

***SCHEME OF EXAMINATION
AND
SYLLABUS***

(for Academic Session 2022-2023)

**B.Sc. Chemistry
Fifth & Sixth 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 Examination for All Semesters</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 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 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. Fifth Semester (Pass Course) Chemistry • B.Sc. Sixth Semester (Pass Course) Chemistry 	17 22

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

Subject Combination: Chemistry, Mathematics, Physics (CMP)

B.Sc. 1st Year: 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 I Semester	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
	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 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 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 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 II Semester	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
	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 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 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 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. 2nd Year: 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 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 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 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 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 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 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. 3rd Year: 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 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 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 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 Practical	6	-	4	2	--	--	50	25	50	25
Total (V Semester)				36	30	24	90	36	510	219	600	195	
3rd Year 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 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 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 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. 1st Year: 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 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 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 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 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 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 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. 2nd Year: 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 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 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 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 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 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 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. 3rd Year: 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.	Credit Pr.	Continuous Assessment (20%)		Semester Assessment (80%)				
							Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	
3rd Year 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 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 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 Practical	6	-	4	2	--	--	50	25	50	25
Total (V Semester)				39	30	24	90	36	510	219	600	195	
3rd Year 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-364	Chemistry: Paper-III: Physical Chemistry	3	2	-	2	10	04	40	16	50	20
	Paper-6.4	CHEM-364	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 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 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

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
1st Year 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	Practical : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
1st Year 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	Practical : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
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	Practical : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
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	Practical : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
3rd Year 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	Practical : Chemistry Practical	6	-	4	2	--	--	50	25	50	25
				12	6	4	8	30	12	170	73	200	85
3rd Year 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	Practical : 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 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 recognised 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 recognised 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

Q. No. 7	Unit-IV	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 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

..... X X X

Syllabus

B.Sc. Chemistry Fifth Semester Examination

Paper-5.1: CHEM-351 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 Chemistry of Elements of First Transition Series:

Characteristics properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Unit-II Chemistry of Elements of Second and Third Transition Series:

General characteristics, comparative treatment with their 3d-analogues in respect to ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit-III Metal-Ligand Bonding in Transition Metal Complexes:

Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field stabilization energy (CFSE), crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters, comparison of CFSE for O_h and T_d complexes, Jahn-Teller distortions, applications and limitations of crystal field theory.

Unit-IV Magnetic Properties of Transition Metal Complexes:

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of n_s and n_{eff} and values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

Unit-V Electronic Spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[(Ti(H_2O)_6)]^{3+}$ complex.

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-5.2: CHEM-352
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 Nitroalkanes and Nitroarenes:

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: reactivity.

Alkyl and Aryl Amines:

Structure and nomenclature of amines, physical properties, stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles). Reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryldiazonium salts, azo coupling.

Unit-II Organometallic Compounds:

Organomagnesium Compounds: The Grignard reagents-formation, structure and chemical reactions. Organozinc Compounds: Formation and chemical reactions. Organolithium compounds: Formation and chemical reactions. Organosulphur compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Unit-III Organic Synthesis via Enolates:

Acidity of α -hydrogens. alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

Unit-IV Synthetic Polymers:

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol-formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Synthetic Dyes:

Colour and constitution (electronic concept), classification of dyes. Synthesis of methyl orange, Congo red, malachite green, crystal violet, phenolphthalein, fluorescein, Alizarin and Indigo.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Unit-V Fats, Oils and Detergents:

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, soaps, synthetic detergents, alkyl and aryl sulphonates.

Suggested Books:

- *Structure and Mechanism in Organic Chemistry*, C.K. Ingold, Cornell University Press.
- *Organic Chemistry*, Clayden, 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, TataMcGraw 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-5.3: CHEM-353

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 Electrochemistry-I:

Electrical transport: conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only).

Unit-II Electrochemistry-II:

Transport number: definition and determination by Hittorf's method and moving boundary method. Applications of conductivity measurements: Determination of degree of dissociation, determination of K_a of acids, conductometric titrations.

Unit-III Electrochemistry-III:

Types of reversible electrodes: Gas-metal ion, metal-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst's equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance.

Unit-IV Electrochemistry-IV:

Electrolyte and Galvanic Cells: Reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG , ΔH and K), polarization, over-potential and hydrogen over-voltage. Concentration cell with and without transport, liquid-junction potential, application of concentration cells, valency of ions.

Unit-V Solubility Product and Activity Coefficient:

Determination of solubility product of a sparingly soluble salt. Definition of pH and pKa. Determination of pH using hydrogen electrode by potentiometric titrations. Buffers: mechanism of buffer action, Henderson-Hasselbalch equation, hydrolysis of salts.

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-5.4: CHEM-354 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.	Viva-voce	10
5.	Practical Record	10
Total Marks		50

Inorganic Chemistry:

Preparation and Analysis:

- Sodium trioxalatoferrate (III). $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$.
- Ni-DMG complex $[\text{Ni}(\text{DMG})_2]$.
- Hexaammine nickel complex $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$
- Tetraammine copper complex $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$.
- Hexaammine chromium complex $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$
- cis-and trans-bisoxalatodiaquachromate (III) ion.

Organic Chemistry:

Chromatography:

Paper Chromatography-Ascending and Circular:

Determination of values and Identification of organic compounds.

- Separation of a mixture of phenyl alanine and glycine. Alanine and aspartic acid. leucine and glutamic acid. Spray reagent-Ninhydrin.

- Separation of a mixture of D,L-alanine, glycine and L-leucine using n-butanol: acetic acid:water (4:1:5). Spray reagent-Ninhydrin.
- separation of mono saccharides-a mixture of D-galactose and D-fructose using n-butanol:acetone:water (4:5:1). Spray reagent- Aniline hydrogen phthalate.

Thin Layer Chromatography:

Determination of R_f values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used)
- Preparation and separation of 2,4-Dinitrophenyl hydrazones of acetone, 2-butanone, hexan-2 and 3-one using toluene and light petroleum (40:60)
- Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)

Column Chromatography:

- Separation of fluorescein and methylene blue.
- Separation of leaf pigments from spinach leaves.
- Resolution of racemic mixture of (Z)-mandelic acid.

Quantitative Analysis:

- Estimation of amino group, phenolic group, carboxylic acid group and glucose.

Physical Chemistry:

Electrochemistry

- To determine the strength of the given acid conductometrically using standard alkali solution.
- To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
- To study the saponification of ethyl acetate conductometrically.
- To determine the ionization constant of a weak acid conductometrically.
- To titrate potentiometrically the given ferrous ammonium sulphate solution using KMnO₄ / K₂Cr₂O₇ as titmate and calculate the redox potential of Fe²⁺/Fe³⁺ system on the hydrogen scale.

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.

..... X X X

Syllabus

B.Sc. Chemistry Sixth Semester Examination

Paper-6.1: CHEM-361

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 Thermodynamic and Kinetic Aspects of Metal Complexes:

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-II Chemistry of Lanthanides:

Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Unit-III Chemistry of Actinides:

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and later lanthanides.

Unit IV Organometallic Chemistry:

Definition, nomenclature and classification of organometallic compounds; preparation and properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn and Ti; a brief account of metal-ethylenic complexes and homogeneous hydrogenation; mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-V Bioinorganic Chemistry:

Essential and trace elements in biological processes, geochemical effect on the distribution of metals, excess and deficiency of some trace metals, metallo-porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to Ca^{+2} and Mg^{2+} . Nitrogen fixation.

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-6.2: CHEM-362
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 Heterocyclic Compounds:

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher-indole synthesis, Skraup's synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit-II Carbohydrates:

Classification and nomenclature. monosaccharides: mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses, configuration, erythro and threo diastereomers, conversion of glucose into mannose, formation of glycosides, ethers and esters, determination of ring size, cyclic structure of D(+) glucose, mechanism of mutarotation, structure of ribose and deoxyribose.

Unit-III Amino Acids:

Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α -amino acids.

Peptides and Proteins:

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins, Levels of protein structure, Protein denaturation/renaturation.

Nucleic Acids:

Introduction. constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Unit-IV Ultraviolet (UV) Spectroscopy:

Absorption laws (Beer-Lambert's law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes and enones.

Infrared (IR) Spectroscopy:

Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit-V Nuclear Magnetic Resonance (NMR) Spectroscopy:

Nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals. interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques

Suggested Books:

- *Structure and Mechanism in Organic Chemistry*, C.K. Ingold, Cornell University Press.
- *Organic Chemistry*, Clayden, Nick Greeves and Stuart Warren, Oxford University Press
- *A Guide Book to Mechanism in Organic Chemistry*, Peter Sykes, Longman.
- *Reaction Mechanism in Organic Chemistry*, S. M. Mukherjee and S. P. Singh, Macmillan.
- *Textbook of Organic Chemistry by P S Kalsi*, New Age International
- *Stereochemistry of Carbon Compounds*, Ernest L. Eliel, TataMcGraw Hill.
- *Stereochemistry of Organic Compounds*, D. Nasipuri, New Age International.
- *Stereochemistry of Organic Compounds*, P.S. Kalsi, New Age International.
- *Stereochemistry, Conformation and Mechanism by 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-6.3: CHEM-363

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 Spectroscopy:

Introduction, electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectroscopy:

Diatomic molecules, energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect.

Unit-II Electronic Spectroscopy:

Concept of potential energy curves for bonding and anti-bonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle. qualitative description of σ , π and n MO, their energy levels and the respective transitions.

Unit-III Vibrational (Infrared) Spectroscopy:

Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies. effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Unit-IV Raman Spectroscopy:

Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Unit-V Photochemistry:

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state. qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, actinometry, photosensitized reactions-energy transfer processes (simple examples).

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.*
- *Basic Programming with Application, V.K. Jain. Tata McGraw Hill.*
- *Computers and Common Sense. R Hunt and Shelly, Prentice Hall.*

Paper-6.4: CHEM-364

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.	Viva-voce	10
5.	Practical Record	10
Total Marks		50

Inorganic Chemistry:

Instrumentation

- Colorimetry - Job's method and Mole-ratio method.
- Adulteration - Food stuff.
- Effluent analysis - Water analysis.
- Solvent Extraction - Separation and estimation of Mg(II) and Fe(II)
- Ion Exchange Method - Separation and estimation of Mg(II) and Zn(II)

Organic Chemistry:

Synthesis of Organic Compounds

- Acetylation: Salicylic acid, aniline, glucose and hydroquinone.
- Benzoylation: Aniline and phenol.
- Aliphatic Electrophilic Substitution: Preparation of Iodoform from ethanol and acetone.
- Aromatic Electrophilic Substitution:
 - Nitration:
Preparation of m-dinitrobenzene,
Preparation of p-nitroacetanilide
 - Halogenation:
Preparation of p-bromoacetanilide
Preparation of 2,4,6-tribromophenol.
- Diazotization/coupling: Preparation of methyl orange and methyl red.
- Oxidation: Preparation of benzoic acid from toluene.
- Reduction: Preparation of aniline from nitrobenzene and m-nitroaniline from m-dinitrobenzene.

Stereo-chemical study of Organic Compounds via Models

- R and S configuration of optical isomers.
- E and Z configuration of geometrical isomers.
- Conformational analysis of cyclohexanes and substituted cyclohexanes.

Physical Chemistry:

Refractometry and Polarimetry:

- To verify law of refraction of mixtures for e.g. of glycerol and water) using Abe's refractometer.
- To determine the specific rotation of a given optically active compound.

Colorimetry:

- To verify Beer-Lambert law KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ and determined the concentration of the given solution of the substance.

Books Suggested:

- *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.

..... X X X