SCHEME OF EXAMINATION

AND

SYLLABUS

(for Academic Session 2019-2020)

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

Bachelor of Science (B.Sc.)

(Mathematics Group)

Subject Combination: Chemistry, Physics, Mathematics (CPM)

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	
								Continuous Assessment (20%)		Semester Assessment (80%)			
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Pr.	Credit Points	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.4	CHEM-112	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-1.5	CHEM-113	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.6	MATH-111	Mathematics-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.7	MATH-112	Mathematics-II	3	3	-	3	15	06	60	24	75	30
	Paper-1.8	MATH-113	Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.9	PHY-111	Physics-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.10	PHY-112	Physics-II	3	3	-	3	15	06	60	24	75	30
	Paper-1.11	PHY-113	Physics Practical	6	-	4	2	--	--	50	25	50	25
	Total (I Semester)			**36+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	ENV-122	Environmental Studies	2	2	-	2	-	-	50	20	50	20
	Paper-2.3	CHEM-121	Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.4	CHEM-122	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.5	CHEM-123	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.6	MATH-121	Mathematics-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.7	MATH-122	Mathematics-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.8	MATH-123	Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.9	PHY-121	Physics-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.10	PHY-122	Physics-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.11	PHY-123	Physics Practical	6	-	4	2	--	--	50	25	50	25
	Total (II Semester)			**36+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, Physics, Mathematics (CPM)

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	
								Continuous Assessment (20%)		Semester Assessment (80%)			
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Teaching Pr.	Credit Points	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-3.2	CHEM-232	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.3	CHEM-233	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.4	MATH-231	Mathematics-I	3	3	-	3	15	06	60	24	75	30
	Paper-3.5	MATH-232	Mathematics-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.6	MATH-233	Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.7	PHY-231	Physics-I	3	3	-	3	15	06	60	24	75	30
	Paper-3.8	PHY-232	Physics-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.9	PHY-233	Physics Practical	6	-	4	2	--	--	50	25	50	25
	Total (III Semester)			**36**	**30**		**24**	**90**	**36**	**510**	**219**	**600**	**195**
2nd Year IV Semester	Paper-4.1	CHEM-241	Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-4.2	CHEM-242	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-4.3	CHEM-243	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.4	MATH-241	Mathematics-I	3	3	-	3	15	06	60	24	75	30
	Paper-4.5	MATH-242	Mathematics-II	3	3	-	3	15	06	60	24	75	30
	Paper-4.6	MATH-243	Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.7	PHY-241	Physics-I	3	3	-	3	15	06	60	24	75	30
	Paper-4.8	PHY-242	Physics-II	3	3	-	3	15	06	60	24	75	30
	Paper-4.9	PHY-243	Physics Practical	6	-	4	2	--	--	50	25	50	25
	Total (IV Semester)			**36**	**30**		**24**	**90**	**36**	**510**	**219**	**600**	**195**

Bachelor of Science (B.Sc.)

(Mathematics Group)

Subject Combination: Chemistry, Physics, Mathematics (CPM)

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					Continuous Assessment (20%)		Semester Assessment (80%)			
					Teaching Th.	Teaching Pr.	Credit Points	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-5.2	CHEM-352	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-5.3	CHEM-353	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.4	MATH-351	Mathematics-I	3	3	-	3	15	06	60	24	75	30
	Paper-5.5	MATH-352	Mathematics-II	3	3	-	3	15	06	60	24	75	30
	Paper-5.6	MATH-353	Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.7	PHY-351	Physics-I	3	3	-	3	15	06	60	24	75	30
	Paper-5.8	PHY-352	Physics-II	3	3	-	3	15	06	60	24	75	30
	Paper-5.9	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-6.2	CHEM-362	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-6.3	CHEM-363	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.4	MATH-361	Mathematics-I	3	3	-	3	15	06	60	24	75	30
	Paper-6.5	MATH-362	Mathematics-II	3	3	-	3	15	06	60	24	75	30
	Paper-6.6	MATH-363	Mathematics Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.7	PHY-361	Physics-I	3	3	-	3	15	06	60	24	75	30
	Paper-6.8	PHY-362	Physics-II	3	3	-	3	15	06	60	24	75	30
	Paper-6.9	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	
								Continuous Assessment (20%)		Semester Assessment (80%)			
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Teaching Pr.	Credit Points	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.4	CHEM-112	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-1.5	CHEM-113	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.6	BOT-111	Botany-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.7	BOT-112	Botany-II	3	3	-	3	15	06	60	24	75	30
	Paper-1.8	BOT-113	Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-1.9	ZOO-111	Zoology-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.10	ZOO-112	Zoology-II	3	3	-	3	15	06	60	24	75	30
	Paper-1.11	ZOO-113	Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (I Semester)				**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	ENV-122	Environmental Studies	2	2	-	2	-	-	50	20	50	20
	Paper-2.3	CHEM-121	Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.4	CHEM-122	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.5	CHEM-123	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.6	BOT-121	Botany-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.7	BOT-122	Botany-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.8	BOT-123	Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-2.9	ZOO-121	Zoology-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.10	ZOO-122	Zoology-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.11	ZOO-123	Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (II Semester)				**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	
								Continuous Assessment (20%)		Semester Assessment (80%)			
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Teaching Pr.	Credit Points	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-3.2	CHEM-232	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.3	CHEM-233	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.4	BOT-231	Botany-I	3	3	-	3	15	06	60	24	75	30
	Paper-3.5	BOT-232	Botany-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.6	BOT-233	Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-3.7	ZOO-231	Zoology-I	3	3	-	3	15	06	60	24	75	30
	Paper-3.8	ZOO-232	Zoology-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.9	ZOO-233	Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (III Semester)			**36**	**30**		**24**	**90**	**36**	**510**	**219**	**600**	**195**
2nd Year IV Semester	Paper-4.1	CHEM-241	Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-4.2	CHEM-242	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-4.3	CHEM-243	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.4	BOT-241	Botany-I	3	3	-	3	15	06	60	24	75	30
	Paper-4.5	BOT-242	Botany-II	3	3	-	3	15	06	60	24	75	30
	Paper-4.6	BOT-243	Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-4.7	ZOO-241	Zoology-I	3	3	-	3	15	06	60	24	75	30
	Paper-4.8	ZOO-242	Zoology-II	3	3	-	3	15	06	60	24	75	30
	Paper-4.9	ZOO-243	Zoology Practical	6	-	4	2	--	--	50	25	50	25
	Total (IV 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. 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	
								Continuous Assessment (20%)		Semester Assessment (80%)			
	Number of Paper	Code or ID of Paper	Nomenclature of Paper		Teaching Th.	Teaching Pr.	Credit Points	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-I	3	3	-	3	15	06	60	24	75	30
	Paper-5.2	CHEM-352	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-5.3	CHEM-363	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.4	BOT-351	Botany-I	3	3	-	3	15	06	60	24	75	30
	Paper-5.5	BOT-352	Botany-II	3	3	-	3	15	06	60	24	75	30
	Paper-5.6	BOT-353	Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-5.7	ZOO-351	Zoology-I	3	3	-	3	15	06	60	24	75	30
	Paper-5.8	ZOO-352	Zoology-II	3	3	-	3	15	06	60	24	75	30
	Paper-5.9	ZOO-353	Zoology 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-I	3	3	-	3	15	06	60	24	75	30
	Paper-6.2	CHEM-362	Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-6.3	CHEM-363	Chemistry Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.4	BOT-361	Botany-I	3	3	-	3	15	06	60	24	75	30
	Paper-6.5	BOT-362	Botany-II	3	3	-	3	15	06	60	24	75	30
	Paper-6.6	BOT-363	Botany Practical	6	-	4	2	--	--	50	25	50	25
	Paper-6.7	ZOO-361	Zoology-I	3	3	-	3	15	06	60	24	75	30
	Paper-6.8	ZOO-362	Zoology-II	3	3	-	3	15	06	60	24	75	30
	Paper-6.9	ZOO-363	Zoology 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.)
CHEMISTRY

(Common for Mathematics / Biology Group: All Semesters)

Subject Combination: Chemistry, Physics, Mathematics (CPM) / Chemistry, Botany, Zoology (CBZ)

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						Continuous Assessment (20%)		Semester Assessment (80%)			
						Teaching		Credit Points	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks
						Th.	Pr.							
1st Year I Semester	Paper-1.3	CHEM-111	Chemistry-I	: Inorganic Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.4	CHEM-112	Chemistry-II	: Organic Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-1.5	CHEM-113	Practical	: Chemistry Practical-I	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-I	: Physical Chemistry-I	3	3	-	3	15	06	60	24	75	30
	Paper-2.4	CHEM-122	Chemistry-II	: Inorganic Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-2.5	CHEM-123	Practical	: Chemistry Practical-II	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-I	: Organic Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.2	CHEM-232	Chemistry-II	: Physical Chemistry-II	3	3	-	3	15	06	60	24	75	30
	Paper-3.3	CHEM-233	Practical	: Chemistry Practical-III	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-I	: Inorganic Chemistry-III	3	3	-	3	15	06	60	24	75	30
	Paper-4.2	CHEM-242	Chemistry-II	: Organic Chemistry-III	3	3	-	3	15	06	60	24	75	30
	Paper-4.3	CHEM-243	Practical	: Chemistry Practical-IV	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-I	: Physical Chemistry-III	3	3	-	3	15	06	60	24	75	30
	Paper-5.2	CHEM-352	Chemistry-II	: Inorganic Chemistry-IV	3	3	-	3	15	06	60	24	75	30
	Paper-5.3	CHEM-353	Practical	: Chemistry Practical-V	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-I	: Organic Chemistry-IV	3	3	-	3	15	06	60	24	75	30
	Paper-6.2	CHEM-362	Chemistry-II	: Physical Chemistry-IV	3	3	-	3	15	06	60	24	75	30
	Paper-6.3	CHEM-363	Practical	: Chemistry Practical-VI	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 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:

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

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 degignated 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 year of study + n^{th} number of semester 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 ponits 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 ponit 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 / Scheme of Examination:

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

(i) Continuous Assessment or Internal or Mid Term Assessment:

(a) The continuous or internal or mid-term assessment (20% weightage of the maximum marks) for each theory paper shall be taken by the faculty members in the Department during each semester. There will be two internal assessment tests (*i.e.* first internal assessment test or first mid-term test and second internal assessment test or second mid-term test) each of 10% weightage of maximum marks of each theory paper. Each internal assessment test shall be of one hour duration for theory paper and shall be taken according to academic calendar which will be notified by the Department / University.

(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. Some marks for regularity shall be given to the student(s) who is/are taken classes regularly from the 2% weightage of the maximum marks. The 2% weightage of the maximum marks of regularity shall be taken from the weightage given for second internal assessment (10% weightage of maximum marks). After excluding the 2% weightage of regularity, the second internal assessment shall be of 8% weightage of maximum marks. If the attendance / regularity factor is similar for all the students, then it may be merged with the weightage of second internal assessment test (class test, home assignment, quiz, seminar, *etc.*) and then second internal assessment test shall be of 10% weightage of maximum marks.

(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) Semester Assessment or External or End Term 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) Continuous or Internal or Mid Term Assessment:

(i) First Continuous or Internal or Mid Term Assessment:

Department of Pure & Applied Chemistry
University of Kota
Kota (Rajasthan)-324 005

First Internal Assessment Test 20… - 20….

Class	**:**	**Max. Marks**	**: 7.5**
Semester	**:**	**No. of Students**	**:**
Subject	**:**	**Duration of Exam**	**:**
Paper	**:**	**Name of Teacher**	**:**

Q. No. 1. ……..
or
…….
2.5 Marks
Q. No. 2. ……..
or
…….
2.5 Marks
Q. No. 3. ……..
or
…….
2.5 Marks

(ii) Second Continuous or Internal or Mid Term Assessment:

(a) Attendance:

Marks shall be given by the faculty member in each paper according to its weightage.

1.5 (2% weightage of Maximum Marks)

Note:

If the attendance / regularity factor is similar for all the students, then it may be merged with the weightage of second internal assessment test (class test / home assignment / quiz, seminar, etc.).

(b) Class Test:

6 (8 % weightage of Maximum Marks)

Format

Department of Pure & Applied Chemistry
University of Kota
Kota (Rajasthan)-324 005
Second Internal Assessment Test 20… - 20….

Class	**:**	**Max. Marks**	**: 6**
Semester	**:**	**No. of Students**	**:**
Subject	**:**	**Duration of Exam**	**:**
Paper	**:**	**Name of Teacher**	**:**

Q. No. 1. …….....
2 Marks
Q. No. 2. ……..
or
……
2 Marks
Q. No. 3. ……..
or
……
2 Marks

or

(b) Assignment:

(May be divided in parts or questions or may not be. It will be depending on the nature of assignment).

6 (8 % weightage of Maximum Marks)

or

(b) Quiz:

(May be divided in parts or questions or may not be. It will be depending on the nature of quiz).

6 (8 % weightage of Maximum Marks)

or

(b) Any other tool may be adopted for internal Assessment

6 (8 % weightage of Maximum Marks)

(B) Semester or External or End Term Assessment:

Duration of Examination: 3 Hours **Max. Marks: 60**

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 12 Marks

or

Q. No. 2 12 Marks

Unit-II

Q. No. 3 12 Marks

or

Q. No. 4 12 Marks

Unit-III

Q. No. 5 12 Marks

or

Q. No. 6 12 Marks

Unit-IV

Q. No. 7 12 Marks

or

Q. No. 8 12 Marks

Unit-V

Q. No. 9 12 Marks

or

Q. No. 10 12 Marks

Practical Examinations:

Continuous or Internal or Mid Term Assessment: *Not applicable in practical.*

External or Semester or End Term Assessment:

Duration of Exam: 6 Hours **Maximum Marks: 50**

Distribution of Maximum Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1	15
2.	Exercise No. 2	15
3.	Viva-voce	10
4.	Practical Record	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 the 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:

(a) 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.

(b) 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.

(c) 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.

(d) 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: Physical Chemistry-III

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 75 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 15 Marks
		Semester Assessment	: 60 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.

Note: *Contents of each unit may be completed into 8-10 lectures or contact hours which also include revisions, seminars, internal assessments, etc.*

Unit-I Chemical Equilibrium:

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le chatelier's principle. Reaction isotherm and reaction isochores, isochore-Clapeyron equation and Clausius-Clapeyron equation. applications.

Unit-II Phase Equilibrium:

Statement and meaning of the terms: Phase, component and degree of freedom. derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component system-solid-liquid equilibria, simple eutectic Pb-Ag system. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point (NaCl-H_2O) system. Freezing mixtures: acetone-dry ice. Partially miscible liquids: Phenol-water and nicotine-water systems. Lower and upper consolute temperature. Effect of imurity on consulate temperature.

Unit-III Solutions, Dilute Solutions and Colligative Properties:

Ideal and non-ideal solutions and thier propoerties, methods of expressing concentrations of solutions, activity and activity coefficient. Roult's and Henry's laws, Azeotropes-ethanol-water system. Nernst Distribution law-Thermodynamic derivation, applications. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal value and abnormal molar mass, degree of dissociation and association of solutes.

Unit-IV Elementary Quantum Mechanics:

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton

effect. De Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom. separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit-V Molecular Orbital Theory:

Basic ideas, criteria for forming MO from AOs, construction of MO's of H_2^+ ion by LCAO, calculation of energy level from wave functions, physical picture of bonding and anti-bonding wave functions, concept of σ, σ^*, π, π^* orbitals and their characteristics. Hybrid orbitals-sp, sp^2, sp^3. calculation of coefficients of AO's used in these hybrid orbitals. Introduction to valence bond model of H_2, comparison of MO and VB models.

Books Suggested :

- *Physical Chemistry, G.M. Barrow. International Student Edition, McGraw Hill.*
- *University General Chemistry, C.N.R Rao, Mac Millan.*
- *Physical Chemistry, RA. Alberty, Wiley Eastern Ltd.*
- *The Elements of Physical Chemistry, P.W. Atkins, Oxford.*
- *Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.*
- *Principles of Physical Chemistry : B. R. Puri Sharma and M. S. Pathania*
- *A Text Book of Physical Chemistry : A. S. Negi and S. C. Anand*
- *A Text Book of Physical Chemistry : Kundu and Jain*

Paper-5.2: CHEM-352: Inorganic Chemistry-IV

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 75 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 15 Marks
		Semester Assessment	: 60 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.

Note: *Contents of each unit may be completed into 8-10 lectures or contact hours which also include revisions, seminars, internal assessments, etc.*

Unit-I 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 $[(T_i(H_2O)_6]^{3+}$ complexion.

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, AI, 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, metalloporphyrins 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.

Books Suggested :

- *Advanced Inorganic Chemistry, Vol I & II. Satya Praksh, G.D. Tuli, S.K. Basu and R.D. Madan*
- *Principles of Inorganic Chemistry : B. R. Puri and L. R. Sharma*
- *Basic Inorganic Chemistry F.A. Cotton. G. Wilkinson and P.L. Gaus. Wiley.*
- *Concise Inorganic Chemistry, J.D. Lee ELBS.*
- *Concepts of Models Inorganic Chemistry B.Douglas. D.McDaniel and J.Alexander, John Wiley.*
- *Inorganic Chemistry. D.E. Shriver P.W. Atkins and C.H. Langfor, Oxford.*
- *Inorganic Chemistry, W.W. Porterfield Addison Wesley.*
- *Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.*
- *Inorganic Chemistry: J. E. Huyee, Principles of Structure & Reactivity, 3rd Ed.*
- *Principles of Inorganic Chemistry : D. Banerje*
- *Modern Aspect of Inorganic Chemistry : H. J. Emeleus and A. G. Sharpe*
- *General Inorganic Chemistry: J. A. Duffy, Longman (2nd Ed.)*

Paper-5.3: CHEM-353: Chemistry Practical-V

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

Distribution of Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Inorganic Chemistry Experiment	15
2.	Exercise No. 2: Physical Chemistry Experiment	15
3.	Viva-voce	10
4.	Practical Record	10
	Total Marks	**50**

Inorganic Chemistry

Synthesis and Analysis

- Preparation of sodium trioxalatoferrate (III). $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permagnomotry.
- Preparation of Ni-DMG complex $[Ni(DMG)_2]$.
- Preparation of copper tetraammine complex $[Cu(NH_3)_3]SO_4$.
- Preparation of cis-and trans-bisoxalatodiaquachromate (III) ion.

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)

Physical Chemistry

Phase Equilibrium

- To study the effect of a solute (*e.g.*NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (*e.g.* phenol-water system)
- To construct the phase diagram of two component (*e.g.* diphenyl-benzo phenone) system by cooling curve method.

Refractometry and Polarimetry

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

Molecular Weight Determination

- Determination of molecular weight of a non-volatile solute by Rast method / Beckmann freezing point method.
- Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebulliscopy.

Books Suggested :

- *Vogel's Textbook of Quantitative Analysis, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham*
- *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

Sixth Semester Examination

Paper-6.1: CHEM-361: Organic Chemistry-IV

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 75 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 15 Marks
		Semester Assessment	: 60 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.

Note: *Contents of each unit may be completed into 8-10 lectures or contact hours which also include revisions, seminars, internal assessments, etc.*

Unit-I Heterocylic 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 heterocyles. Preparation and reactions of indole, quauinoline 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 isoquionoline.

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.

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

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 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.

Unit-IV Spectroscopy-I

Ultra-violet (UV) Absorption 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) Absorption 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 Spectroscopy-II

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.

Books Suggested :

- *Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.*
- *Organic Chemistry, Clayden, Nick Geeves and Staurt 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*
- *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*
- *Elementary Organic Spectroscopy, Y.R. Sharma*
- *Spectroscopy of Organic Compounds, P.S. Kalsi.*

Paper-6.2: CHEM-362: Physical Chemistry-IV

Contact Hours / Week	: 3 Hours / Week	Maximum Marks	: 75 Marks
Duration of Examination	: 3 Hours	Continuous Assessment	: 15 Marks
		Semester Assessment	: 60 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.

Note: *Contents of each unit may be completed into 8-10 lectures or contact hours which also include revisions, seminars, internal assessments, etc.*

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-Huckle-Onsager's equation for strong electrolytes (elementary treatment only). 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-II Electrochemistry-II:

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.

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 themodynamic 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.

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-Hazel equation, hydrolysis of salts.

Unit-III Spectroscopy-I:

Introduction, electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Openheimer 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.

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-IV Spectroscopy-II:

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.

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-Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the exited sate. qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, actinometry, photosensitized reactions-energy transfer processes (simple examples).

Books Suggested :

- *Physical Chemistry, G.M. Barrow. International Student Edition, McGraw Hill.*
- *University General Chemistry, C.N.R Rao, Mac Millan.*
- *Physical Chemistry, RA. Alberty, Wiley Eastern Ltd.*
- *The Elements of Physical Chemistry, P.W. Atkins, Oxford.*
- *Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.*
- *Principles of Physical Chemistry : B. R. Puri Sharma and M. S. Pathania*
- *A Text Book of Physical Chemistry : A. S. Negi and S. C. Anand*
- *A Text Book of Physical Chemistry : Kundu and Jain*
- *Spectroscopy, Gurdeep Raj Chatwal.*

Paper-6.3: CHEM-363: Chemistry Practical-VI

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

Distribution of Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Organic Chemistry Experiment	15
2.	Exercise No. 2: Physical Chemistry Experiment	15
3.	Viva-voce	10
4.	Practical Record	10
	Total Marks	**50**

Organic Chemistry

Qualitative Analysis:
Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.

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 toulene.
- 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 cyc1ohexanes.

Quantitative Analysis:

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

Physical Chemistry

Electrochemistry

- To determine the strength of the given acid condcutometrically 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 $KMnO_4$ / $K_2Cr_2O_7$ as titmate and calculate the redox potential of Fe^{2+}/Fe^{3+} system on the hydrogen scale.

Colorimetry

- To verify Beer-Lambert law $KMnO_4$ / $K_2Cr_2O_7$ 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.*
- *Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.*
- *Handbook of Organic Analysis: Qualitative and Quantitative. H. Clark, Adward 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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