

# **J.S. University, Shikohabad (Firozabad)**

Established by UP Govt. Act No. 07 of 2015  
Recognized by U.G.C. under section 2 (f) of Act-1956



**Post- Graduate Programme Ordinance-2022**

**under**

**National Education Policy-2020**

**for**

**M.Sc. (Chemistry)**

# ORDINANCES & RULES / REGULATIONS

## For Regular Candidates

### 1. Introduction

JS University, Shikohabad is the “dream come true” of Shri Jagdish Singh Ji, through Sri Jagdish Jan Kalyan Educational Trust which is working continuously in the field of quality education for the students of rural area since long back. Dynamic educationist Dr. Sukesh Kumar working vigorously in expanding the Colleges of this Trust in terms of a well-planned University. The State Government of Uttar Pradesh took cognizance and introduced a Bill to the status of a University in March 2015 and christened it as J.S. University, Shikohabad, Firozabad. Our motto is; विद्या विनोयोगदिवकासः (Progress through proper application of knowledge and skills).

The U.G. programmes of the university are aimed to impart education with experiential learning in frontier areas of research in arts, sciences, commerce and interdisciplinary areas. These programmes also inculcate the habit of independent thinking and initiative by the students in planning and execution of their work in their professional life. These seek to train manpower of the high quality and competence, having academic values and work ethics in the students for societal, industrial and national service. The UG programmes of B.A, B.Sc (Mathematics, Biology and Computer Science) and B.Com are started in the year 2021 with the aim to educate the youths of rural areas thereby contributing to nation building.

### 2. Applicability

These ordinances shall apply to all two-years, four semesters, Post-Graduate (PG) Degree Programme in the J.S. University, Shikohabad from the session 2022-23 in conjunction with the directions/orders issued by the University/Uttar Pradesh State Government.

### 3. Definitions of Key Words

- a. **Academic Year:** Two consecutive semesters, one odd and one even semester shall constitute one academic year.
- b. **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed courses (core, elective, value added, intra-departmental and interdepartmental).
- c. **Course:** Sometimes referred to, as ‘papers’ is a component of a programme. A course is designed to comprise lectures/tutorials/laboratory work/ outreach activities/ project work/ vocational training/ viva/seminars/term papers/assignments/presentations/self-study etc. or a combination of some of these.
- d. **Credit:** A unit by which the weightage of course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture/tutorial) or two hours of practical work/field work per week.
- e. **Semester Grade Point Average (SGPA):** It is a measure of academic performance in a semester
- f. **Cumulative Grade Point Average (CGPA):** It is a measure of overall cumulative academic performance of a student.
- g. **Grade point:** It is a numerical value allotted to marks obtained in a course.

- h. **Grade/Score Card:** the grade cards will be given to all students at all end of any semester of a program and also on improvement of grades. It will display the course details (code, title, number of credits) Grade points obtained in each course, and SGPA/CGPA.
- i. **Letter Grade:** it is an index of the performance of students in a said course. Grades are denoted by letters O,A<sup>+</sup>,A,B<sup>+</sup>,B,C,P,F,AB,Q AND NQ.
- j. **Programme:** An academic programme leading to award of a Degree with Research or Master in Chemistry.
- k. **Faculty** – Student own faculty will be the faculty from which he/she selects the major subject for his Post Graduation.
- l. **Semester:** Each semester will consist of academic work equivalent to 90 working days including examination/evaluation. The odd semester will be from July/August to December and even semester from January to May in every academic year.
- m. **Transcript:** The Transcript issued on successful completion of all semester of a program will display the course details (Code, title, number of credits) and grade points obtained in each course and CGPA.

#### 4. **Types of courses**

- a) **Core (Major) Course:** Core (Major) course is a course which is compulsory for a student to study.
- b) **Elective (Minor) Course:** Elective (Minor) course is a course which can be chosen from a pool of elective courses or from other faculty.
- c) **Credited Value-Added Course:** these courses add value through enhanced employability skills and have credits assigned to them and may be offered through vocational and Co-curricular courses. These courses will be counted for calculation of SGPA/CGPA.
- d) **Non-credited Value-added Course:** These courses may be offered to add value through enhanced employability skills but do not have credits assigned to them. The performance in these course shall not be counted for computation of 'SGPA' and 'CGPA'.
- e) **Internship:** Students of Post Graduate Programmes may undertake an internship/termpaper during the summer vacation between eighth and ninth semester, carrying credits as specified by BOS.
- f) **Online courses/ MOOCs:** The Student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/ministry of education in place of a Course offered in the semester as specified by the Department. MOOC/SWAYAM courses may be opted depending upon the availability on the government approved portal. Online papers credit maximum of 20% of the total credits required for that course could be earned in minor/elective papers from this mode and those credits have to be added by the University in their SGPA/CGPA.
- g) **Dissertation/Research Project:** All students of PG Programmes shall be required to prepare a Dissertation/Research Project in each Year of the programme.

## **5. Minimum Eligibility Requirement and process of Admission**

**5.1 Minimum Eligibility Requirement:** A certificate of successfully completing Degree or equivalent from any University/HEI recognized by the State or Centre Government shall constitute the minimum prerequisite requirement for admission to the post graduate degree programmes. Additional higher requirements may be laid down by the competent authority of the University.

**5.2 Admission Process:** The admission of Indian Nationals shall be based on entrance test or academic merit or a combination of the two and reservation/weightage in admissions shall be as per the UP State Government rules. However, Foreign National applying for admission through authorized channels shall be eligible for direct admission with a maximum capping as per University norms.

## **6. Program Duration and Credit Requirements**

- a) The post graduate degree programmes shall be spread over four semesters (02 academic years).
- b) The maximum duration for completing the Bachelor (Research) in faculty is 02 years after enrolment in seventh semester and Master Degree in Subject is 03 Years after enrolment in ninth semester. These will be consecutive academic years.

**Explanation:** If a student studies for both the years in continuity, he/she will have a maximum duration of 05 years to complete the programme. But if a student exits after completing Bachelor (Research) Degree, then he/she may come back at any time for completing the remaining one year required for master degree and he/she will get a maximum duration of 03 years to complete the studies required for the remaining final year.

## **7. Fees**

The applicable fee(S) charged from the students of post graduate degree programmes shall be as approved by the finance Committee of the University or by any other competent authority.

## **8. Course Structure**

The course structure and course outlines of the post graduate degree programmes shall be as per the respective Regulations recommended by the respective Board of Studies and Ratified by the competent authority.

## **9. Attendance Requirement**

Students with less than 75% attendance shall not be eligible to appear in the End Semester Examination. However, in exceptional cases, the Principal/Vice chancellor may grant a relaxation in the minimum attendance requirement by not more than 15% on the basis of genuine reason.

## **10. Examination(s) and Assessment/Evaluation:**

**10.1 a.** In each year from VII to X semesters student have to do research project of 08 credits per year. This project may be interdisciplinary/multi-disciplinary or in the form of industrial training/internship/survey. Research project will be done under supervision of one faculty member; the student can opt for another supervisor (co-supervisor) from either industry, company, technical institutes or research institutes.

**9.1 b.** Student in the end of each year will submit report/Dissertation which will be evaluated by external examiner (recommended by BOS) and supervisor of 100 maximum marks.

**9.2** In all credit courses (other than Internship/survey/minor project report and Dissertation/major Project), there shall be continuous internal assessment of the students and end semester examination as per the scheme of examination.

**9.3** The end semester examination shall have a weightage of 75 marks. Questions for this examination shall be set by a panel of examiners approved by the Board of Studies and duly moderated by the Moderation Committee. The scheme of examination shall ensure that no student has to appear for examinations in more than two courses on any single day.

**9.4** The continuous internal assessment shall have a weightage of 25 marks and shall be based on assignments, group discussions, class test, quizzes etc.

**9.5** It shall be the duty of the teacher teaching a particular course, to conduct internal assessment. In case more than one teacher is sharing the teaching work in a course, each teacher shall evaluate independently and a weighted average would be taken.

**9.6** For the case of computation, the assessment/evaluation of each course will be out of a maximum of 100 marks (25 for internal assessment and 75 for end semester examination) irrespective of number of credits allotted to the course. The marks shall be converted to grades. **(for further Details refer to Annexure No. 1)**

**9.7 Examination, Promotion and Reappearing Rules: (Refer to Annexure no. 1)**

**9.8 Grade Card:** A grade card shall be issued to each student at the end of every semester.

**9.9 Transcript:** A Transcript shall be issued to a student on successful completion of the programme on request as per rules.

**9.10 Withholding of Grade Card/Transcript**

The Grade Card/Transcript of a student shall be withheld if he/she has not paid his/her dues. Or if there is a case of indiscipline pending against him/her.

**10a. Exit Option and Award of Bachelor (Research) in Faculty: (Refer to Annexure NO.1)**

**10b.** The students who have qualified graduation from Non-NEP scheme will not be eligible for graduation with research Degree. For them VII<sup>th</sup> Semester shall be considered as I<sup>st</sup> semester of the post Graduate programme. Likewise VIII<sup>th</sup>, IX<sup>th</sup> and X<sup>th</sup> semesters will be considered as II<sup>nd</sup>, III<sup>rd</sup> and IV<sup>th</sup> semesters of the Post Graduate programme respectively.

**11. Interpretation clause**

In case of any issue of interpretation arising during the course of implementation of these ordinances or in case of any unforeseen circumstance, decision of the Vice-Chancellor shall be final.

**स्नातकोत्तर/परास्नातक (एम0ए0, एस0एम0सी0, एम0कॉम0) हेतु ग्रेड िंग प्रणाली।**

राष्ट्रीय शिक्षा नीति-2020, प्रदेश के सभी विश्वविद्यालयों में स्नातक स्तर पर विासनादेशि सॉख्या 1567/ सत्तर-3-202116 (26)/2011 टी.सी. शदनांक 13 जुलाई 2021 द्वारा सत्र 2021-2022 से विा स्नातक स्तर/परास्नातक स्तर पर विासनादेशि सॉख्या-401/सत्तर-03-2022, शदनांक: 09 फरिरी 2022 के द्वारा सत्र 2022-23 से लागू की गई। प्रदेश के सभी विश्वविद्यालयों में स्नातक स्तर पर बी0ए0, बी0एस0सी0 एिं बी0काम0 के विीन िर्ष हेिु 10 पॉइंट ग्रेशिगा प्रणाली विासनादेशि सॉख्या 1032/सत्तर-3-2022-08(35)/2020 शदनांक 20 अप्रैल

2022 के द्वारा सत्र 2021-22 से लागू की गई है। यह ग्रेडिंग यूसीसी के शिवा शनदेडों पर आधारित है। उक्त के क्रम में सत्रिक त्र/परासत्रिक स्तर पर सत्र 2022-23 से 10 भीमरति अडंडे कर शिशुशिक्षललय में शनडुशलखिति 10 डडंडे ग्रेडिंग डुरणाली लागू की डलएगी।

डिशलका-1 (Table)

लेटर ग्रे	शिरण	अडंडे की सीमा	ग्रे डडंडे
O	Outstanding	91&100	10
A+	Excellent	81&90	9
A	Very good	71&80	8
B+	Good	61&70	7
B	Above Average	51&60	6
C	Average	41&50	5
P	Pass	36&40	4
F	Fail	0&35	0
AB	Absent	Absent	0
Q	Qualified		
NQ	Not Qualified		

## 2- उत्तीणण डुरडतशत (Passing Percentage)

- 2.1 मुख्य ँडें डलइनर शिरुडंडेस कल डुरत्येक क सड/डेडर (थु री ँडें डुरेखिल सडुडु) डुरणलडंडेक 100 के डुतडकडुडु डुडुनडुडु है डुथल इन सडुडु कल उत्तीणण डुरशरडुडुडु 36 डुरशरडुडुडु ह गल। डुरडुडुडुडु डुडु डुरररुडु डुनल के क सड/डेडर डुडु डुरणलडंडेक 100 के credit course है डुथल इनडें डुडु उत्तीणलडंडेक 36 डुरशरडुडुडु ह गल।
- 2.2 सडुडु शिरुडुडुडुडु के मुख्य/डलइनर/डुरडुडुडुडु डुडु डुरररुडु डुनल के डुरत्येक क सड/ डेडर (थु री ँडें डुरेखिल सडुडु ) डें अशडुकडुडु अडंडेक 100 डे से डुरलडुडुडुडु डुडु की गणनल 25 अडंडेक डुडु के सरडुडुडु अलनुतररक डुडुडुडुडुडुडु 75 अडंडेक की शिशुशिक्षललय (डलहुडु) डुरीकुषल डें डुरलडुडु डुडु क डुडु कर की डलडेगी।
- 2.3 मुख्य ँडें डलइनर शिरुडुडुडुडु के डुरत्येक क सड/डेडर (थु री ँडें डुरेखरकल सडुडु) डें उत्तीणण ह ने हेडुडु

(अ) शिशुशिक्षललय की डुरीकुषल डें अशडुकडुडु 75 अडंडेक डें से नुडुन डुडु 27 अडंडेक (75 कल 36 डुरशरडुडुडुडु) ललने अलशुडुडु ह गडुडु डुथल

(डु) अलनुतररक ँडें डलहुडु डुरीकुषलडुडुडु डें कुल शडुलकलर डुरणलडंडेक 100 डें से नुडुनडुडु 36 अडंडेक डुरलडुडु करने ह गडुडु।

- 2.4 िृहद ि ध पररय जना के क सष/पेपर में उत्तीणष ह ने हेिु शिश्वशिक्षालय की परीक्षा में अशधकिम 100 अोंक ों में से न्यूनिम 36 अोंक लाने आश्यक ह गों।
- 2.5 शकसी भी क सष/पेपर के आन्तररक मूल्याोंकन में क ई भी न्यूनिम उत्तीणष प्रशििि नहीों है। यशद शकसी शिद्याथी क ओरिरक परीक्षा में िून्य अोंक प्राप् ह िे हैं ि उस खथथशि में पेपर उत्तीणष करने हेिु शिद्याथी क बाह्य परीक्षा में पूणाांक 75 में से न्यूनिम उत्तीणष 36 (मुख्य ििं माइनर शिर्ष ों में) अोंक प्राप् करने आश्यक ह गों। आन्तररक मूल्याकोंन में पूणष अनुपखथथशि पर भी िून्य अोंक ही शमलेगें।
- 2.6 शकसी भी प्रकार के कृपाोंक (Grace marks) नहीों शदये जायेंगोंे।
- 2.7 स्नािक (ि ध सशहि) (Graduation with Research) अथा परास्नािक/स्नािक तर (Post-Graduation) उपाशध प्राप् करने हेिु न्यूनिम ब्ळ्च। 4.0 प्राप् करना आश्यक ह गा।

### **3& कक्षात्रोडत (Class Promotion)**

- 3.1 शिद्याथी क ििषमान शिर्म (Odd) सेमेस्टर से अगले सम (Even) सेमेस्टर में सदैि प्र त्रि शकया जायेगा, चाहे ििषमान शिर्म सेमेस्टर का पररणाम कुछ भी ह ।
- 3.2 ििषमान सम सेमेस्टर से अगले शिर्म सेमेस्टर अथाषि स्नािक तर के ििषमान प्रथम िर्ग से अगले शर्द्वीय िर्ष में प्र त्रशि शनम्न ििों के साथ दी जायगी:-
- (अ) शिद्याथी ने ििषमान प्रथम िर्ष (द न ों सेमेस्टर शमलाकर) के कुल आश्यक िमुनपिमकद्ध केश टस का न्यूनिम 50 प्रशििि केश ट के पेपसष (थ्य री ििं प्रेखिकल, िृहद ि ध पररय जना शमलाकर) उत्तीणष कर शलए ह 50 प्रशििि केश ट की गणना करने में दिमलि के बाद के अोंक नहीों शगने जायेंगोंे। जैसे शक 27.6 िथा 27.3 क 27 ही माना जायगा।
- (ब) कक्षात्र शि के शलए क ई न्यूनिम CGPA नहीों ह गा।
- 3.3 स्नािक तर कायषक्रम का प्रथम िर्ष उच्च शिक्षा का चिथष िर्ष ह गा। इसक न्यूनिम 4.0 CGPA के साथ पूणष करके यशद क ई शिद्याथी छ िकर जाना चाहि है। ि उसे स्नािक (ि ध सशहि) (Graduation with Research) की उपाशध दी जायेगी। यह सुशिधा केिल उन्ीों शिद्याशथषय ों क उपलब्ध ह गी शजन् नोंे उ0प्र0 में लागू राष्ट्रीय शिक्षा नीशि 2020 के अन्तगिष शत्रि्रीय स्नािक उपाशध पूणष की है।



#### **4- बैक पेपर अथवा सुधार (Back paper and Improvement)**

- 4.1 आन्तरिक परीक्षा में बैक पेपर अथवा सुधार (Improvement) हेतु परीक्षा नहीं होगी। केवल पूरा सेमेस्टर का बैक परीक्षा के रूप में दो बार देने की व्यवस्था में विश्वविद्यालय परीक्षा के साथ आन्तरिक मूल्यांकन भी करा जा सकता है। शक्यता पर एक छात्र दो पूरा सेमेस्टरस के संपूर्ण परीक्षाओं एक साथ नहीं दे सकेगा।
- 4.2 छात्रों के बैक पेपर अथवा सुधार (Improvement) की सुविधा सम (शिर्ष) सेमेस्टर के पेपर के शेष सम (शिर्ष) सेमेस्टर में ही उपलब्ध होगी।
- 4.3 छात्रों के बैक पेपर अथवा सुधार (Improvement) हेतु परीक्षा के शेष का सप/पेपर विथा उसका पाठ्यक्रम (Syllabus) विही होगा जो उस विषयमान सेमेस्टर शेषमें विही परीक्षा दे रहा है, में उपलब्ध होगा।
- 4.4 छात्रों के बैक पेपर अथवा सुधार (Improvement) हेतु शक्यता पर भी का सप/पेपर की विश्वविद्यालय (बाह्य) परीक्षा काल बाधना नहीं करे कि चाहे शक्यता पर भी बार दे सका है।

#### **5 CGPA की गणना**

5-1 SGPA विं CGPA की गणना शनमिति सूत्रों से की जाएगी

$j^{\text{th}}$ सेमेस्टर के शेष $SGPA (S_j) = \frac{\sum(C_i \times G_i)}{\sum C_i}$	यहां पर: $C_i$ = number of credits of the $i^{\text{th}}$ course in $j^{\text{th}}$ semester. $G_i$ = grade point scored by the student in the $i^{\text{th}}$ course in $j^{\text{th}}$ semester.
$CGPA = \frac{\sum(C_j \times S_j)}{\sum C_j}$	यहां पर: $S_j$ = SGPA of the $j^{\text{th}}$ semester. $C_j$ = total number of credits in the $j^{\text{th}}$ semester.

5-2 CGPA का प्रविं अंक में शनमिति सूत्र के अनुसार परिवशिषि शकया जायेगा: समुल्य प्रविं =

$$CGPA \times 9.5$$

5-3 शिद्याशथय का शनमिति सारणी के अनुसार श्रेणी (Division) प्रदान की जाएगी

शलका - 2 (Table-2)

çFke Js.kh	6-50 vFko mlIs vf/kd rFkk 10-00 ls de vFkok çkçj CGPA
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fjrh; Js.kh	5-00 vFkok mlls vf/kd rFkk 6-50 ls de CGPA
Rk`rh; Js.kh	4-0 vFkok mlls vf/kd rFkk 6-50 ls de CGPA

## **ANNEXURE-02**

### **(Regarding Selection of MINOR paper as per NEP- 2020)**

As per NEP-2020 a student has to pass a MINOR paper in Undergraduate first year (either in I or II semester, Undergraduate Second Year (either in III or IV Semester) and Postgraduate First Year (either in VII or VIII semester). It is to be mentioned here about the selection of MINOR paper at different levels:

S.No.	Level	Options
	if opted in I semester	May select any paper of minimum 04 credits among the Papers taught in Semester I.
	if opted in II semester	May select any paper of minimum 04 credits among the Papers taught in Semester II.
	if opted in III semester	May select any paper of minimum 04 credits among the Papers taught in Semester I and III.
	if opted in IV semester	May select any paper of minimum 04 credits among the Papers taught in Semester II and IV.
	if opted in VII semester	May select any paper of minimum 04 credits among the Papers taught in Semester I, III, V and VII.

		opted in VIII among semester	May select any paper of minimum 04 credits if the Papers taught in Semester II, IV, VI and VIII.
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Note:

1. At UG level the provision of multi-faculty is to be maintained as per NEP-2020.
2. At PG level MINOR Paper is to be selected from other faculty.
3. A student cannot opt the same paper as MINOR at different levels.

### **Program Educational Objectives (PEOs)**

1. Postgraduate will have significant opportunities in various service domains at national and international level, and can work as scientist, analyst, quality controller, academics, research organizations and set testing labs.
2. On the basis of specialized knowledge and experience, postgraduate students will be able to do diverse synthesis, separation, analysis, computational, design and development of new products.
3. Post-graduate will have leadership quality to handle all kind of circumstances in diversities by providing interdisciplinary and multidisciplinary learning environment.
4. Postgraduate will be continuous learner to learn and adopt new skills and techniques to overcome the problem related with new technologies.
5. Postgraduate will be able to formulate, investigate and analyze scientifically real life problems along with ethical attitude which works in multidisciplinary team.

### **Program Specific Outcomes (PSOs)**

1. Apply principles of pharmaceutical chemistry, medicinal chemistry, analytical chemistry, quantum chemistry, chemical process and laboratory skills for volumetric analysis, synthesis, separation, isolation and formulation.
2. Work with professional ethics in quality control and quality assurance sections of pharmaceutical, paint, polymers, ceramics, food and agrochemical industries.
3. Apply knowledge of chemistry to excel in higher studies and field of research.
4. Application of research skills to pursue doctoral programme.
5. To be in a noble profession of teaching and helping in nation building.



# NATIONAL EDUCATION POLICY-2020

J S UNIVERSITY, SHIKOHABAD, FIROZABAD

## PAPER CODING AND CREDIT DISTRIBUTION M.Sc. (CHEMISTRY)

S.NO.	Name of Degree	SEMESTER	TITLE OF PAPER	CREDITS	CODE NUMBER
1	Bachelor Research of Science in Chemistry	VII	Computer for Chemists	5	B020702T
			Inorganic Chemistry	5	B020702T
			Organic Chemistry	5	B020703T
			Physical Chemistry	5	B020704T
			Adulterant in Foods (Minor for Other faculty)	4	B020705T
			Research Project		
2		VIII	Group Theory and Spectroscopy	4	BD20B01T
			Bio-Inorganic Chemistry	4	B0Z0802T
			Bio-Physical Chemistry	4	B020803T
			Spectroscopic Methods of Analysis	4	B020804T
			Practical	4	B020805P
			Research Project	g	Bozos06R
		One minor paper to be selected from other faculty in VII or VIII semester	4/5/6		
3	Master of Science in Chemistry	IX	Photo and Stereochemistry	5	B020901T
			Solid State Chemistry, Surface Phenomenon and Chemical Equilibria	5	B020902T
			Coordination Chemistry		
			Basic Analytical Chemistry	5	B020903T
			Chemistry of Natural Products	5	B020904T
			Polymer Chemistry	5	B020905T
		5	B020906T		
		X		4	B021001T
			4	B021002T	
			4	B021003T	

4

Polymer Chemistry Research Project Interdisciplinary Topics Separation Techniques Advance Analytical Methods Advance Inorganic Chemistry Advance Organic Chemistry Advance Physical Chemistry Practical Research Project	<b>Choose any ONE</b>	4	<i>B021004T</i>
		4	B021005T
		4	B021006T
		4	B021007P
		8	B021008R

Students of Science Faculty may choose MiNOR paper from Faculty of Commerce/ Arts, Humanities and Social Sciences/ Languages/F-ine Art and Performing Art/Education/Rural Science.

## Purpose of the Program

### **Programme Specific Outcomes (PSO)**

#### **Programme Name: Master of Science**

- Sound knowledge about the fundamentals of theories concerning behind formation of new substances.
- To appropriately apply techniques for the qualitative and quantitative analysis of chemicals in laboratories and industries.
- To develop analytical skills and problem solving skills requiring application of chemical principles.
- To become familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer, biochemistry etc.
- To acquire the ability to undertake independent research.
- To understand the different issues of environmental concern and sustainable solution.

The purpose of the M.Sc. Program at the University is to provide the key knowledge of various disciplines in Chemistry and on Advances in this field. To prepare students for careers as professional in various Research Institutes and Industries.

After completing M.Sc. Chemistry program, students will be able to:

#### **Knowledge Outcomes: (PO)**

**PO1:** Exhibit and apply the fundamental knowledge of the basic principles in various fields of Chemistry

**PO2:** Identifying and analysing complicated scientific problems in order to achieve the solution by utilising the principles of chemistry

**PO3:** Make consciousness and sense of responsibilities towards environmental sustainability

**PO4:** Develop small scale industry leading to entrepreneurship for developing endogenous product.

**PO5:** Develop team-oriented projects in the field of Chemical Science.

**PO6:** Link scientific information in a concise way both orally and in written document.

**PO7:** Develop the ecological and eco-friendly technology in Industrial Chemistry.

**PO8:** Ability to develop critical thinking, reasoning, enable to design experiments, analysis and interpretation of data and conclude the result.

**PO9:** Implement the ethical principles, embrace professional ethics, obligations, and standards of scientific practice.

**PO10:** Apply logical thinking within the research field and industrial domain knowledge to assist society in all spheres, including healthcare, the environment, and industry, with the most recent advancements in scientific and professional ways.

**PO11:** Recognize the importance of, and be prepared for, autonomous, lifelong learning in the context of technological development as a whole.

## SEMESTER-VII

After completing this course, students will be able to:

**CO1:** Knowledge of basic software and hardware and used in chemistry.

**CO2:** Explain the detailed of computer language with operating and analysis level.

**CO3:** Illuminate about the basic networking for web of science.

**CO4:** Elucidate the knowledge about journals and understanding of chemistry software.

**CO5:** Explain the MS-Office software for drafting the research in readable formate.

**B020701T    COMPUTER FOR CHEMISTS                    M.M. 75**

*Credits-05*

**Unit-I:** History of Development of Computer, Classification of Computers, Generation of Computers, General Awareness of Computer Hardware — CPU and other peripheral devices, Input, Output and Auxiliary Storage Devices.

**Unit II:** Software and their types (System Software & Application Software), Computer Language and their types (Low Level & High Level Languages), Operating System, requirement of OS, Types of OS Single User and Multi-user OS with example

**Unit III:** **Computer and Internet 1:** What is Networking, Different types of Networking (LAN, WAN and MAN), Optical Fibres, Ethernet, Network Interface Card, Hub, Switch, Routers, Modems, Protocols TCP/IP, Internet Service Providers (ISP), Web Search Engine, Intranet, Difference between Internet & Intranet

**Unit IV:** Educational and Research Resources on Net for Chemical Sciences, Online Tutorials and Lectures Virtual Labs, Electronic Journals, E-books, Digital Libraries, Use of Chemdraws like tools for Chemical Education.

**Unit V:** MS Word, facilities in MS Word, MS- Excel, Facilities in MS Excel, MS PowerPoint, Oral Presentations using visual aids such as Power Point etc. Adobe Photoshop (Introductory), Multimedia, Digital Arts.



**B020702T INORGANIC CHEMISTRY**

M.M. 75

*Credits-05*

After completing this course, students will be able to:

**CO1:** Elaborate the detailed chemistry of inorganic reactions.

**CO2:** Explain the detailed mechanism of reaction mechanism.

**CO3:** Illuminate the chemistry of boranes and metal complexation.

**CO4:** Elucidate the chemistry of macromolecule such porphyrin ring to crown ether.

**CO5:** Explain the reaction steps of inorganic polymers.

**Unit I: Mechanism of inorganic reactions:**

Mechanisms of redox reactions of metal complexes, Substitution reactions of octahedral and square planar complexes in aqueous solutions, Cis- and Trans effects.

**Unit II: Nuclear Chemistry:**

Radioactive decay and equilibrium, Nuclear reactions and its types, Q-value, cross section of reactions, chemical effects of nuclear transformation. Nuclear fission—Fission products, Mission Yield and Nuclear Reactors, Nuclear Fusion and Stellar energy.

**Unit III:** **Radioactive techniques:** (i) Tracer techniques (neutron activation analysis) (ii) Counter techniques such as G.M., Ionization and proportional counters **Metal clusters:**

Higher boranes, carboranes, metalloboranes, metallocarboranes, metal carbonyl and halide clusters. Compounds with metal-metal multiple bonds, Wade's rule, LNCC & HNCC, Capping rule.

**Chemistry of macrocycles:**

**Unit IV:** Complexes of crown ethers, porphyrins and cryptands, their synthesis, important characteristics with special reference to hole size and importance in biological systems.

**Unit V: Inorganic Polymers:**

Classification, characteristics and properties. Type of inorganic polymerization (step growth, chain growth, ring opening, reductive coupling, condensation synthesis). Synthesis, properties and applications of important inorganic polymers: polyphosphazines, phosphonitrilic halides,

polysiloxanes, polysilanes, co-ordinate polymers, condensed phosphate, silicates and S-N compounds.

**Books Suggested:**

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
4. Comprehensive Coordination Chemistry Eds G.Willöanson, R.D. Gillars and JAMc Cleverty, Pergamo
5. Nuclear and Radioactivity- Friedlander G; Kennedy J.M Mamas E.S., Miller J.M., Wiley Inter Science N.Y. (1981).
6. Nuclear Reactions, S R. Singh & S. N. Mukherjee, New Age International. New Delhi.

**ORGANIC CHEMISTRY****M.M.75*****Credits-05***

After completing this course, students will be able to:

**CO1:** Enlighten the nature of electronic movements in various organic compounds.

**CO2:** Explain the chemistry of reaction mechanism which involved in organic synthesis.

**CO3:** Differentiate between reaction mechanism to maintain the inversion and retention in configuration.

**CO4:** Elucidate the reaction mechanism and its intermediates in advanced synthesis.

**CO5:** Importance of organic reagent in the synthesis of selective reaction.

- Unit-I:**
- (a) Delocalized chemical bonding — conjugation, cross conjugation, resonance, hyperconjugation, tautomerism.
  - (b) Reaction intermediates- Generation, geometry, stability and reactions of carbocations, carbanions, free radicals, carbenes, nitrenes and benzyoes.

**Substitution reactions:**

- Unit-II:**  $SN^1$ ,  $SN^2$   $sN^i$  and  $SN^{2i}$  mechanisms, neighboring group participation in aliphatic nucleophilic substitutions, Electrophilic and nucleophilic aromatic substitutions reactions.

**Elimination reactions:**

- Unit- III:** The  $E^1$ ,  $E^2$ ,  $E^1cB$  mechanisms, orientation in  $E^2$  reactions (Saytezeff and Hoffman), Pyrrolyticsyn-elimination, Stereochemistry of elimination reaction.

**Common Organic Reaction and Mechanism****Unit- IV:**

Aldol, Perkin, Dieckmann condensation, Reformatsky, Benzoin, Wittig, Mannich reaction, Michael reaction, Diels-Alder reaction, Knoevengel reaction.

**Unit- V:****Reagents in Organic Synthesis:**

Lithium aluminium hydride, Sodium borohydride, lithium dialkylcuprate, lithium di-isopropylamine, Grignard reagents, mono & dialkylboranes, 1,3-Dithiane, Gerard's reagent P & T, dicyclohexylcarbodiimide, N-bromosuccinimide.

## **Books Suggested**

1. Vogel's Text book of Quantitative Analysis, revised. J. Bassett, R. C. Denney. G.H. Jeffery and J. Mendham ELBS.
2. Experiments and Techniques in Organic Chemistry, D. Pasto. C. Johnson and M. Miller, Prentice Hall.
3. Macroscale and Microscale Organic experiments, K.L. Williamson. D.C. Heath.
4. Systematic qualitative Organic Analysis, H. Middleton, Adward Arnold.
5. Handbook of Organic Analysis Qualitative and Quantitative. H. Clark, Adward Arnold.
6. Vogel's text book of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
7. Reaction and Reagents , O.P.Agrawal, Krishna Publication, Meerut.

B02O704TPHYSICAL CHEMISTRYM.M.75

Credits-05

After completion of this course students should be able to:

**CO1:** Explain the failure of classical mechanics for defining microscopical systems.

**CO2:** Account for theory of angular momentum theory for orbitals and electrons, and describe both coupled and uncoupled representation.

**CO3:** Describe the laws of chemical dynamics of intermediate of molecular reaction.

**CO4:** Macromolecule phenomenon Understand the mechanism behind the various surface, micelles.

**CO5:** Define central parts of electrochemical cells and mechanism of various electrochemical processes.

## Quantum Chemistry:

### Unit-I

Approximation Method: The variation theorem, Linear variation principles, Perturbation theory (First order and non degenerates), application of variation method and perturbation theory to be helium molecule.

### Unit-II

**Statistical thermodynamics:** Chemical equilibria and equilibrium constant interns of partition function, Fermi-Diarc statistics, Distribution law and application of fomatal, Bose-Einstein statistics-distribution law and application to helium.

### Unit-III

**Chemical Dynamics:** Methods of determining rate laws, collision theory of Unit-III: reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory, ionic reaction, kinetic salt effects, steady state kinetics, kinetics and thermodynamic control of reaction, treatment of unimolecular reactions treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde decomposition of ethane, Photochemical (hydrogen-bromine and hydrogen-chlorine reactions).

### Unit -IV

**Micelles:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factor-affecting the CMC of surfactants.

**Macromolecules:** Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystals polymers, kinetics of polymerization, mechanism of polymerization.

### Unit-V

**Electrochemistry:** Electrochemistry of solution, Debye-Huckel-Onsager treatment and its extension, ion solvent interaction, Debye-HuckelJerum mode, thermodynamic of electrified interface equation, over potential, exchange current density.

### Book Suggested:

1. Physical chemistry, P.W. Atkins, ELBS
2. Introduction to Quantum chemistry, A.K. Chandra, Tata McGraw Hill.

3. Quantum chemistry, Era N Levine, Prentice Hall.
4. Coulson's Valence, R. McWeeny, ELBS.
5. Chemical Kinetics, K.J. Laidler, McGraw- Hill.
6. Kinetics and mechanism of chemical transformations, J. Rajaraman and J. Kuriacose, McMillan.
7. Micelles, Theoretical and applied aspect, V. Moroi, Plenum.
8. Modern electrochemistry, Vol. 1 and Vol. 2, J.O.M. Bockris and A.K.N. Reddy, Plenum.



**B020705T    ADULTERANTS IN FOODS**

(MINOR for Other Faculty)

M.M. 75

After completion of this course students should be able to:

**CO1:** Explain the food nutrition for human growth and health.

**CO2:** Explain the diet analysis to check the hygienist of food utilizing various chemical test

**CO3:** Describe the nutrition analysis of our daily liquid and protein diet.

**CO4:** Explain the awareness about the fake packaged product /materials of human diet.

**CO5:** Describe the food safety packaging and labeling and its rules.

**UNIT-I**

**Introduction**

Food and food for life, adulteration, types of adulteration, identification of adulterant: problems, common adulterants in food and their injurious effects on health

**Unit-II**

**Detection of adulterants**

Qualitative Analysis: Qualitative macro, semi-micro and micro techniques involving tests, flame tests, etc., microscopic examination Quantitative Analysis: Titrimetric and instrumental methods

**Unit-III**

**Materials to be analysed**

**Milk analysis:** Detection of added water, neutralizers, hydrogen peroxide, formalin, sugar, ammonium sulphate, salt, pulverized soap, detergents, skim milk powder, vegetable fat, salicylic acid, borax, boric acid and buffalo milk in cow's milk

**Khoya and Sweet analysis:** Detection of starch (maida, etc) aluminium foil replacing sweets, detection of washing powder in ice cream.

**Spice analysis:** Detection of added starch, lead chromate, Metanil yellow in tumeric powder in coriander powder, identification of artificially coloured foreign seeds shown a poppy seed and black pepper



#### **Unit-IV**

**False labelling and fake products in food packets:** How to read a food label, elements of list of ingredients, terms used in food labels, market survey and analysis of packaged products. Hazards of reckless use of faulty food preservatives in food products

#### **Unit-V**

**Creation of public awareness:** Dissemination of information about the “food Safety and (Packaging and Labelling) Regulation, Act 2011”. Creation of consumer awareness for checking adulteration and about fake and spurious products through print and visual media.



## SEMESTER-VIII

B020801T

GROUP THEORY AND SPECTROSCOPY

M.M. 75

Credits-04

**Course Outcome (COs):** Upon successful completion of M.Sc. Group theory and spectroscopy second semester programme students should be able to

- To give the knowledge of group theory and the classification with examples.
- To give the knowledge of rotational and vibrational spectroscopy.
- To give the knowledge of electronic transitions and their application.
- To give the knowledge of principle and application of atomic absorption spectroscopy.
- To give the knowledge of principle and application of flame photometry.

**Unit-I:** Symmetry elements and symmetry operation, point groups and their classification with examples, sub groups. General methods of assigning point groups to a molecules like water ( $C_{2v}$ ). Ammonia ( $C_{3v}$ ), phosphorous ( $D_{2h}$ ) and Xenon tetrafluoride ( $D_{4h}$ ).

**Unit II:** Rotational and vibrational spectroscopy: Introduction, fundamental principle and applications.

**Unit III:** Electronic spectroscopy: Introduction, theory involving electronic transition and applications.

**Unit IV:** Atomic absorption spectroscopy: Introduction, principle, techniques.

**Unit V:** Instrumentation and applications Flame photometry: Introduction, principle, technique, instrumentation, interference and applications.

**Books Suggested:**

1. Modern spectroscopy, J M. Hollas, John Willey.
2. Applied Electronic Spectroscopy For Chemical Analysis. Ed.H, Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Method in Chemistry, R.S. Drago, Saunders College.
5. Introduction to Molecular Spectroscopy, G.M. Barrow, Megraw Hill.
6. Basic Principles of Spectroscopy, R. Chang. McGraw Hill.
7. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford.
8. Introduction of Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
9. Introduction of Magnetic Resonance, A. Carrington and A.D. Maclachlan, Harper and Row.

**B020802T BIO-INORGANIC CHEMISTRY****M.M.75*****Credits-04***

**Course Outcome (COs):** Upon successful completion of M.Sc. Bio-inorganic, chemistry second semester programme students should be able to

**CO1:** To give the knowledge of concept of molecular mechanism & sodium and potassium pump.

**CO2:** To give the knowledge of structure and function of biomolecules.

**CO3:** To give the knowledge of bioinorganic pigments.

**CO4:** To give the knowledge of biochemistry of calcium, copper and zinc.

**CO5:** To give the knowledge of toxicity of metals and their complexes in therapeutic applications.

**Unit-I****Metal ions in biology:**

Molecular mechanism of ion transport across membranes sodium and potassium pump, Essential and trace elements.

**Unit-II****Biomolecules:**

Structures and functions of metalloproteins in electron transport process - cytochromes and Iron-Sulphur proteins, DNA polymerisation, glucose storage.

**Unit-III****Bio-inorganic pigments:**

Chlorophyll, Photosystem-I and Photosystem-II in cleavage of water, haemoglobin, myoglobin, haemocyanin and hemerythrin. Storage of oxygen and its transport.

**Unit-IV****Bio-Chemistry:**

Biochemistry of calcium, copper and zinc. Biological Nitrogen fixation (Associative nitrogen fixation, symbiotic nitrogen fixation).

**Unit-V**

(a) Toxicity of metals (cadmium, mercury, lead, arsenic, copper). Deficiency of Metal ions

(b) Medicinal Inorganic chemistry- Metal ions and chelating agent in medicines. Drug activity, control of metal ion concentration, In vivo removal of metal ions, Antimicrobial drugs, anticancer drugs.

**Books Suggested:**

1. Progress in Inorganic Chemistry, vol. 18 and 38 Ed. J J. Lippard, Wiley.
2. Inorganic Biochemistry vol. I and II ed. G. L. Eichhorn, Elsevier.
3. Principles of Bioinorganic Chemistry, S. J. Lippard and J. M. Berg, University Science Books.

**B020803T**      **Bio- Physical Chemistry**

**M.M.75**

***Credits-04***

**Course Outcome (COs):** Upon successful completion of M.Sc. Bio-physical, chemistry second semester programme students should be able to

- To give the knowledge of enzyme catalyzes the reaction with outmost efficiency.
- To give the knowledge of structure and biological function of coenzymes.
- To give the knowledge of synthesis of ATP from ADP.
- To give the knowledge of Structure and functions of cell membrane and transport of ions.
- To give the knowledge of Biopolymer interactions; various types of binding processes in biological systems.

**Unit-I: Enzymes:**

Introduction, nomenclature and classification, Fischer lock and key: Kosland and Induced hypothesis: Transition state theory, acid base catalysis, Nucleophilic displacement on phosphorous atom. Multiple displacement reaction and the coupling of ATP, cleavage to endergonic processes, Addition and Elimination reaction of enzyme catalyzed carboxylation and decarboxylation

**Unit-II: Coenzymes:**

Apoenzymes, structure and biological function of coenzymes, production, purification of enzymes, methods of immobilization of enzyme activity, application of immobilised enzymes, clinical use of enzymes

**Unit-III: Bio-energetics:**

Standard and free energy change in biochemical reactions, exergonic endergonic, hydrolysis of ATP, synthesis of ATP from ADP

**Unit-IV: Cell membranes and Transport of ions:**

Structure and functions of cell membrane, ion transport through cell membrane, nerve conduction. irreversible thermodynamics treatment of membrane transport.

**Unit-V: Biopolymer Interactions:**

Forces involved in biopolymer interactions, electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interaction, multiple equilibrium and various types of binding processes in biological systems.

**Books Suggested:**

1. Understanding enzymes, Trevor Palmer, Prentice Hall.
2. Enzyme Mechanisms Ed, M. I. Page and A. Williams, RSC.
3. Fundamental of Enzymology, N. C. Price and L. Stevens, Oxford University Press.
4. Biochemistry, L. Stryer, W.H. Freeman.
5. Macromolecules: Structure and Function, F. Wold. Prentice Wall.
6. Biochemistry, Voet and Voet, John Wiley

**Course Outcome (COs):** Upon successful completion of M.Sc. Bio-physical, chemistry second semester programme students should be able to

- To give the knowledge of absorption spectroscopy and its application.
- To give the knowledge of classical and quantum theories of Raman Effect and Coherent anti stokes raman spectroscopy.
- To give the knowledge of NMR Spectroscopy; chemical shift, spin-spin splitting, factors influencing coupling constant.
- To give the knowledge of fragmentation pattern and application by mass spectroscopy.
- To give the knowledge of principles of ESR spectra and g-values and hyperfine interaction.

### **Unit-I: Absorption spectroscopy**

LB's Law and its limitations, Einstein's two level transition model. Transition moment and its relation to molar extinction coefficient. Different types of transitions (pp\*, sp\*, np\* etc.), Selection rules with symmetry arguments, Solvent perturbation method, Weak and CT transition, Vibronic and spin orbit coupling.

### **Unit-II: Raman Spectroscopy**

Classical and quantum theories of Raman Effect, pure rotational vibrational and vibrational-rotational, Raman spectra, Selection rules, Mutual exclusion principle, Resonance Raman spectroscopy, Coherent anti stokes raman spectroscopy (CARS)

### **Unit-III: Nuclear magnetic resonance spectroscopy (NMR):**

Introduction, Theory, relaxation process and saturation, environmental effects on NMR spectra, chemical shift, spin-spin splitting, factors influencing coupling constant 'I', Spin decoupling, basic ideas about instrument, NMR studies of nuclei other than proton  $^1\text{C}$ ,  $^9\text{F}$ , and  $^{\text{P}}$ , FT-NMR advantages of FT-NMR, use of NMR in medical diagnostics.

### **Unit IV: Mass Spectrometry:**

Introduction, molecule ion peak, base peak, isotopic abundance, metastable ions fragmentation mechanism of compounds containing C,H,O,N and halogen, Mac Lafferty rearrangement, nitrogen rule and ring rule and applications.

### **Unit-V: ESR Spectroscopy:**

Introduction, principle, hyperfine splitting, and significance of g-value, determination of g - value. Rules for hyperfine splitting and applications.

**Books Suggested:**

1. Modern spectroscopy, J.M. Hollas, John Willey.
3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
5. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.
6. Basic Principles of Spectroscopy, R. Chang. McGraw Hill.
7. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford.
9. Introduction of Magnetic Resonance, A. Carrington and A.D. MacLachlan, Harper and Row.

**B020805P****M.Sc. CHEMISTRY Practical Semester VIII ( M.M.100 )***Credits-04*

**Course Outcome (COs):** In order to make students understand the theories taught to them in M.Sc. semester (II) in different branches of chemistry e.g. Inorganic, Organic and Physical, the following practical's are introduced. Students will learn:

- Practical knowledge of quantitative estimation.
- Practical knowledge of qualitative analysis.
- Practical knowledge of synthesis of various complexes.
- Practical knowledge of organic synthesis of sulphonation, diazotization and Friedel Crafts Reaction.
- Practical knowledge of hardness of water by ethylene diamine tetra-acetic acid (EDTA).
- To give the knowledge of Separation, Purification and Identification of compounds of tertiary mixtures.

**INORGANIC CHEMISTRY**

(A) Qualitative and Quantitative Analysis: [20]

- (i) Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Zn, etc. involving volumetric and gravimetric methods.

(B) Inorganic Preparations: [10]

- (i) Reineckel Salt  
 (ii) Tetraamine Cupric Sulphate  
 (iii) Chrome Alum  
 (iv) Aluminium Chloride Hexahydrate  
 (v) Nickel Dimethyl Glyoxime  
 (vi) Sodium Cobalt Nitrate  
 (vii) Potassium Trioxalato Ferrate (III)  
 (viii) Cis-Potassium DioxalatoDiaqua Chromate  
 (ix) Trizinc-Potassium DioxalatoDiaqua Chromate  $K[Cr(C_2O_4)(H_2O)_2] \cdot 2H_2O$  (x) Prussian Blue

**ORGANIC CHEMISTRY**

(A) Qualitative Analysis: [10]

Separation, Purification and Identification of compounds of tertiary mixtures (three solids)

(B) Organic Synthesis: [10]

Sulphonation, Diazotization, Aldol Condensation, Friedel Crafts Reaction, Cannizzaro Reaction, Acetylation, Benzoylation, Nitration.

(C) Quantitative Analysis: [10]

- (a) Determination of percentage or number of Hydroxyl Groups in an organic compound by acetylation method.  
 (b) Estimation of amines/ Phenols using bromated bromide solution/ or acetylation method.

**PHYSICAL CHEMISTRY** [30]

- (1) To estimate hardness of water by ethylene diamine tetra-acetic acid (EDTA).  
 (2) To study the distribution co-efficient of benzoic acid between benzene and water.



- (3) To determine the distribution co-efficient of iodine between water and  $CCl_4$  at room temperature.
- (4) To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.
- (5) To titrate the given mixture of  $CO_3$  and  $HCO_3$  ions against a strong acid (HCl) using p- meter and to determine the strength of it.
- (6) To determine the amount of chloride ions present in the given KCl solution.
- (7) To determine nickel as dimethyl glyoximate complex spectrophotometrically. (g) Preparation of standard solution.
- (9) Determination of proton coefficient between water and an organic solvent.
- (10) To test the validity of Lambert-Beer's Law (using methylene blue) and to determine

I.  $\epsilon_{max}$

II. Molar extinction coefficient (C)

**RECORD** [05]

**VIVA** [05]

**B020806R**      **RESEARCH PROJECT**

M.M.100

*Credits-08*

The research project is based on the following areas of topics —

1. Coordination Chemistry
2. Macro Cyclic Chemistry
3. Green Chemistry
4. Nano Chemistry
5. Pesticide Chemistry
6. Polymer Chemistry
7. Polymer Nano Composite
8. Environmental Science
  - i. Air Pollution
  - ii. Soil Pollution
  - iii. Water Pollution
9. Natural Products
10. Synthetic Organic Chemistry
11. Drug Chemistry
12. Industrial Chemistry



M.Sc. Chemistry Syllabus will be effective from (2022-23 onwards)

**SEMESTER-IX**

**BO20901T          PHOTO AND STEREOCHEMISTRY          M.M. 75**  
**Credits- 05**

**COURSE OUTCOMES**

- CO-1** Explain the general principle of Photochemical energy, Frank codon Principle, Jablonski diagram.
- CO-2** Elaborate the detail chemistry of carbonyl compounds, Paterno- Buchi reactions, photoreduction and photo chemistry of unsaturated systems.
- CO-3** Explain the concept of chirality, Interconversions of Fischer, Newman and sawhorse projections.
- CO-4** Elucidate the Molecular dissymmetry and chiroptical properties.
- CO-5** Explain the concept of racemates and their classification.

**UNIT 1** - General principles- Photochemical energy, Frank-Condon principle, Jablonski diagram, singlet and triplet states, photosensitization, quenching, quantum efficiency and quantum yield, energy transfer process in photochemistry, experimental methods of photochemistry.

**UNIT 2**- Photochemistry of carbonyl compounds, Nourish type-I and Norrish type-II cleavages, Paterno-Buchi reactions, photoreductions, photochemistry of unsaturated systems like olefins, cis-trans isomerisation, dimerizations, hydrogen abstraction, addition. Photochemistry of enones-rearrangement of unsaturated ketones and cyclohexadienones.

**UNIT 3**- (A) Concept of chirality, elements of symmetry, R-S nomenclature,

E-Z isomerisms. Interconversion of Fischer, Newman and Sawhorse projections

(B) Conformation and reactivity in acyclic compound (upto four C-atoms) and cycloalkanes (upto cyclohexane)

(c) Transannular effects in medium sized ring compounds:

**UNIT 4**- Molecular dissymmetry and chiroptical properties, linear and circularly polarized light, circular birefringences and circular dichroism, ORD and CD curves. Plain and Cotton effect curves and their applications. The octant rule and axial haloketone rule with applications

**UNIT 5**- A) Racemates and their classification, method of resolution of recemates.

A) Chemoselectivity, regioselectivity, stereoselective, stereospecific reactions and enantioselectivity with examples.

**Books Suggested:**

1. Fundamental of Photochemistry, K. K. Rohtagi-Mukheiji, Wiley-Eastern.
2. Molecular Photochemistry, N.J. Turro, W. A. Benjamin.
3. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.
4. Photochemistry, R P. Kundall and A. Gilbert, Thomson Nelson
5. Stereoselective Synthesis: A Practical Approach M.Nogradi, VCH.

**BO20902T      SOLID STATE CHEMISTRY, SURFACE PHENOMENON AND  
CHEMICAL EQUILIBRIA**

**M.M. 75  
Credits-05**

**Course Outcomes**

**CO-1** Students will learn about the State of solids and fundamental aspects of X-ray diffraction studies.

**CO-2** Elucidate about the crystals defects and non-Stoichiometry.

**CO-3** Students can be familiarizing with Band theory and electronic properties.

**CO-4** Explain the detail about the surface phenomenon and Augur spectroscopy to the study surfaces.

**CO-5** Student will learn about the detail knowledge of chemical equilibria.

**UNIT 1- SOLID STATE**

Crystalline state of solids, unit cells and Bravais lattices, Miller indices, Diffraction of X-rays by crystalline solids, fundamental aspects of X-ray, electron and neutron diffraction studies.

**UNIT 2- Crystal Defects and Non- Stoichiometry.**

Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky defects and frenkeldefects, structural imperfections and properties of solids such as ionic conductivity, diffusion, ferroelectric properties and luminescence, non-stiochiometry and defects.

**UNIT 3- Electronic properties and Band theory**

Metals, insulators and semiconductors, electronic structure of solids-band theory, band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors,

**UNIT 4- Surface Phenomenon**

Surface tension, adsorption on solids, electrical phenomena at interfaces, including electrokinetic, micelles and reverse micelles: solubilization, micro- emulsion, application of photoelectron spectroscopy, ESCA and Augor spectroscopy to the study of surfaces.

## **UNIT 5-Chemical Equilibria**

Free energy and entropy of mixing, partial molar quantities, Gibbs- Duhemequation.

Equilibrium constant, temperature- dependence of equilibrium constant, phase diagram of one- and two component systems, phase rule.

### **Books Suggested:**

1. Solid State Chemistry and its Application, Anthony R. West, Wiley Publication, US
2. Solid State chemistry an Introduction, Lesley E.Smart and Elaine A.Moore,Taylor and Francis,Lo ndon .
3. Principles of Physical Chemistry, Purr, Sharma and Pathania, Vishal Publising, Delhi.

**B02903T**

**COORDINATION CHEMISTRY M.M. 75**

**Credits-05**

**Course outcomes**

**CO-1** To Know the basic of coordination chemistry, bio-inorganic chemistry and aimed at advanced knowledge in the field of industrial chemistry.

**CO-2** To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them.

**CO-3** To able to know the bonding and structure of coordination compounds and their applications.

**CO-4** Students' will learn about the Application of lanthanoids and actinoids.

**UNIT 1-** Crystal field theory, crystal field splitting of d-orbitals in octahedral, tetrahedral and square planar complexes, crystal field stabilization energy (CFSE) in octahedral (weak and strong fields) and tetrahedral complexes, factor affecting CFSE and uses of CFSE, spectrochemical series.

**UNIT 2-** (a) Applications of CFT in colour of transition metal complexes, limitations of CFT, valence bond theory and comparison of VBT and CFT.

(b) Ligand field theory, evidences of covalance and adjusted crystal field theory (ACFT), molecular orbital treatment of octahedral complexes and bonding, molecular orbitals for tetrahedral and square planar complexes, spin cross over coordination compounds.

**UNIT 3 -** Coordination chemistry of transition metal ions, stability constants of complexes and their determination; stabilization of unusual oxidation states. Stereochemistry of coordination compounds. Jahn-Teller effect; Interpretation of electronic spectra including charge transfer spectra; nephelauxetic series, magnetism: Dia -, para -, ferro — and anti-ferromagnetism quenching of orbital angular moment, spin orbit coupling.

**UNIT 4-** Inorganic reaction mechanism; substitution reactions, trans effect and electron transfer reactions, photochemical reaction of chromium and ruthenium complexes. Fluxional molecules, iso- and heteropoly acid, metal clusters spin crossover in coordination compounds.

**UNIT-5 Studies and application of lanthanides and actinides.**

Spectral and magnetic properties, Modern methods of separation of lanthanides and actinides.

Organometallic compound of lanthanides, Applications of lanthanides and actinides compounds in industries. Use of lanthanides compounds as Shift's reagent.

**Books Suggested:**



1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
4. Comprehensive Coordination Chemistry Eds G. Wilkinson, R. D. Gillars and I.AMcCleverty, Pergame
5. Synthesis and Characterization of Inorganic compounds, W.L. Jolly, Prentice Hall. 6.  
Concise Inorganic Chemistry, J.D.Lee, Wiley Publication

**Course outcomes**

**CO-1** Explain about the fundamentals of analytical chemistry.

**CO-2** Student will learn about the Coulometry and its applications.

**CO-3** Elucidate the principle, techniques and conductometric titrations and its applications.

**CO-4** Briefly explain about the polarography and its applications.

**Unit- 1 Amperometry:** Introduction, principle, types of current, technique, amperometric titrations with DME, amperometric titrations with rotating platinum micro electrode, biampero-metry, applications.

**Unit 2 Coulometry:** Introduction, constant Gurrent coulometry, controlled potential coulometry (principle and technique), types of coulometer, applications.

**Unit 3- Conductometry:** Introduction, principle, technique, electrolytic conductivity, measurement of electrolytic conductivity, conductometric titration, applications.

**Unit 4- Polarography :** Introduction, principle, technique, D.M.E., half-wave potential, residual current, migration current, diffusion current, limiting current, applications.

**Unit 5- Voltammetry :** (a) Introduction, principle, technique and applications

(e) Cyclic voltammetiy and anodic stripping voltammetry.

**Books Suggested**

1. Instrumental Method of Chemical Analysis, B.K. Sharma, Krishna Prakashan, Media, Meerut.
2. Instrumental Method of Chemical Analysis, Gurdeep Chatwal, Himalaya Publication House, New Delhi.
3. Instrumental Method of Chemical Analysis, H. Kaur, Pragati Prakashan, New Delhi
4. Instrumental Method of Analysis, Willard, Meritt, Dean, Wadsworth Publishing Co. Inc, Australia
5. Basic Concept of analytical Chemistry, S.M. Khopkar, New Age International Publisher, New Delhi.
5. Fundamental of Analytical Chemistry, Holler and Crouch, Brooks Cole, US.

**BO20905T**

**CHEMISTRY OF NATURAL PRODUCTS**

**M.M 75**

**(ELECTIVE-2)**

**Credits- 05**

**Course outcomes:**

**CO-1** It provides an overview of the field of natural product chemistry.

**CO-2** Identify different types of natural products, their occurrence, structure, biosynthesis and properties.

**CO-3** Student will learn about the classification of various antibiotics.

**Unit 1- Plant Pigments:**

Introduction, occurrence, general methods of structure determination, isolation and synthesis of apigenin, luteolin, vitexin, myrcetin, quercetin, lycopene, aureusin, cyanidin, hirostidin.

**Unit 2- Alkaloids:**

Introduction, classification, occurrence, isolation of alkaloids, general methods of determination of structure of alkaloids, Constitution and synthesis of cocaine, nicotine, atropine, morphine, reserpine. Biosynthesis of alkaloids.

**Unit 3- Terpenoids and Carotenoids:**

Introduction, classification, occurrence, general methods of structure determination, isoprene rule, constitution and synthesis of citral, zingiberene, farnesol, bisabolene,  $\beta$ - carotenoids, Biosynthesis of terpene.

**Unit-4: Steroids:**

Introduction, classification, occurrence, isolation, constitution and synthesis of cholesterol, testosterone, progesterone, androsterone. Biosynthesis of steroid.

**Unit 5- Antibiotics**

Introduction classification, synthesis of penicillin-G, penicillin-V, Amoxycillin, tetracyclin, chloramphenicol, streptomycin. **Books Suggested:**

Natural Products: Chemistry and Biological Significance J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope an J.B. Harbome, Longman Essex

Organic Chemistry, Vol 2, I L. Finar. ELBS.

Rodd's Chemistry of Carbon Compounds, Ed, S. Coffe Elsevier.

Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston, Harwood Academic Publishers.

Introduction to Flavonoids, B.A. Bohm, Harwood Academic Publishers.

New Trends in Natural Product Chemistry, Atta-Ur-Rahman and M.I. Choudhary, Harwood Academic Publishers.

Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers

**B020906T**

**POLYMER CHEMISTRY**

**M.M. 75**

**(ELECTIVE-3)**

**Credits- 04**

**Course outcomes**

**CO-1** Students are able to explain polymer structure, properties and processing in chemical and physical aspects. **CO-2** Students are able to implement knowledge for polymer synthesis, modification and processing.

**CO-3** Elucidate about the laboratory skills, analyse scientific information, and are able to conduct and solve research problems.

**CO-4** Students are able to communicate and collaborate effectively with others as well as be responsible to assigned work.

**Unit 1-** Basics Importance of polymers basic concepts; Monomers, repeat units, degree of polymerization, Linear, branched and network polymers, classification of polymers. Polymerization : condensation, addition, radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems

**Unit 2-** Polymer Characterization Polydispersion - Average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weights. Endgroup, viscosity, light scattering, osmotic and ultracentrifugation methods Analysis and testing of polymers-chemical analysis of polymers, spectroscopic methods, X-ray diffraction study, Microscopy. Thermal analysis and physical testing-tensile strength. Fatigue. impact. Tear resistance. Hardness abrasion resistance

**Unit 3-** Structure and Properties Morphology and order in crystalline polymers-configurations of polymer chains. Crystal structures of polymers Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. Polymer structure and physical properties crystalline melting point  $T_m$ . melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature,  $T_g$  relationship between  $T_m$  and  $T_g$  effects of molecular weight diluents, chemical structure, chain topology, branching and cross linking, property requirements and polymer utilization.

**Unit 4-** Polymer Processing Plastics, Elastomers and fibres. Compounding Processing Techniques; Calendering, Die casting, rotational casting. Film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

**Unit 5-** Properties of Commercial Polymers Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicon polymers. Functional polymers - Fire retarding polymers and electrically conducting polymers. Biomedical polymers-contact lens, dental polymers artificial heart, kidney, skin and blood cells.

**Books Suggested:**

Textbook of Polymer Science, F. W. Billmeyer. Jr. Wiley.

Polymer Science. V. R. Gowarikar, N.V. Viswanathan and J. Sreedhar, Wiley - Eastern.

Functional Monomers and Polymers , K. Takemoto, Y. Inaki and R.M. Ottanbrite.

Contemporary Polymer Chemistry, H.R. Alcock and F.W. Lambe, Prentice Hall.

Physics and Chemistry of polymers, J.M. . Cowie, Blackie Academic and Professional.

## SEMESTER -X

**B021001T**

**Interdisciplinary Topics**

**M.M. 75**

**Credits -04**

### **Course outcomes**

**CO-1** Students will learn the basics of Nanotechnology and its applications.

**CO-2** This course enables the students to understand about the green chemistry and future trends in green chemistry.

**CO-3** This course will enlighten the students to supramolecular chemistry.

**CO-4** Elucidate about the environmental chemistry, greenhouse effect, air pollution and their chemistry.

**CO-5** Students will learn about the pollutants, water quality parameter, standards and waste treatments.

### **UNIT 1- Chemistry in Nanoscience and Technology**

Introduction to nanotechnology, scope of applications, techniques for synthesis of nano particles, important nano materials (Nano optics, Nano magnetic, Nano electronics) carbon nanotubes (types, properties and applications)

### **UNIT 2- Catalysis and Green Chemistry:**

Introduction to green chemistry, principles of green chemistry, designing and chemical synthesis, examples of green synthesis / reactions, future trends in green chemistry.

### **Unit 3- Supra Molecular Chemistry:**

Introduction, concept and language, molecular recognition, supra molecular reactivity and catalysis, transport processes and carrier design.

### **Unit 4- Environment and Atmosphere:**

Environmental chemistry, chemical composition of atmosphere — particles, ions and radicals and their formation. Heat budget of the earth atmospheric system, vertical stability of atmosphere, chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, green house effect, acid rain, air pollution controls and their chemistry.

### **Unit 5- Environmental chemistry (Hydrosphere and soils):**

Aquatic pollution — inorganic, organic, pesticide, agricultural, industrial and sewage, detergents, oil spills and oil pollutants, water quality parameters, water quality standards, purification and treatments of waste. Soil composition, micro and macro nutrients, pollution — fertilizers and pesticides, waste treatment.

### **Books Suggested;**

A Text Book of Nanoscience and Nanotechnology, Me Graw Hill Education, New York  
Principles of Physical Chemistry, Purr, Sharma and Pathania, Vishal Publishing,  
Delhi New trends in Green Chemistry, V.K. Ahluwalia, Springer, New York.  
Environmental Chemistry, H.Kaur, Pragati Prakashan, Meerut.

**B021002T**

**SEPARATION TECHNIQUES M.M. 75**  
**Credits- 04**

**Course outcomes:**

Explain about the classification applications of TLC and column chromatography.  
Student will learn about the principle, classification gas chromatography and its applications.  
Explain about the techniques of HPLC and solvent extractions and its principle, classification and experimental setup.

**Unit 1- Adsorption Chromatography:** Principles, classification, experimental set up and applications of TLC and column chromatography.

**Unit 2- Partition Chromatography:** Principles, classification, experimental set up, special features, mechanism of separation procedures, advantages and disadvantages, and applications liquid-liquid and reverse phase partition chromatography, paper chromatography, thin layer chromatography (TLC) and ion pair chromatography.

**Unit 3- Gas Chromatography (GC):** Principles, classification, experimental set up, special features, mechanism of separation procedures, advantages and disadvantages, and applications Plate theory, gas-solid and gas-liquid chromatography, Hyphenated technique. GC-MS and its applications.

**Unit 4- HPLC:** Principles, classification, experimental set up, special features, mechanism of separation procedures, advantages and disadvantages, and applications Super critical fluid chromatography, gel permeation chromatography and molecular sieves.

**Unit 5- Solvent Extraction:** Principles, classification, experimental set up, special features, mechanism of separation procedures, advantages and disadvantages, and applications Extraction equilibria, partition coefficient and extraction coefficient, extraction by chelation and solvation; solid-phase extraction (SPE).

**Books Suggested:**

Instrumental Method of Chemical Analysis, B.K. Sharma, Krishna Prakashan, Media, Meerut  
Instrumental Method of Chemical Analysis, Gurdeep Chatwal, Himalaya Publication House, New Delhi  
Instrumental Method of Chemical Analysis, H. Kaur, Pragati Prakashan, New Delhi  
Instrumental Method of Analysis, Willard, Meritt, Dean, Wadsworth Publishing Co. Inc, Australia  
Basic Concept of analytical Chemistry, S.M. Khopkar, New Age International Publisher, New Delhi.

**Course outcomes**

**CO-1** Elucidate about the data analysis errors, significant figures, computation of results and learn about the certified reference material.

**CO-2** Students will learn about the principle, instrumentation, applications of ICP, XRD, TEM, SEM, TGA, DTA etc.

**Unit 1- Data Analysis :** Errors, classification of errors, mean deviation and standard deviation, accuracy precision, rejection of measurements, confidence interval tests significance, *error* curve, minimization of errors, significant figures and computation of results, certified reference material and standard reference material.

**Unit 2-** Principle, Instrumentation, Applications of Inductively Coupled Plasma (ICP) Spectroscopy.

**Unit 3-** Principle, Instrumentation, Applications of X-Ray Diffraction (XRD).

**Unit 4-** Principle, Instrumentation, Applications of Scanning Electron Microscopy (SEM) & TEM.

**Unit 5- TGA :** Introduction, principal, instrumentation, Curre point, factor affecting the TGA curves and applications & DTA.

**Books Suggested:**

Instrumental Method of Chemical Analysis, B.K. Sharma, Krishna Prakashan, Media, Meerut  
Instrumental Method of Chemical Analysis, Gurdeep Chatwal, Himalaya Publication House, New Delhi

Instrumental Method of Chemical Analysis, H. Kaur, Pragati Prakashan, New Delhi

Instrumental Method of Analysis, Willard, Meritt, Dean, Wadsworth Publishing Co. Inc, Australia.





**B021005T**

**ADVANCED ORGANIC CHEMISTRY  
ELECTIVE- 2**

**M.M. 75  
Credits-04**

**Course outcomes**

**CO-1** Elaborate the detailed of heterocycles, synthesis and reaction of benzo diazoles, pyrazole, indole, pyrimidine etc.

**CO-2** Student will learn about the common organic rearrangements and their mechanism reactions.

**CO-3** Elucidate the concept of pericyclic reactions and are governed by Woodward-Hoffmann rules will be presented.

**CO-4** Students will elucidate the chemistry of drugs preparations and its applications.

**Unit 1- Heterocycles**

Introduction, classifications, IUPAC names of mono and bicyclic hetero aromatic compounds. Criteria of aromaticity in heterocycles. Synthesis and reaction of benzo [b] and benzo [c], benzodiazoles and acridines, pyrazole, imidazole oxazole, thiazole, indole, pyrimidine.

**Unit 2- Common Organic Rearrangements and their mechanism:**

Pinacol- Pinacolone, Wagner- Meerwein, Demjanove Beckmann, Hoffmann, Curtius, Schmidt, Lossen, Sommelet-Hauser, Favoroskii and Baeyer- Villiger rearrangement.

**Unit 3- Pericyclic Reactions:**

Classification and examples, Woodward-Hofmann's Rule, Electrocyclic reaction, Cycloaddition reaction ([2+2] and [4+2] only) and Sigmatropic shifts [1,3]-shift, [1,5]-shift and [3,3]- shift (Cope rearrangement and Claisen rearrangement), FMO approach only.

**Unit 4- Disconnection Approach**

Introduction to disconnection approach, FGI (Functional Group Interconversion), Synthons, Guidelines for order of events in disconnection, use of protecting group in disconnection approach

**Unit 5- Drugs**

Antibacterials Drugs:-Introduction, preparation and uses of sulphanilamide,sulpha pyridine, sulphathiazole, sulpha guanidine.

Antihistaminic Drugs:- Introduction, preparation and uses of Benadryl, dimenhydrinate, antergan, pyribenzamine.

Anti-inflammatory:- Introduction, Preparation and uses of Steroid and non-steroid drugs (Ibuprofen, mefenamic acid, diclofenac)

Antimalarials:- Synthesis of mepacrine, chloroquin, Pamaquin, paludrin.

**Books Suggested:**

Heterocyclic Chemistry Vol. 1-3, R. R. Gupta, M. Kumar and V. Gupta. Springer Verlag.

The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.

Heterocyclic Chemistry, J.A. Joule, K. Mills and G. F. Smith, Chapman and Hall.

Heterocyclic Chemistry, T. L. Gilchrist, Longman Scientific Technical

The Organic Chemistry of Drug Design and drug Action, R.B. Silverman, Academic Press.

Strategies for Organic Drug Synthesis and design. D. Leilnicer. John Wiley.

**B021006T ADVANCED PHYSICAL CHEMISTRY M.M. 75**  
**Elective -3 Credits-04**

**Course Outcomes**

**CO-1** Elaborate the detailed about molecular shape, structure and configuration, polymer types and their applications.

**CO-2** Explain about the principle of quantum mechanics.

**CO-3** Explain the type of ionic conductor, examples and their application of ionic conductors.

**Unit 1- Thin Film and Langmuir-Blodgett Films:** Preparation techniques, evaporation/sputtering, chemical processes, MOCVD, Sol-gel, etc. Langmuir-Blodgett (LB) films, growth techniques, Photolithography, properties and application of thin & LB films.

**Liquid Crystal:** Mesomorphic behavior, thermotropic liquid crystal, positional order, bond orientation order nematic and smectic mesophases, smectic-nematic, transition and clearing temperature, homeotropic, planar and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, Optical properties of liquid crystal, Dielectric description of ordering in liquid crystals.

**Unit 2- Polymeric Materials:** Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their application, conducting and ferro-electric polymers.

**Unit 3- Ionic Conductors:** Types of ionic conductors, mechanism of conduction, interstitial jumps (Frenkel); Vacancy, mechanism, diffusion superionic conductor, phase transitions and mechanism of conduction in super ionic conductors, examples and application of ionic conductors.

**Unit 4-** Theoretical and computation treatment of atoms and molecules, Hartree-Fock theory. Review of the principles of quantum mechanics, Born — Oppenheimer approximation, Slater Condon rules. Hartree Fock equation, Koopmans and Brillouin theories, Roothaan equation, Gaussian sets.

**Unit 5. General Properties of Liquids:**

- (a) Liquids as dense gases, liquids as disordered solids, some thermodynamic relation, internal pressures and its significance in liquids. Equation of state, critical constants. Different types of intermolecular forces in liquids, different potential function for liquids, additivity of pair potential approximation.
- (b) A classical partition function for liquids, correspondence principle, configuration integral, configuration properties. **Books Suggested:**

Physical chemistry, P.W. Atkins, ELBS

Advanced Physical Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.

Principles of Physical Chemistry, Puri, Sharma and Pathania, Vishal Publishing, Delhi  
Solid State Physics, N. W. Ashcroft and N.D. Mermin, Holt, Rinehart and Winston, New York, 1976.  
Textbook of Polymer Science, F. W. Billmeyer, Jr. Wiley

**B021007P M.Sc. Chemistry Practical ( Semester X) M.M. 75**

**Credit-04**

**Course outcomes**

Student will learn about the extraction of organic compounds, multistep synthesis of organic compounds, green chemistry etc.

**M.Sc. (Inorganic Chemistry) Practical**

1. Flame Photometric Determinations
  - (a) Sodium and Potassium when present together
  - (b) Li/ Ca/ Ba/ Sr
  - (c) Cd and Mg in tap water
2. Spectrophotometric Determinations
  - (a) Fluoride/ Nitrite/ Phosphate
  - (b) Copper-Ethylene diamine complex; slope ratio method
3. Chromatographic Separations
  - (a) Cd and Zn
  - (b) Zn and Mg
  - (c) Thin-layer chromatography

Separation of Ni, Mn, Co & Zn Determination of R<sub>f</sub> values

**M.Sc. (Organic Chemistry) Practical**

**1. Extraction of Organic compounds from natural resources: (One exercise) [20]**

Isolation of lactose from milk.  
Isolation of casein from milk.  
Isolation of caffeine from tea leaves.  
Isolation of carotene from carrot.  
Isolation of lycopene from tomatoes.  
Isolation of cystine from human hair.  
Isolation of Nicotine from tobacco.

**2. Multi-step synthesis of organic compounds: (One exercise) [20]**

Preparation of p- Bromoaniline from Aniline (Bromination)  
Preparation of p-nitroaniline from Aniline (Nitration)  
Preparation of quinoline from aniline (Skraup Synthesis)  
Preparation of 2- phenyl indole from phenyl hydrazine ( Fischer- Indole synthesis)

Benzoyl chloride to Benzaniline (Benzoylation)  
Benzene to Acetanilide (Acetylation)

**3.Green Chemistry: (One exercise)**

**[20]**

Coenzyme catalysed benzoin condensation (Thiamine hydrolysed catalysed synthesis of benzene)

Electrophilic aromatic substitution reaction-I (Nitration of Phenol)

Radical coupling reaction (Preparation of 1,1-Bis-2-naphthol)

Three component coupling (Synthesis of dihydropyrimidinone)

Transesterification reaction (Synthesis of biodiesel)

Preparation of Iron (III) acetylacetonate.

**4. Paper chromatography**, separation and Identification of sugars present in glucose, fructose, sucrose by paper chromatography and determination of R<sub>f</sub> values / TLC.

**5. Spectrophotometric estimation/Identification: (one exercise)**

**[20]**

Aspirin, disprin, Sprintas

Caffeine

Ascorbic Acid (Lemon, Amla)

Carbohydrate (Glucose, Sucrose, Fructose)

Amino acids

**M.Sc. (Physical Chemistry) Practical**

Number of hours for each experiment 3-4 hours.

A list of experiment under different headings are given below.

Typical experiments are to be selected from each type

**Thermodynamics :**

Determination of partial molar volume of solute (e.g. KCl) and solvent in a binary mixture.

Determination of the temperature dependence of the solubility of a compound in two solvents having similar intermolecular interaction (benzoic acid in water & in DMSO water mixture) and calculate the partial molar heat of solution.

**2.Spectroscopy:**

Determination of p<sub>K</sub>a of an indicator (e.g. Methyl red) in (a) aqueous and (b) micellar media

Determination of stoichiometry and Stability constant of inorganic (e.g. ferric-salicylic acid) and organic (e.g. amine iodine) complexes.

Characterization of the complexes by electronic and IR Spectral Data.

**3.Polarography:**

Estimation of Pb and Cd and Ni ions in a mixture of Pb and Cd/Zn and Ni by polarography.

Determination of dissolved oxygen in aqueous solution of organic solvents.

#### **4.Electronics.**

Measurements of resistance with multimeter and calculate the colour code. '

To measure the resistance of the given ammeter.

TO study the characteristics of light emitting diode.

To study the characteristics of Zener diode.

To study the characteristics (cs of FET)

To plot the characteristics curve of a diode.

Setting up of a thermostat: Constant temperature both.

Record [05]

Viva [05]

**B021008R**

**Research Project**

**M.M. 100**

**Credits- 08**

**Course outcomes**

An experience to done a research work in coordination chemistry, green chemistry, Nano chemistry, Pesticide chemistry, polymer chemistry and other broad areas of chemistry field.

The research project is based on the following areas of topics —

1. Coordination Chemistry
2. Macro Cyclic Chemistry
3. Green Chemistry
4. Nano Chemistry
5. Pesticide Chemistry
6. Polymer Chemistry
7. Polymer Nano Composite
8. Environmental Science
  - i. Air Pollution ii.  
Soil Pollution
  - iii. Water Pollution
9. Natural Products
10. Synthetic Organic Chemistry
11. Drug Chemistry
12. Industrial Chemistry



## **Programme Outcomes**

Ensures the students to understand, acquire knowledge in Quantum Chemistry, Group Theory Symmetry, Photochemistry, Advanced Concepts in Spectroscopy, Polymer Science, Green Chemistry, Solid State, Natural Products, disconnection approach as well as role of Modern Synthetic Reagents in Organic Transformations, Nanotechnology, Thermodynamics, Advanced Chemical Kinetics, Surface Analytical Techniques to measure Surface Properties of materials and the Advanced Principles of various Electrochemical Techniques and all branches of Chemistry. This syllabus also ensures the students to understand acquire knowledge and have hands on experience in multistep Inorganic/ Organic Compound Synthesis and Analysis by using Spectroscopic Techniques and have hands on experience in multistep Organic Synthesis and Analysis by using Spectroscopic Techniques.