KURUKSHETRA UNIVERSITY KURUKSHETRA

[Established by the State Legislature Act XII of 1956]

('A+' Grade, NAAC Accredited)

AQAR-2020-21

1.2.2 : Scheme of Examination for the programmes in the Department/Institute of

Chemistry

Scheme of Examination 1.2.2

Kurukshetra University, Kurukshetra
(Established by the State Legislature Act XII of 1956)
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(Perform Actions while Steadfasting in the State of Yoga)

DEPARTMENT OF CHEMISTRY
(DOCHEM)

CBCS CURRICULUM (2020-21)
M.Sc. Chemistry

(For the Batches Admitted From 2020-2021)

OUTCOME BASED EDUCATION SYSTEM / LEARNING OUTCOME CURRICULUM FRAMEWORK

OBES / LOCF, CBCS CURRICULUM (2020-21)

M. Sc. Chemistry
(For the Batches Admitted From 2020-2021)

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Department of Chemistry
K.U. KURUKSHETRA.

VISION

Be globally acknowledged as a distinguished centre of academic excellence.

MISSION

To prepare a class of proficient students, scholars and professionals with human values and commitment to expand the frontiers of knowledge for the advancement of society.

DEPARTMENT VISION AND MISSION

VISION

To provide competitively trained young minds to contribute as efficient teachers, chemists, researchers and assist chemical based industries and stakeholders globally.

MISSION

1. To develop researchers, scientists and educators in chemical sciences
2. To develop competent manpower for industries and business houses which are based on experimental methodologies and practices of Chemistry.
3. To provide student centric learning facilities for the development of the overall personality of the learner.

Mapping of University Vision and Mission to Department Vision and Mission

Acclaimed as Modal Centre of Learning and Research by

University Vision and Mission	Department Vision and Mission
High quality knowledge delivery through state of art infrastructure and ethical values to the students	**Yes**
Students excellence will make them professionals and innovators emerging as global leaders	**Yes**
Research and development will help in furtherance of Faculty knowledge	**Yes**

Program Outcomes (PO) for Post Graduate Programmes (CBCS) in the Faculty of Sciences, Kurukshetra University, Kurukshetra

PO1	Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study.
PO2	Research Aptitude	Capability to ask relevant/ appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis.
PO3	Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large.
PO4	Problem Solving	Capability of applying knowledge to solve scientific and other problems.
PO5	Individual and Team Work	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, multidisciplinary settings.
PO6	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO7	Modern Tool usage	Ability to use and learn techniques, skills and modern tools for scientific practices.

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PO8	Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO9	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life.
PO10	Ethics	Capability to identify and apply ethical issues related to one's work, avoid unethical behaviour such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work.
PO11	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

Programme Educational Objectives (PEOs):

The Department of Chemistry has formulated the Programme Educational Objectives (PEO's) with those in fields. The program educational objectives (PEO) are the statement that describes the career and professional achievement after receiving the degree. The PEO's of the Master's degree in Chemistry are as follows:

PEO1: To have fundamental as well as advanced knowledge of the chemistry domain.

PEO2: To provide the professional services to industries, Research organization, in the domain of super specialization.

PEO3: To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.

Program Specific Outcomes (PSO's): The program outcomes (PSO) are the statement of competencies/ abilities. PSOs are the statement that describes the knowledge and the abilities the post-graduate will have by the end of program studies.

PSO1: The detailed functional knowledge of theoretical concepts and experimental aspects of chemistry.

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PSO2: To integrate the gained knowledge with various contemporary and evolving areas in chemical sciences like analytical, synthetic, pharmaceutical etc.

PSO3: To understand, analyze, plan and implement qualitative as well as quantitative analytical synthetic and phenomenon-based problems in chemical sciences.

PSO4: Provide opportunities to excel in academics, research or Industry.

Mapping of PEO's with PO's and PSO's

S. No.	*Program Educational Objectives*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
1	To have fundamental as well as advanced knowledge in the domain of chemistry.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
2	To provide the professional services to industries, Research organization, in the domain of super specialization.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
3	To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

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Structure and Syllabi of
M. Sc. Chemistry (Four Semesters) Course
Under Choice Based Credit System
Outcome Based Education System /
Learning Outcome Curriculum Framework (LOCF) Pattern
(Effective from the Academic Session 2020-21)

COURSE SCHEME M.Sc. Programme: Two-year (Four semesters) under Choice Based Credit System – OBES / LOCF Pattern

SYLLABUS M.Sc. (Chemistry) Programme

Credits requirement for completion of the Programme	**:**	**100**
Credits Compulsory Courses	**:**	**51**
Credits Elective Courses	**:**	**03**
Credits Open Elective Courses	**:**	**04**
Credits Specialisation Elective Courses	**:**	**40**
Credits Seminar	**:**	**02**
Credits Total	**:**	**100**

Semester-wise distribution of Credits -

Semester I	**:**	**24 (CT-12, ET-3, CP-9)**
Semester II	**:**	**23 (CT-12, OE-2, CP-9= 23)**
Semester III	**:**	**27 (CT-9, OE-2, SET-8, SEP-8)**
Semester IV	**:**	**26 (SET-16, SEP-8, SEMINAR-2**

CT	**:**	**Compulsory Theory**
ET	**:**	**Elective Theory**
CP	**:**	**Compulsory Practical**
OE	**:**	**Open Elective**
SET	**:**	**Specialisation Elective Theory**
SEP	**:**	**Specialisation Elective Practical**

SEMESTER - I

Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
					Internal Assess-ment*	End-semester Exam-ination	Total	
CHEM 101	Inorganic Chemistry-I	CT	4	4	20	60	80	**3 Hrs.**
CHEM 102	Physical Chemistry-I	CT	4	4	20	60	80	**3 Hrs.**
CHEM 103	Organic Chemistry-I	CT	4	4	20	60	80	**3 Hrs.**
CHEM 104a	Mathematics for Chemists	ET	3	3	15	45	60	**3 Hrs.**
CHEM 104b	Chemistry of Life Science	ET	3	3	15	45	60	**3 Hrs.**
CHEM 104c	Introduction to pharmacy and pharmacology	ET	3	3	15	45	60	**3 Hrs.**
CHEM 105	Inorganic Chemistry Practical-I	CP	3	6	15	45	60	**6 Hrs.**
CHEM 106	Physical Chemistry Practical-I	CP	3	6	15	45	60	**6 Hrs.**
CHEM 107	Organic Chemistry Practical-I	CP	3	6	15	45	60	**6 Hrs.**
Total Credits/Marks			**24**	**33 (T-15, P-18)**			**480**	

CT = Compulsory Theory, CP = Compulsory Practical, ET =Elective Theory, Student has to opt any one of the elective theory paper (ET) based upon the course in B.Sc.

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SEMESTER - II

Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
					Internal Assess-ment*	End-semester Exam-ination	Total	
CHEM 201	Inorganic Chemistry-II	CT	4	4	20	60	80	**3 Hrs.**
CHEM 202	Physical Chemistry-II	CT	4	4	20	60	80	**3 Hrs.**
CHEM 203	Organic Chemistry-II	CT	4	4	20	60	80	**3 Hrs.**
OE-201	OPEN ELECTIVE	OE	2	2	15	35	50	**2 Hrs.**
CHEM 204	Inorganic Chemistry Practical-II	CP	3	6	15	45	60	**6 Hrs.**
CHEM 205	Physical Chemistry Practical-II	CP	3	6	15	45	60	**6 Hrs.**
CHEM 206	Organic Chemistry Practical-II	CP	3	6	15	45	60	**6 Hrs.**
Total Credits/Marks			**23**	**32 (T-14, P-18)**			**470**	

OE = Open elective, Students of Chemistry department will study one open elective paper offered by other department from among the department of physical sciences and students of other department (s) of physical sciences may opt open elective paper (OE-201)offered by Chemistry department.

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SEMESTER - III

Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
					Internal Assess-ment*	End-semester Exam-ination	Total	
CHEM 301	Inorganic Chemistry General	CT	3	3	15	45	60	**3 Hrs.**
CHEM 302	Physical Chemistry General	CT	3	3	15	45	60	**3 Hrs.**
CHEM 303	Organic Chemistry General	CT	3	3	15	45	60	**3 Hrs.**
OE-301	OPEN ELECTIVE	OE	2	2	15	35	50	**2 Hrs.**
CHEM 304	Inorganic Chemistry Special-I	SET	4	4	20	60	80	**3 Hrs.**
CHEM 305	Inorganic Chemistry Special-II	SET	4	4	20	60	80	**3 Hrs.**
CHEM 304	Physical Chemistry Special-I	SET	4	4	20	60	80	**3 Hrs.**
CHEM 305	Physical Chemistry Special-II	SET	4	4	20	60	80	**3 Hrs.**
CHEM 304	Organic Chemistry Special-I	SET	4	4	20	60	80	**3 Hrs.**
CHEM 305	Organic Chemistry Special-II	SET	4	4	20	60	80	**3 Hrs.**
CHEM 304	Pharmaceutical Chemistry Special-I	SET	4	4	20	60	80	**3 Hrs.**
CHEM 305	Pharmaceutical Chemistry Special-II	SET	4	4	20	60	80	**3 Hrs.**
CHEM 306	Inorganic Chemistry Special Practical-I	SEP	4	8	20	60	80	**6 Hrs.**

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Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Durati of Exa
					Internal Assess-ment*	End-semester Exam-ination	Total	
CHEM 307	Inorganic Chemistry Special Practical-II	SEP	4	8	20	60	80	6 Ho
CHEM 306	Physical Chemistry Special Practical-I	SEP	4	8	20	60	80	6 Ho
CHEM 307	Physical Chemistry Special Practical-II	SEP	4	8	20	60	80	6 Ho
CHEM 306	Organic Chemistry Special Practical-I	SEP	4	8	20	60	80	6 Ho
CHEM 307	Organic Chemistry Special Practical-II	SEP	4	8	20	60	80	6 Ho
CHEM 306	Pharmaceutical Chemistry Special Practical-I	SEP	4	8	20	60	80	6 Ho
CHEM 307	Pharmaceutical Chemistry Special Practical-II	SEP	4	8	20	60	80	6 Ho
Total Credits/Marks			**27**	**(83)T-35, P-48**			**550**	

SET=Specialization elective theory, SEP=Specialization elective the (Student has to opt all three CT, One OE offered by other departme from among the physical sciences and any two SET and two SEP from same specialization)

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SEMESTER - IV

Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
					Internal Assess-ment*	End-semester Exam-ination	Total	
CHEM 401	Inorganic Chemistry Special-III	SET	4	4	20	60	80	**3 Hrs.**
CHEM 402	Inorganic Chemistry Special-IV	SET	4	4	20	60	80	**3 Hrs.**
CHEM 403	Inorganic Chemistry Special-V	SET	4	4	20	60	80	**3 Hrs.**
CHEM 404	Inorganic Chemistry Special-VI	SET	4	4	20	60	80	**3 Hrs.**
CHEM 401	Physical Chemistry Special-III	SET	4	4	20	60	80	**3 Hrs.**
CHEM 402	Physical Chemistry Special-IV	SET	4	4	20	60	80	**3 Hrs.**
CHEM 403	Physical Chemistry Special-V	SET	4	4	20	60	80	**3 Hrs.**
CHEM 404	Physical Chemistry Special-VI	SET	4	4	20	60	80	**3 Hrs.**
CHEM 401	Organic Chemistry Special-III	SET	4	4	20	60	80	**3 Hrs.**
CHEM 402	Organic Chemistry Special-IV	SET	4	4	20	60	80	**3 Hrs.**
CHEM 403	Organic Chemistry Special-V	SET	4	4	20	60	80	**3 Hrs.**
CHEM 404	Organic Chemistry Special-VI	SET	4	4	20	60	80	**3 Hrs.**
CHEM 401	Pharmaceutical Chemistry Special-III	SET	4	4	20	60	80	**3 Hrs.**

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Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Duration of Exam
					Internal Assess-ment*	End-semester Exam-ination	Total	
CHEM 402	Pharmaceutical Chemistry Special-IV	SET	4	4	20	60	80	3 Hrs
CHEM 403	Pharmaceutical Chemistry Special-V	SET	4	4	20	60	80	3 Hrs
CHEM 404	Pharmaceutical Chemistry Special-VI	SET	4	4	20	60	80	3 Hrs
CHEM 405	Inorganic Chemistry Special Practical-III	SEP	4	8	20	60	80	6 Hrs
CHEM 406	Inorganic Chemistry Special Practical-IV	SEP	4	8	20	60	80	6 Hrs
CHEM 405	Physical Chemistry Special Practical-III	SEP	4	8	20	60	80	6 Hrs
CHEM 406	Physical Chemistry Special Practical-IV	SEP	4	8	20	60	80	6 Hrs
CHEM 405	Organic Chemistry Special Practical-III	SEP	4	8	20	60	80	6 Hrs
CHEM 406	Organic Chemistry Special Practical-IV	SEP	4	8	20	60	80	6 Hrs
CHEM 405	Pharmaceutical Chemistry Special Practical-III	SEP	4	8	20	60	80	6 Hrs
CHEM 406	Pharmaceutical Chemistry Special Practical-IV	SEP	4	8	20	60	80	6 Hrs

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Course Code	Course Title		Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
					Internal Assess-ment*	End-semester Exam-ination	Total	
	Seminar*	C	2				20	
Total Credits/Marks			**26**	**96 (T-48,P-48)**			**500**	

Student has to opt four SET and Two SEP from same specialization and every student has to deliver one seminar on the topic assigned by the seminar committee.

***2 credits per specialization, Student should prepare and submit a seminar report, typed by computer using chemistry software on the topic as assigned by seminar committee.**

Open Elective Papers

For the Students of M.Sc. Chemistry

A student will earn four credits by choosing any two papers out of the open elective papers offered by the departments in the faculty of sciences other than the department of Chemistry.

Course Code	Course Title	Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
				Internal Assess-ment*	End-semester Exam-ination	Total	
OE*	Open Elective Paper -01	2	2	15	35	50	**2 Hrs.**
OE*	Open Elective Paper -02	2	2	15	35	50	**2 Hrs.**
Total Credits/Marks		**04**				**100**	

For the Students of Other Departments in the Faculty of Science

The Department of Chemistry offers the following open elective papers to the students of second and third semesters of other departments in the faculty of sciences.

Course Code	Course Title	Credits	Teaching Hours per week	Maximum Marks			Duration of Exam.
				Internal Assess-ment*	End-semester Exam-ination	Total	
OE-201	Environmental & Analytical Chemistry	2	2	15	35	50	**2 Hrs.**
OE-301	Applied Chemistry	2	2	15	35	50	**2 Hrs.**
Total Credits/Marks		**04**				**100**	

***code will be provided by the respective department, opted by the student.**

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Total Marks of all Four Semesters

Semester	Credits	Marks
Semester I	24	480
Semester II	23	470
Semester III	27	550
Semester IV	26	500
Grand Total	100	2000

Internal Assessment in theory papers will be made on the basis of sessional test (s) and other parameters as decided by the University from time to time, while in Laboratory papers it will be decided from continuous assessment in internal viva-voce examination of all the experiments performed. Current guidelines for determining Internal Assessment in theory papers are given as Annexure 1.

Each student will deliver one seminar of about 40 minutes duration on the topic to be allotted by the departmental seminar committee in the 4th Semester of the M.Sc. Chemistry Course as per the schedule given by the department. The marks will be awarded by the seminar committee on the basis of performance in the seminar and the seminar report submitted by the student.

The special papers will be allotted to students on the basis of their preference-cum-merit (percentage of marks in the First Semester examination of M.Sc. Chemistry) basis.

General objectives of the course

Chemistry is the science of matter; the branch of the natural sciences dealing with the composition of substances, their properties and reactions. Chemistry is involved in almost everything with which we come in contact. The life processes of all organisms involve chemical changes. Chemistry enables the development of drugs to cure and alleviate diseases and prolong life span. It also connects the fundamental principles of physics to the other natural sciences - biology, botany, medicine, geology, ecology- in short, to the life sciences and the earth sciences. It is an experimental science and students need to be trained in practicals to get expertise in doing fine experiments and handle sophisticated instruments and statistically analyse the experimental data.

Master of Science (M.Sc.) in Chemistry is the oldest **(1961)** post graduation course of University of Kurukshetra. The Curriculum is so designed that it offers four specializations to the M.Sc. Chemistry students, which includes Physical, Organic, Inorganic and Pharmaceutical Chemistry.

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Through this curriculum, a choice based credit system (CBCS) is being implemented for all round development of the students, giving a fair weightage to their interest. It would allow the students to develop their abilities in the disciplines of their own interest. The students pursuing this course will develop in depth understanding of various aspects of the subject. The conceptual understanding of structure and behaviour of elements (atoms), energy changes associated with the reactions, principles and rules that unite these phenomenon in to comprehensive system, development of experimental skills, designing and implementation of novel synthetic methods, developing the aptitude for academic and professional skills, acquiring basic concepts for structural elucidation with hyphenated techniques, understanding the fundamental biological processes and rationale towards computer assisted drug designing are among such important aspects. This curriculum has an immense potential for chemistry and post graduate students to develop as a good chemistry teacher or as skilled chemists to undertake advanced research in laboratory or in Industry.

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