.
- *Experimental Physical Chemistry*, R.C. Das and B. Behera, Tata McGraw Hill.

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