Study & Evaluation Scheme

of

Master of Science (Chemistry)

[Applicable for Academic Session 2020-21]

[As per CBCS guidelines given by UGC]

TEERTHANKER MAHAVEER UNIVERSITY

N.H.-24, Delhi Road, Moradabad, Uttar Pradesh-244001

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TEERTHANKER MAHAVEER UNIVERSITY
(Established under Govt. of U.P. Act No. 30, 2008)
Delhi Road, Bagarpur, Moradabad (U.P.)

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*Faculty of Engineering*
Programme	*M.Sc. Chemistry*
Duration	*Two Years full time(Four Semesters)*
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Maximum Credits	*100*
Minimum Credits Required for Degree	*96*

Assessment:

Evaluation			**Internal**	**External**	**Total**
Theory			40	60	100
Practical/ Dissertations/ Project Reports/ Viva-Voce			50	50	100
Class Test-1	**Class Test-2**	**Class Test-3**	**Assignment(s)**	**Attendance& Participation**	**Total**
Best two out of three					
10	10	10	10	10	40
Duration of Examination			**External**	**Internal**	
			3 Hours	1.5 Hours	

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester end examination and teachers continuous evaluation.(i.e. both internal and external). A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have at least 45% marks in aggregate to clear the semester.

 # Provision for delivery of 25% content through online mode.

Policy regarding promoting the students from semester to semester & year to year. No specific condition to earn the credit for promoting the students from one semester to next semester.

Maximum no of years required to complete the program: N+2 (N=No of years for program)

Question Paper Structure	
1	*The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.*
2	*Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.*
3	*The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.*
IMPORTANT NOTES:	
1	*The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to of attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy).*
2	*Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.*
3	*There shall be continuous evaluation of the student and there will be a provision of fortnight progress report.*

Program Structure-M.Sc. Chemistry

A. Introduction:

Chemistry is referred to as the science that systematically studies the composition, properties, and reactivity of matter at atomic and molecular level. The scope of chemistry is very broad. The key areas of study of chemistry comprise Organic chemistry, Inorganic Chemistry, Physical Chemistry and Analytical Chemistry. Organic chemistry deals with study of substances containing carbon mostly; inorganic chemistry deals with study of all other elements/compounds/substances and their chemical properties. Physical chemistry deals with applications of concepts, laws to chemical phenomena. Analytical chemistry, in general, deals with identification and quantification of materials. Development of new interdisciplinary subjects like nano-materials, biomaterials, etc. and their applications from chemistry point of view added new dimension to materials chemistry. Thus, the degree programme in chemistry also intended to cover overlapping areas of chemistry with physics, biology, environmental 10 sciences. Further, a broad range of subjects such as materials chemistry, biomaterials, nanomaterials, environmental chemistry, etc., has also been introduced which can be helpful for students/faculty members to broaden the scope of their studies and hence applications from job prospective point of view. Therefore, as a part of efforts to enhance employability of graduates of chemistry, the curricula also include learning experience with industries and research laboratories as interns. In addition, industrial visits/industrial projects are encouraged and added to the curriculum in order to enhance better exposure to jobs/employment opportunities in industries, scientific projects and allied sectors.

The aim of master degree programme in chemistry is intended to provide: (i) Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories. (ii) To develops students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems. (iii) To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self employment/entrepreneurship. (iv) To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects. (v) To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment. (vi) To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication. (vii) To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

The programme structure and credits for M.Sc. are finalized based on the stakeholders' requirements and general structure of the programme. Minimum number of classroom contact teaching credits for the M.Sc. program will be 100 credits (one credit equals 1.0 hour) and Project will be of 08 credits. However, the minimum number of the credits for award of M.Sc. degree will be 96 credits. Out of 100 credits of classroom contact teaching, 48 credits are to be allotted for core courses (CC), 121 credits are allotted to Ability-Enhancement Compulsory Course (AECC), 14credits are allotted to Laboratory Course (LC), 12 credits are allotted to Program/Discipline Specific Elective Course (DSEC), o1 credit for skill enhancement course (SEC) & 05 credits for Industrial Training (IT). Credits distribution is given below in tabular form:

M.Sc. Chemistry : Two-Year (4-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S. No.	**Type of Course**	**Credit Hours**	**Total Credits**
1	Core Course (CC)	12 Courses of 4 Credits each (Total Credit Hrs. 12X4)	48
2	Ability-Enhancement Compulsory Course (AECC)	3 Courses of 4 Credits each (Total Credit Hrs. 3X4)	12
3	Program/Discipline Specific Elective Course (DSEC)	3 Courses of 4 Credits each (Total Credit Hrs. 3X4)	12
4	Laboratory Courses (LC)	7 Courses of 2 Credits each (Total Credit Hrs. 7X2)	14
5	Skill Enhancement Course (SEC)	1 course of 01 credit (Total Credit Hrs. 1X1)	01
6	Value Added Course (VAC)	4 Courses of 0 Credits each (Total Credit Hrs. 6X0)	00
7	PROJ-Viva Voce	1 Courses of 8 Credits each (Total Credit Hrs. 1X8) 1 course of 5 credits each (Total Credit Hrs. 1X5)	13
8	MOOC-Optional (credits will consider only in case a student fails to secure minimum required credits for the award of degree)	2 Courses of 0 Credits each (Total Credit Hrs. 2X0)	00
Total Credits			**100**

Contact hours include work related to Lecture, Tutorial and Practical (LTP), where our institution will have flexibility to decide course wise requirements.

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the M.Sc. program:

- ***Core competency:*** Students will acquire core competency in the subject Chemistry, and in allied subject areas. (i) Systematic and coherent understanding of the fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and all other related allied chemistry subjects. (ii) Students will be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis. (iii) The students will be able to understand the characateriziaton of materials. (iv) Students will be able to understand the basic principle of equipments, instruments used in the chemistry laboratory. (v) Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.
- ***Program/Discipline Specific Elective Course (DSEC):*** A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry, etc. Further, the student will be capable of using of advanced instruments and related soft-wares for in-depth characterization of materials/chemical analysis and separation technology.

- ***Skilled communicator:*** The course curriculum incorporates basics and advanced training in order to make a post graduate student capable of expressing the subject through technical writing as well as through oral presentation.

- ***Critical thinker and problem solver:*** The course curriculum also includes components that can be helpful to post graduate students to develop critical thinking ability by way of solving problems/numerical using basic &advance knowledge and concepts of mathematics.

- ***Sense of inquiry:*** It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

- ***Skilled project manager:*** The course curriculum has been designed in such a manner as to enabling a post graduate student to become a skilled project manager by acquiring knowledge about mathematical project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

- ***Ethical awareness/reasoning:*** A post graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

- ***Lifelong learner:*** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

- ***Value Added Course (VAC):*** A Value Added Course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be Two courses of Aptitude in Semester I, II semesters and two courses of Soft Skills in I&II Semesters and will carry no credit, however, it will be compulsory for every student to pass these courses with minimum 45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in the specific course of the respective semesters.

- ***Skill Enhancement Course:*** This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge. We offer one SECs course as theory or lab with 2 credits.

C. Programme Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of three-years M.Sc Chemistry**:**

PSO – 1	**Understanding** basic information of chemistry including symbols, types of bonds, structure, definitions etc.
PSO – 2	**Remembering** basic concept of chemistry including classification & properties of elements, functional groups, formation of bonds and configuration of compounds.
PSO – 3	**Applying** the basic concept of chemistry including classification & properties of elements, functional groups, formation of bonds and configuration of compounds.
PSO – 4	**Applying** concept of chemistry to bring out the chemical synthesis of compounds, various types of chemical reactions, physicochemical analysis and identification of compounds.

PSO – 5	**Applying** positive aptitude to face new challenges in the field of interest.
PSO – 6	**Developing** new derivatives of the existing compounds and study their physical and chemical properties and comparative studies for various derivatives of existing compounds and can grow evaluating aptitude.
PSO – 7	**Developing** new compounds, elemental analysis for percentage determination and establishing the molecular formula and structure by modern techniques like IR, NMR, and Raman Spectroscopy etc.

D. Pedagogy & Unique practices adopted:

"Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will **emphasize on experiential learning:**

- ***Role Play & Simulation:*** Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

- ***Video Based Learning (VBL)&Learning through Movies (LTM):***These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

- ***Field/Live Projects*:** The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

- ***Industrial Visits:*** Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

- ***MOOCs:*** Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each

course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval.

Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.

For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

a) This is recommended for every student to take at least one MOOC Course throughout the programme.

b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.

c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.

d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.

e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.

f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.

g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

- ***Special Guest Lectures (SGL) &Extra Mural Lectures (EML):*** Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

- ***Student Development Programs (SDP):*** Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

- ***Industry Focused programes:*** Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice based insight to the students.

- ***Special assistance programe for slow learners & fast learners:*** write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

- ***Induction program:*** Every year 3 weeks induction program is organized for 1st year students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

- **Mentoring scheme:** There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

- **Extra-curricular Activities:** organizing& participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

- **Career & Personal Counseling:** - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change.
  Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.
  Strategies: a) Once in a week the counselors meet the students in order to inquire about problems. b) Available 24x7 on SOS basis.

- **Participation in Workshops, Seminars & writing & Presenting Papers:** Departments plan to organize the workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. These participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non credit course.

- **Formation of Student Clubs, Membership & Organizing & Participating events:** Every department has the departmental clubs with the specific club name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

- **Capability Enhancement & Development Schemes:** The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

- **Library Visit & Utilization of E-Learning Resources:** Student can visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.

a) Institute Library & Information is subscribing online e-books and e-journals databases (DELNET and EBSCO host E-databases) as per the requirement of the institute and fulfilling AICTE norms. IP based access is given to all computers connected on campus LAN to access e-journals.

b) For the effective utilization of resources, Information Literacy training programs are conducted to the staff and students.

c) Wi-Fi enabled campus

d) Regular addition of latest books and journals

e) Well maintained e-library to access e-resources

Study & Evaluation Scheme

M.Sc. (Chemistry)-Semester I

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-1	MCH111	Inorganic Chemistry-I	4	-	-	4	40	60	100
2	CC-2	MCH112	Organic Chemistry-I	4	-	-	4	40	60	100
3	CC-3	MCH113	Physical Chemistry-I	4	-	-	4	40	60	100
4	AECC-1	MAT115	Research Methodology	3	1	-	4	40	60	100
5	LC-1	MCH161	Inorganic Chemistry-I (Lab)	-	-	4	2	50	50	100
6	LC-2	MCH162	Physical Chemistry-I (Lab)	-	-	4	2	50	50	100
7	SEC-1	MCH165	Computer Skills for Chemist (Lab)			2	1	50	50	100
8	DGP-1	MGP111	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**15**	**1**	**10**	**21**	**310**	**390**	**700**

Value Added Course: It is an audit course. The performance of the student in this course will not be counted in the overall result however the student has to pass it compulsorily with 45% marks.

1	VAC-1	TMUPA-101	Elementary Arithmetic & Analytical Reasoning	2	1	-	-	40	60	100
2	VAC-2	TMUPS-101	Managing Self	2	1	-	-	50	50	100

M.Sc. (Chemistry)-Semester II

S. No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-4	MCH211	Inorganic Chemistry-II	4	-	-	4	40	60	100
2	CC-5	MCH212	Organic Chemistry-II	4	-	-	4	40	60	100
3	CC-6	MCH213	Physical Chemistry-II	4	-	-	4	40	60	100
4	CC-7	MCH214	Spectroscopy-I	4	-	-	4	40	60	100
5	CC-8	MCH215	Industrial Chemistry	4	-	-	4	40	60	100
6	LC-3	MCH261	Inorganic Chemistry-II (Lab)	-	-	4	2	50	50	100
7	LC-4	MCH262	Organic Chemistry-II (Lab)	-	-	4	2	50	50	100
8	DGP-2	MGP211	Discipline & General Proficiency	-	-	-	-	100	-	100
			Total	**20**	**-**	**8**	**24**	**300**	**400**	**700**

***Value Added Course:**

1	VAC-3	TMUPA-201	Progressive Algebra & Data Management	2	1	-	-	40	60	100
2	VAC-4	TMUPS-201	Managing Work and Others	2	1	-	-	50	50	100

MOOC Course:

1	MOOC-1	MOOC12	MOOC Program –I (Optional)	-	-	-	2	-	100	100

M.Sc. (Chemistry)-Semester III

S. No	*Category*	*Course Code*	**Course**		*Periods*			*Credit*	*Evaluation Scheme*		
					L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-9	MCH311	Spectroscopy-II		4	-	-	4	40	60	100
2	AECC-2	MSC011	Industrial Safety & Health Hazards		4	-	-	4	40	60	100
3	DSE-1		Discipline Specific Elective Courses	Discipline Specific Elective Course-I	4	-	-	4	40	60	100
4	DSE-2			Discipline Specific Elective Course-II	4	-	-	4	40	60	100
5	LC-5	MCH361	Organic Chemistry II (Lab)		-	-	4	2	50	50	100
6	LC-6	MCH362	Physical Chemistry II (Lab)		-	-	4	2	50	50	100
7	PROJ-1	MCH392	Industrial Training & Presentation		-	-	-	5	50	50	100
8	DGP-3	MGP311	Discipline & General Proficiency		**-**	**-**	**-**	**-**	100	-	100
			Total		**16**	**-**	**8**	**25**	**310**	**390**	**700**

MOOC Course:

1	MOOC-2	MOOC13	MOOC Program –II (Optional)	-	-	-	2	-	100	100

M.Sc. (Chemistry)-Semester IV

S. No	*Category*	*Course Code*	**Course**	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-10	MCH411	Bio-Chemistry	4	-	-	4	40	60	100
2	CC-11	MCH412	Photochemistry & Disconnection approach	4	-	-	4	40	60	100
3	CC-12	MCH416	Environmental Chemistry	4	-	-	4	40	60	100
4	AECC-3	MHM420	Entrepreneurship	4	-	-	4	40	60	100
5	DSE-3		Discipline Specific Elective Courses: Discipline Specific Elective Course-III	4	-	-	4	40	60	100
6	LC-7	MCH461	Environmental Chemistry (Lab)	-	-	4	2	50	50	100
7	PROJ-2	MCH492	Project	**-**	**-**	16	8	50	50	100
8	DGP-4	MGP411	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**20**	**-**	**20**	**30**	**300**	**400**	**700**

ELECTIVE COURSES OFFERED

S.No	Code	Course	L	T	P	Credit
Semester III-Discipline Specific Elective Course-I -(Any one)						
1	MCH312	Polymer Chemistry	4	-	-	4
2	MCH313	Chemistry of Nano-materials	4	-	-	4
3	MCH314	Chemistry of Natural Products	4	-	-	4
Semester III-Discipline Specific Elective Course-II -(Any one)						
4	MCH315	Organomettalic Chemistry	4	-	-	4
5	MCH316	Medicinal Chemistry	4	-	-	4
6	MCH317	Quantum Chemistry & Solid State Chemistry	4	-	-	4
Semester IV-Discipline Specific Elective Course-III -(Any one)						
7	MCH413	Bio-Inorganic Chemistry	4	-	-	4
8	MCH414	Bio-Organic Chemistry	4	-	-	4
9	MCH415	Bio-Physical chemistry	4	-	-	4
10	MCH417	Heterocyclic Chemistry	4	-	-	4

Course Code: MCH111	**M.Sc.-Chemistry- Semester-I** **Inorganic Chemistry-I**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the participants will be**	
CO1.	**Understanding** the Stereochemistry & bonding in inorganic molecules.	
CO2.	**Understanding** the metal ligand Equilibria, Substitution reaction & electron transfer reaction in coordination chemistry.	
CO3.	**Applying** concept of electronic transition to study the splitting of electronic energy levels & spectroscopic terms of coordination compounds.	
CO4.	**Applying** concept of Nucleophilic substitution in synthesizing metal complexes.	
CO5.	**Analyzing** VSEPR theory in determining the shape of molecules, Molecular orbital theory in constructing MO diagram of triatomic molecules & transition metal complexes.	
Course Content:		
Unit-1:	**Stereochemistry and Bonding in Main Group Compounds:** VSEPR theory and its application for treating structures of inorganic molecules and ions containing lone pairs of electrons, shortcomings of VSEPR model. MO treatment of polyatomic molecules, e.g., ozone, nitrite, nitrate, hydarzoic acid and benzene.	**8 Hours**
Unit-2:	**Metal-Ligand Bonding**: Molecular orbital theory. Qualitative aspects of metal-ligand sigma-bonding in octahedral, tetrahedral and square planar complexes. Jahn-Teller Effect, Electronic Spectra and of Transition Metal Complexes. Spectroscopic term, terms and microstates for the p^2 and d^2 configurations, Hund's rules for ground state terms, the correlation of spectroscopic terms into Mulliken symbols, electronic transition selection rules, Orgel diagrams for transition metal complexes (d^1-d^9 states). Jahn-teller effect and electronic spectra of complexes	**8 Hours**
Unit-3:	**Metal-Ligand Equilibria in Solution:** Stepwise and overall formation constants and their relationship, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by Bjerrum method, Job's and Mole ratio methods.	**8 Hours**
Unit-4:	**Reaction Mechanisms of Transition Metal Complexes I:** Energy profile of a reaction, reactivity of a metal complexes, inert & labile complexes, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct & indirect evidence in favour of conjugate mechanism, anation reaction, reaction without metal ligand bond cleavage. Substitution reaction in square planar complexes, the trans effect, mechanism of the substitution reaction.	**8 Hours**
Unit-5:	**Reaction Mechanisms of Transition Metal Complexes II:** Redox reaction, Electron transfer reactions, outer and inner sphere electron transfer process, Marcus-hush theory, doubly bridged inner-sphere transfer, other electron transfer reactions; two electron transfers,	**8 Hours**

	Non-complementary reaction, Ligand exchange via electron exchange, reductions by hydrated electrons.	
Text Books:	**1.** Huheey, J.E. Inorganic Chemistry, Pearson.	
Reference Books:	**1.** Cotton, F.A. and Wilkinson,G. Advanced Inorganic Chemistry, Wiley eastern. **2.** Shriver,D.F.,Atkins,P.W. and Langford,C.H. Inorganic Chemistry, ELMS, Oxford. **3.** William W. Porterfield, Inorganic Chemistry. **4.** K.F. Purcell and J.C. Kotz.An Introduction to Inorganic Chemistry. **5.** https://www.youtube.com/watch?v=Rf1luRh6Y5w *** Latest editions of all the suggested books are recommended.**	

Course Code: MCH112	**M.Sc.-Chemistry- Semester-I** **Organic Chemistry-I**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Understanding** the basic concept of chirality, stereo isomerism, conformational isomerism, nucleophilic & free radical substitution reaction.	
CO2.	**Understanding** the addition reaction in C==C and C==O and their stereochemistry involved in various organic reactions.	
CO3.	**Applying** free radical reaction in explaining various oxidation reactions.	
CO4.	**Applying** the concept of resonance, inductive and steric effect to explain reaction mechanism in Organic Chemistry.	
CO5.	**Analyzing** the nucleophilic substitution reaction in aliphatic and aromatic substrates & effect of neighboring group participation by π and σ bonds.	
Course Content:		
Unit-1:	**Stereochemistry.** Chirality, elements of symmetry, molecules with more than one chiral center, threo and erythro isomers. R and S configuration. Separation of enantiomers. Regioselective, stereospecific and stereoselective rections. Asymmetric synthesis. Optical activity in the absence of chiral carbon (atropisomerism) biphenyls, allenes and spiranes, and their nomenclature. Conformational analysis of cyclohexanes and decalins. Effect of conformation on reactivity	**8 Hours**
Unit-2:	**Reaction Mechanism**. Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, and control, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Effect of structure on reactivity -resonance and field effects, steric effect. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation.	**8 Hours**
Unit-3:	**Aliphatic Nucleophilic Substitution.** The S_N2, S_N1, mixed S_N2 and S_N1, and SET mechanisms. The S_Ni mechanism. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium. The neighbouring group mechanism, neighbouring group participation by Pi and Sigma bonds. Classical and nonclassical carbocations, norbornyl system, carbocation rearrangements Aromatic Nucleophilic Substitution. The S_NAr, S_N1, benzyne and $S_{RN}1$ mechanisms. Reactivity, effect of substrate structure, leaving group and attacking nucleophile. Bucherer reaction, alkylation, and amination. The Bamberger rearrangement. The von Richter rearrangement	**8 Hours**
Unit-4:	**Free Radicals**. Free radical reactions and their stereochemistry. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, hydroperoxide formation, replacement of diazonium group. Hunsdiecker reaction. Electron spin resonance (ESR) spectroscopy. Electron paramagnetism, derivative curves, g values and hyperfine splitting.	**8 Hours**
Unit-5:	**Addition to Carbon-Carbon Multiple Bonds.** Mechanistic and stereochemical aspects of addition reactions. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation. Addition to Carbon-Hetero atom Multiple Bonds. Mechanism of metal hydride reduction of carbonyl compounds, acids, esters and nitriles. Wittig reaction. Mechanism of condensation reactions involving enolates. Mannich, Benzoin, Perkin, and Stobbe reactions.	**8 Hours**

Text Books:	**1.** March, Jerry.Advanced Organic Chemistry: Reactions, Mechanism and Structure, John Wiley.	
Reference Books:	**2.** Sykes, Peter.A Guide Book to mechanism in Organic Chemistry, Longman. **3.** Morrison, R. T. and Boyd, R. N. Organic Chemistry, Prentice Hall. **4.** Kalsi, P. S. Organic Reactions and their Mechanisms, New Age International Publishers. **5.** Mukherji and SinghReactions Mechanism in Chemistry, Vol. I, II, III, Macmillan. **6.** https://www.youtube.com/watch?v=dfA9t8i38-k *** Latest editions of all the suggested books are recommended**	

Course Code: MCH113	M.Sc.-Chemistry- Semester-I **Physical Chemistry-I**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Understanding** the concepts of Schrodinger wave equation, variation method, perturbation theory and angular momentum.	
CO2.	**Understanding** the laws of thermodynamics, rate laws, Phase rule & Fugacity.	
CO3.	**Understanding** the Chemical dynamics and Partial molar properties of chemical compounds.	
CO4.	**Applying** the Schrodinger wave equation to explain Eigen value & Eigen Vector for particle in a box, rigid rotor, harmonic oscillator and hydrogen atom.	
CO5.	**Analyzing** Partial molar properties of partial molar volume, and partial molar heat content.	
Course Content:		
Unit-1:	Introduction to exact quantum mechanical results. The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to systems such as particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.	**8 Hours**
Unit-2:	Approximate Methods. The variation theorem, linear variation principle. Perturbation theory (introductory idea). Application of variation method to the Helium atom. Angular Momentum. Ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum, addition of angular momenta, spin, antisymmetric and Pauli exclusion principle.	**8 Hours**
Unit-3:	Classical Thermodynamics. Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar properties; partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity. Derivation of phase rule and its application to three component systems, second order phase transitions.	**8 Hours**
Unit-4:	Chemical Dynamics (Part I). Methods of determining rate laws, Arrhenius equation, collision theory of reaction rates, steric factor, activated complex theory, ionic reactions, kinetic and thermodynamic control of reactions.	**8 Hours**
Unit-5:	Chemical Dynamics (Part II). Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and oscillatory reactions, homogeneous catalysis, kinetics of enzyme reactions	**8 Hours**
Text Books:	**1.** Atkins, P.W. Physical Chemistry, ELBS.	
	1. Young, R-J and Lovell, P.A. Introduction to Polymers, Replika Press Pvt. Ltd. **2.** Flory, P.J. Principles of Polymer Chemistry, Asian Book Private Ltd. **3.** Thomas, E. and Philip, R. Thermodynamics: Statistical	

Reference Books:	Thermodynamics and Kinetics,Pearson Education. **4.** Moore, J.W. and Pearson, R.G. Kinetics and Mechanism, John Wiley and Sons. **5.** https://www.digimat.in/nptel/courses/video/115103104/L01.html *** Latest editions of all the suggested books are recommended**	

Course Code: MAT115	M.Sc. Chemistry- Semester-I **Research Methodology**	L-3 T-1 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concepts of research and its methodologies, sampling techniques, meaning of scaling, its classification, important scaling techniques, basic principles of graphical representation	
CO2.	**Identifying** appropriate research topics using better central tendency and dispersion procedures	
CO3.	**Analyzing** different research problem and their associated parameters, hypothesis with significance levels and different degree of freedoms, correlation and regression	
CO4.	**Evaluating** appropriate project proposal (to undertake a project), significance of report writing, layout and precautions for writing research report	
CO5.	**Creating,** organizing and conducting research (advanced project) in a more appropriate manner with the help of SPSS for data analysis	
Course Content:		
Unit-1:	**Research Methodology**: Introduction to Research methodology: Meaning, Objective, Types of research & research approaches, Criteria for Good research .Review of Literature. Research problem: Statement, Purpose, Objective, Necessity of defining the problems. Research design: Meaning, Need Features, Different research design.	**8 Hours**
Unit-2:	**Measurement of scaling techniques**: Measurement scales, sources of error in measurement, technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques. Methods of collection, Sampling Techniques.	**8 Hours**
Unit-3:	**Introduction to statistics:** Meaning, Definition, Characteristics, importance of the study of statistics, Tabulation of Data: Basic principles of graphical representation, Types of diagrams histograms, frequency polygons, smooth frequency polygons, cumulative frequency curve. Measures of central Tendency: Mean, Median, Mode, Measures of Dispersion: Range, Mean deviation and Standard deviation.	**8 Hours**
Unit-4:	Testing of Hypotheses, Level of significance, Degree of freedom, Student t-test, F- test, Chi Square-test, Anova-one way & two way; Correlation & Regression: Significance, Types of Correlation, Linear Regression	**8 Hours**
Unit-5:	**Interpretation and report writing**: Meaning, Techniques of interpretation, significance of report writing, steps in writing, layout of the research report, types of report and precautions for writing research report. Use of SPSS in Data Analysis.	**8 Hours**
Text Books:	**1.** Dr. J. A Khan: Biostatistics & Research Methodology, APH Publishing.	

Reference Books:	**2.** C. R Kothari: Research Methodology, Methods & techniques New age international Publishers. **3.** R. Paneerselvam Research Methodology, PHI Learning Second Edition. **4.** Kapoor B.K & Gupta S.C, Fundamental of Statistics, S. Chand Publication, New Delhi. **5.** Malhotra Naresh K. Marketing Research, Pearson Education. **6.** http://www.ltcconline.net/greenl/courses/201/descstat/mean.htm ***Latest editions of all the suggested books are recommended.**	

Course Code: MCH161	M.Sc. Chemistry- Semester-I **Inorganic Chemistry-I (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	Detecting of acid and basic radicals including interfering radicals from the given inorganic mixture qualitatively.	
CO2.	Applying the chromatographic techniques for Separation of cations & anions.	
CO3.	Applying the concepts of complexation by synthesize metal complex.	
CO4.	Measuring of molar conductance using conductivity meter.	
CO5.	Measuring of magnetic susceptibility of metal complex by Gouy's Method.	
Course Content:		

List of Experiment:

I- Qualitative analysis:

To identify the given cation, anion and interfering radicals (total six including one interfering radical) from the given inorganic mixture.

II- Chromatography

1. Separation of cations and anions by Paper Chromatography

2. Separation of cations and anions by Column Chromatography; Ion exchange

III- Synthesis:

Preparation of selected inorganic compounds and their studies by measurements of decomposition temperature, molar conductance and magnetic susceptibility measurements.(**Any five**)

1. [Co(NH3)6] [$Co(NO2)_6$]
2. cis-[Co(trien) $(NO_2)_2$]Cl.H_2O
3. Hg[$Co(SCN)_4$]
4. [$Co(Py)_2Cl_2$]
5. [$Ni(NH_3)_6$]Cl_2
6. [$Ni(dmg)_2$]
7. [$Cu(NH_3)_4$]$SO_4 \cdot H_2O$
8. aquabis(acetylacetonato)nitrosylchromium(I), [$Cr(NO)(acac)_2(H_2O)$]
9. Cis-Bis (glycinato) copper(II) and trans-Bis (glycinato)copper(II)
10. Preparation of Zn, Cd and Hg thiocyanates from their respective chlorides
11. Bis (benzoylacetonato)copper(II)
12. Bis (acetylacetonato)oxovanadium(IV), [$VO(acac)_2$][$MoO_2(acac)_2$]
13. Hexaammminenickel (II) tetrafluoroborate, [$Ni(NH_3)_6$]$(BF_4)_2$ and determination of nickel content gravimetrically.
14. Potassium tris (oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.

15. Preparation of N,N-bis (salicylaldehyde) ethylenediamine [salenH_2], Co(salen)

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MCH162	**M.Sc. Chemistry- Semester-I** **Physical Chemistry-I (Lab)**	**L-0 T-0 P-4 C-2**
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Determining** of specific rotation and inversion kinetics of sucrose using polarimeter.	
CO2.	Applying the phase rule, constructing the phase diagram for three component system.	
CO3.	Determining of Rate constant for various chemical reactions.	
CO4.	Validating of Langmuir's and Freundlich adsorption isotherm.	
CO5.	Analyzing the variation of thermo emf with the temperature for the copper-iron thermocouple and characteristics of Si and Ge semiconductor diode.	
Course Content:		

List of Experiment:

1. To study surface tension -concentration relationship for solutions (Gibbs equation).
2. To construct the phase diagram for three component system (e.g., chloroform-acetic acid-water).
3. To calculate specific rotation of sucrose
4. Enzyme kinetics -inversion of sucrose
5. Determine the rate constant of hydrolysis of an ester as methyl acetate catalysed by an acid. Determine also the energy of activation of the reaction
6. Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidised by persulphate ion)
7. Determination of the velocity constant of hydrolysis of an ester and to study the effect of change of concentration on it.
8. To study the adsorption of oxalic acid on charcoal and to prove the validity of Freundlich adsorption isotherm.
9. To study the adsorption of oxalic acid on charcoal and to prove the validity of Langmuir's adsorption isotherm.
10. To study the variation of thermo emf with the temperature for the copper-iron thermocouple.
11. To study forward and reverse characteristics of Si and Ge semiconductor diode

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MCH165	M.Sc. Chemistry (Semester-I) Computer Skills for Chemist (Lab)	L-0 T-0 P-2 C-1
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Describe the usage of computers and why computers are essential components in business and society.	
CO2.	Utilize the Internet Web resources and evaluate on-line e-business syste	
CO3.	Solve common business problems using appropriate Information Technology applications and systems.	
CO4.	Identify categories of programs, system software and applications. Organize and work with files and folders.	
CO5.	Describe various types of networks network standards and communication software.	
Course Content:		

Module 1:

Introduction to computers hardware and software components; Operating System; Usage of Internet and Intranet; protocols and their importance; networking; Internet Browsing: Net Surfing, Search Engine, Email.

Module 2:

Introduction to MS office: Word, Power point, Excel, Short cut Keys, Mail Merge, Watermarking, Animation in presentation.

****Module 1 & 2 are prerequisite for experiment hence needs to be explained before commencement of experiments.***

LIST OF EXPERIMENTS:

1. Fundamentals of computer system, with its functional components.
2. Create a formatted WORD document.
3. Create a WORD document using different fonts.
4. Create a table & perform operations in it.
5. Create a WORD document, using the functions page set up, & page preview, and then print that document.
6. Implement Mail Merge.
7. Collect the information of any company & perform the below operation in it:

(a) Insert the data into Row/Column of Excel, worksheet

(b) Create a worksheet in Excel, perform alignment, text wrapping & sort the data.

8. Collect the information of any company & perform the below operation in it:

(a) Generate the graph in Excel.

(b) Create a Hyperlink to a word document.

(c) Create a worksheet using the functions- page set up, print preview & then print the worksheet.

9. Create, save & print the power point presentation
10. Create a power point presentation using clipart, Word art gallery & then add transition & Animation effects.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MGP111	M.Sc. Chemistry- Semester-I **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: TMUPA-101	VAC (Value Added Course) M.Sc. Chemistry (Semester-I) **Elementary Arithmetic & Analytical reasoning**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount.	
CO2.	Applying the arithmetical concepts in Ratio and Proportion, Mixture and Allegation.	
CO3.	Employing the techniques of Percentage, Ratios and Average in inter related concepts of Time and Work, Time speed and Distance.	
CO4.	Evaluating the different possibilities of various reasoning based problems in series, Direction and Coding-Decoding.	
Course Content:		
Unit-1:	**Percentages** Basic calculation, ratio equivalent, base, change of base, multiplying factor, percentage change, increment, decrement, successive percentages, word problems	**4 Hours**
Unit-2:	**Profit Loss Discount** Basic definition, formula, concept of mark up, discount, relation with successive change, faulty weights	**3 Hours**
Unit-3:	**Ratio, proportions and variations** Concept of ratios, proportions, variations, properties and their applications	**3 Hours**
Unit-4:	**Mixtures and allegations** Mixtures of 2 components, mixtures of 3 components, Replacements	**4 Hours**
Unit-5:	**Time and Work** Same efficiency, different efficiency, alternate work, application in Pipes and Cisterns	**4 Hours**
Unit-6:	**Time Speed Distance** Average speed, proportionalities in Time, Distance, trains, boats, races, circular tracks	**6 Hours**
Unit-7:	**Number and Alphabet Series** Different kind of series and pattern	**2 Hours**
Unit-8:	**Direction sense** Simple statements, shadow type	**2 Hours**
Unit-9:	**Coding and decoding** Sequential coding, reverse coding, abstract coding	**2 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com • R6:-Logical Reasoning by Nishith K Sinha	

	• R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: TMUPS-101	Value Added Course M.Sc. Chemistry- Semester-I **Managing Self**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings	
CO2.	Understanding and analyzing self and devising a strategy for self growth and development.	
CO3.	Adapting a positive mindset conducive for growth through optimism and constructive thinking.	
CO4.	Utilizing time in the most effective manner and avoiding procrastination.	
CO5.	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.	
CO6.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.	
Course Content:		
Unit-1:	**Personal Development:** Personal growth and improvement in personality Perception Positive attitude Values and Morals High self motivation and confidence Grooming	**10 Hours**
Unit-2:	**Professional Development:** Goal setting and action planning Effective and assertive communication Decision making Time management Presentation Skills Happiness, risk taking and facing unknown	**8 Hours**
Unit-3:	**Career Development:** Resume Building Occupational Research Group discussion (GD) and Personal Interviews	**12 Hours**
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Tracy, Brian, Time Management (2018), Manjul Publishing House 3. Hill, Napolean, Think and grow rich (2014), Amazing Reads 4. Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub 5. https://www.hloom.com/resumes/creative-templates/ 6. https://www.mbauniverse.com/group-discussion/topic.php 7. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 8. Burne, Eric, Games People Play (2010), Penguin UK 9. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression *** Latest editions of all the suggested books are recommended.**	

Course Code: MCH211	M.Sc. Chemistry -Semester-II **Inorganic Chemistry-II**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the Students will be:**	
CO1.	**Understanding** of bonding, synthesis & structure of transition metal π acid complexes.	
CO2.	**Understanding** of structure, bonding, electron counting in metal cluster compounds.	
CO3.	**Understanding** of Origin of magnetic moment & application of magneto chemistry in coordination chemistry.	
CO4.	**Understanding** & Applying Mossbaeur spectroscopy to study bonding & structure of Iron & Tin compounds.	
CO5.	**Applying** 4 digit coding (s, y, t, x numbers) to study the bonding & topology of boranes.	
Course Content:		
Unit-1:	**Metal π-complexes:** Metal carbonyls, structure & bonding, important reactions of metal carbonyls, preparation, bonding, structure & important reactions of transition metal nitrosyls, dinitrogen, dioxygen complexes & tertiary phosphine as ligands.	**8 Hours**
Unit-2:	**Metal cluster compounds:** Introduction, metal carbonyl clusters; Low Nuclearity (M_3 M_4) clusters: isoelectronic and isolobalrelaltionships high nuclearity carbonyl clusters; hetero atoms in metal atom clusters, electron counting schemes for HNCC: HNCC of Fe, Ru, Os, Co, Rh, a) Lower halide and chalcogenide clusters, octahedral metal halide, chalocogenide clusters, triangular clusters. b) Compounds with M-M multiple bonds; I) Major structural types; quadrupole bonds Bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for B_2H_6, B_4H_{10}, B_5H_9, B_5H_{11} and B_6H_{10} and their utilities	**8 Hours**
Unit-3:	Organic Reagents in Inorganic Chemistry: Chelation, factors determining the stability of chelates (effect of ring size, oxidation state of the metal, coordination number of the metal); Use of the following reagents in analysis: (a) Dimethylglyoxime (in analytical chemistry) (b) EDTA (in analytical chemistry) (c) 8-Hydroxyquinoline (in analytical chemistry) (d) 1,10-Phenanthroline (in analytical chemistry) (e) Thiosemicarbazones (in analytical chemistry) (f) Dithiazone (in analytical chemistry)	**8 Hours**
Unit-4:	**Magneto chemistry:** Origin of Magnetic moment, factors determining Para magnetism, application of magnetochemistry in co-ordination chemistry (spin only moment, Russell Saunder's coupling, quenching of orbital angular moment, orbital contribution to a magnetic moment) in spin free and spin paired octahedral and tetrahedral complexes. Magnetic susceptibility (diamagnetic, paramagnetic) and its measurements, Van Vlecks formula for magnetic susceptibility, temperature dependence of magnetic	**8 Hours**

Unit-5:	**Mossbauer spectroscopy** - Mossbauer effect, recoilless emission and absorption, hyperfine interaction, chemical isomer shift, magnetic hyperfine and quadruple interaction, Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds and (3) detection of oxidation state	**8 Hours**
Text Books:	**1.** Cotton, F.A. and Wilkinson, G. Advanced Inorganic Chemistry, Wiley eastern.	
Reference Books:	**1.** Shriver, D. F., Atkins, P.W. and Langford, C. H. Inorganic Chemistry, ELMS, Oxford. **2.** William W. Porterfield, Inorganic Chemistry. **3.** K.F. Purcell and J.C. Kotz. An Introduction to Inorganic Chemistry. **4.** Huheey, J.E. Inorganic Chemistry, Pearson. **5.** https://www.youtube.com/watch?v=5_XiWbHswqY *** Latest editions of all the suggested books are recommended**	

Course Code: MCH212	M.Sc. Chemistry -Semester-II **Organic Chemistry-II**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the Students will be:	
CO1.	Understanding elimination reactions, molecular orbital symmetry of conjugated system, oxidation-reduction in various organic substrates.	
CO2.	Applying elimination reactions, orientation of double bond, elimination versus substitution.	
CO3.	Applying conrotatory and disrotatory motion mechanism of various oxidation and reduction reaction.	
CO4.	Analyzing the effect of various factors in elimination reactions on electrocyclic, cyclo-addition and sigma tropic rearrangements.	
CO5.	Analyzing the effect of photochemical and thermal effect on electrocyclic, cyclo-addition and sigma tropic rearrangements.	
Course Content:		
Unit-1:	**Elimination Reactions**. The E2, E1 and E1cB mechanisms and their spectrum. Orientation of the double bond. Reactivity, effect of substrate structure, attacking base, the leaving group and the medium. Elimination versus substitution. Mechanism and orientation in pyrolytic elimination. The Hofmann degradation. Dihalo-elimination. Decomposition of toluene-p-sulphonylhydrazones. Conversion of ketoximes to nitriles. N-Nitrosoamine to diazoalkane transformation	**8 Hours**
Unit-2:	**Pericyclic Reactions**: Molecular orbitals and their symmetry. Molecular orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system, and their symmetry properties. Pericyclic reactions. Characteristics and classification. Electrocyclic reactions: conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Cycloaddditions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Antarafacial and suprafacial additions. 4n and 4n+2 systems, 2+2 addition of ketenes. Ene synthesis. Sigmatropic Rearrangements. Suprafacial and antarafacial 1,3- and 1,5-shifts of H, sigmatropic shifts involving carbon moieties, 2,3-, and 3,3-sigmatropic rearrangements. Claisen, Cope, aza-Cope, Sommlet-Hauser, and Fisher Indole rearrangements	**8 Hours**
Unit-3:	**Oxidation**. Oxidation of carboncarbon double bond. Perhydroxylation, potassium permanganate, osmium tetroxide, iodine together with silver carboxylates, ozonolysis. Enantioselective epoxidation of allylic alcohols (Sharpless epoxidation). Oxidation of alcohols. Chromic acid, chromiun (VI) oxide-pyridine complexes, manganese (IV) oxide, silver carbonate, oxidation via alkoxysulphonium salts. Baeyer-Villiger oxidation of ketones. Oxidation with ruthenium tetroxide, thallium (III) nitrate and iodobenzene diacetate.	**8 Hours**
Unit-4:	**Reduction**. Catalytic hydrogenation (homogeneous and heterogenous). Stereochemistry and mechanism, selectivity of reduction. Reduction by dissolving metals. Metal and acid, metal and alcohol, metal and ammonia.	**8 Hours**

	Reduction by hydride-transfer reagents. Aluminium alkoxides, lithium aluminium hydride, sodium borohydride, lithium hydrido-alkoxyaluminates. Wokff-Kishner reduction. Reduction with di-imide	
Unit-5:	**Designing organic synthesis**. The Disconnection Approach. Basic principles, synthons, functional group interconversions. Order of events in organic synthesis. One group CX disconnections and two group CX disconnections. Chemoselectivity. Reversal of polarity (umpolung). Amine synthesis **Rearrangements** General mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Benzil-Benzilic acid, Favorskii,Arndt-Eistert synthesis, Neber, Backmann, Hofmann, Curtius, Schmidt, Benzidine, Baeyer-Villiger, Shapiro reaction, Witting rearrangement and Stevens rearrangement	**8 Hours**
Text Books:	**1.** March, Jerry. Advanced Organic Chemistry: Reactions, Mechanism and Structure, John Wiley.	
Reference Books:	**1.** Sykes, Peter.A Guide Book to mechanism in Organic Chemistry, Longman. **2.** Morrison, R. T. and Boyd, R. N. Organic Chemistry, Prentice Hall. **3.** Kalsi, P. S. Organic Reactions and their Mechanisms, New Age International Publishers. **4.** Mukherji, S.M. and Singh, S.P. Reactions Mechanism in Chemistry, Vol. I, II, III, Macmillan. **5.** Kalsi, P.S. Stereochemistry of Organic Compounds, New Age International. **6.** Kalsi, P.S. Stereochemistry: Conformation and Mechanism, Wiley Eastern Limited. **7.** https://www.digimat.in/nptel/courses/video/104106077/L01.html *** Latest editions of all the suggested books are recommended**	

Course Code: MCH213	**M.Sc. Chemistry -Semester-II** **Physical Chemistry-II**	**L-4 T-0 P-0 C-4**
Course Outcomes:	On completion of the course, the Students will be:	
CO1.	**Understanding** the fundamentals of Chemical kinetics to know the rate andorder of the chemical reactions.	
CO2.	**Understanding** the reaction rates by different theories.	
CO3.	**Understanding** the potential energy surface & reaction mechanism.	
CO4.	**Understanding** the partition function & chemical equilibrium to understand RRK & RRKM theories.	
CO5.	**Understanding** theories of electrochemical phenomenon.	
CO6.	**Understanding** the irreversible and reversible electrode processes.	
Course Content:		
Unit-1:	Chemical Dynamics (Part III). General features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of molecular motions and of barrier less chemical reactions in solution, probing the transition state. Dynamics of unimolecular reactions; Lindemann-Hinshelwood and Rice-Ramsperger-Kassel-Marcus and Slater theories of unimolecular reactions.	**8 Hours**
Unit-2:	Adsorption. Surface tension, capillary action, pressure difference across curved surface, Laplace equation, vapour pressure of droplets, Kelvin equation; Gibbs adsorption isotherm. Multilayer adsorption, BET equation. Calculation of surface area, catalytic activity at surfaces. Surface films on liquids; electrokinetic phenomena; surface active agents. Micellisation, hydrophobic interaction. Critical micellar concentration. Solubilisation. Donnan's membrane equilibria.	**8 Hours**
Unit-3:	Electrochemistry of solutions. Debye-Huckel -Onsager treatment and its extension to concentrated solutions. Ion size factor and ion-solvent interactions. Concept of activity. Determination of mean ionic activity and activity coefficient. Lippmannn electrocapillary phenomenon. Electrocapillary curves of mercury and their interpretation. Structure of electrified interfaces. Helmholtz, Guoy and Chapmann and Stern models. Introductory idea of advancements in electrified surfaces. Electro kinetic potential, its determination and significance.	**8 Hours**
Unit-4:	Irreversible electrode phenomenon. Decomposition voltage and overvoltage. Consecutive electrode processes. Exchange current density. Butler-Volmer's equation. Tafel's plot. Theory of polarography. Ilkovic equation. Half wave potential and its significance. Introduction to corrosion. Forms of corrosion. Corrosion monitoring and prevention	**8 Hours**
Unit-5:	Applied ElectrochemistryElectrochemistry: Nernst equation, electrode kinetics, electrical double layer, Debye-Huckel theory. Voltammetry, Current voltage relationship, Characteristic of DME, Half wave potential. Amperometric titrations, Corrosion:	**8 Hours**

	Introduction to corrosion, forms of corrosion, corrosion monitoring and prevention methods.	
Text Books:	**1.** Maron, S. HandPrutton, C.F. Principles of Physical Chemistry, Oxford and IBH publishing.	
Reference Books:	**1.** Laidler, Keith J. Chemical Kinetics, New York: Harper & Row Publishers. **2.** Atkins, P.W. Physical Chemistry, ELBS. **3.** Thomson, S.J. and Webb, G.Heterogeneous Catalysis, Edinburgh; London: Oliver & Boyd. **4.** Moore, J.W. and Pearson, R.G. Kinetics and Mechanism, John Wileyand Sons. **5.** Silbey, R.J., Alberty, R.A. and Bawendi, M.G. Physical Chemistry, Wiley-Interscience Publication. **6.** https://www.youtube.com/watch?v=kDt8Hzr9ZnU *** Latest editions of all the suggested books are recommended**	

Course Code: MCH214	M.Sc. Chemistry -Semester-II **Spectroscopy-I**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the Students will be:	
CO1.	**Understanding** the fundamentals of unifying principles and natural line width and natural line broadening.	
CO2.	**Understanding** the basic principles and theory of Microwave Spectroscopy.	
CO3.	**Understanding** the basic principles and theory of Infrared and Raman Spectroscopy.	
CO4.	**Applying** the Microwave Spectroscopy to determining the structures of organic molecules.	
CO5.	**Applying** the Infrared and Raman Spectroscopy to determining the structures of organic molecules.	
Course Content:		
Unit-1:	Unifying Principles. Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering. Uncertainty relation and natural line width and natural line broadening, transition probability, transition moment, selection rules, intensity of spectral lines.	**8 Hours**
Unit-2:	Microwave Spectroscopy. Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.	**8 Hours**
Unit-3:	Infrared Spectroscopy. Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero-point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R branches. Vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region.	**8 Hours**
Unit-4:	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).	**8 Hours**
Unit-5:	Infrared and Raman Spectroscopy. Instrumentation and sample handling. Calculation of vibrational frequencies. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, carbonyl compounds, alcohols, ethers, amines, phenols and aromatic compounds. Finger-print region. Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance. FT-IR. Resonance Raman effect. Concept and factors that influence group frequencies	**8 Hours**

Text Books:	**1.** Drago, R. S. Physical Methods in Chemistry, Reinhold Publishing Corporation.	
Reference Books:	**1.** Silverstein, R. M. Bassler, G. C. and Morrill, T. C. Spectrometric Identification of Organic Compounds, Wiley. **2.** Kemp, W. Organic Spectroscopy, Macmillan. **3.** Dyer, J. R. Application of Absorption Spectroscopy of Organic Compounds, Prentice Hall. **4.** Williams, D. H. and Fleming, I. Spectroscopic Problems in Organic Chemistry, McGraw Hill. **5.** Barrow, G. M. Introduction to Molecular Spectroscopy, McGraw Hill. **6.** Banwell, C. N. Fundamentals of Molecular Spectroscopy, McGraw Hill. **7.** https://www.youtube.com/watch?v=jzFnvSPbwzM *** Latest editions of all the suggested books are recommended**	

Course Code: MCH215	M.Sc. Chemistry (Semester-II) **Industrial Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering the introduction of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.	
CO2.	Understanding the classification & properties of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.	
CO3.	Understanding the manufacturing & uses of glass, ceramics, cements, fertilizers, alloys, paints & pigments and soaps & detergents.	
CO4.	Analysing the saponification value, acid value and iodine number.	
CO5.	Understanding about oils & fats.	
Course Content:		
Unit-1:	**Silicate Industries:** Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.	**8 Hours**
Unit-2:	**Fertilizers:** Different types of fertilizers. Need for fertilizers, Straight and mixed fertilizers, Sources offertilizers, Artificial fertilizers, Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, Ammonium sulphate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate. NPK fertilizers**.**	**8 Hours**
Unit-3:	**Alloys:** Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demagnetization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.	**8 Hours**
Unit-4:	**Paints and Pigments:** Introduction, : Characteristic of the pigments Classification of paints, Manufacture of paints, for example white lead, Sublimed white lead (Basic sulphate), Zinc oxide, Lithophone, Titanium dioxide, manufacture, Ultramarine blue , Read lead, Chrome green, Guignet's green , Reinmann's green , Setting of the paints Requirements of a good paint Emulsion paints, Constituents of emulsion paints. Advantages, Luminescent paints. Heat resistant paints, Varnishes, Manufacturing of varnishes, Lacquers, Solvents and thinners.	**8 Hours**

Unit-5:	**Soaps & Detergents:** Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity. Soap:Soap and its manufacture, Toilet and transparent soap, Other soaps, Oil to be used for soap, Cleansing action of soap. Detergents: Principal groups of synthetic detergents, Classification of surface active agents, Anionic detergents, Cationic detergents. Non-ionic detergents. Amphoteric detergents..	**8 Hours**
Text Books:	**1.** Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut.	
Reference Books:	**2.** E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. **3.** R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi. **4.** https://nptel.ac.in/content/storage2/courses/103107086/module1/lecture1/lecture1.pdf *** Latest editions of all the suggested books are recommended.**	

Course Code: MCH261	M.Sc. Chemistry -Semester-II **Inorganic Chemistry-II (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the Students will be:**	
CO1.	Determining Gravimetric & volumetric estimation of mixture of two metal ions present in the given inorganic mixture.	
CO2.	Determining the molecular composition of ferric salicilate /iron-phenanthroline/iron-dipyridyl complex by Job's method of continuous variation.	
CO3.	Determining the Stability constant of $FeSCN^{2+}$ complex.	
CO4.	Determining the pH of a given solution by spectrophotometry using methyl red indicator.	
CO5.	Synthesizing of metal complexes	
Course Content:		

List of Experiments:

I. Gravimetric and Volumetric Estimation.

1. Estimate mixture of two metal ions (Copper and Zinc)

II. Sectrophoto metric Determination

1. Determination of molecular composition of ferric salicilate /iron-phenanthroline/iron-dipyridyl complex by Job's method of continuous variation
2. Stability constant of $FeSCN^{2+}$complex
3. Determination of the pH of a given solution by spectro photometry using methyl red indicator

III. Synthesis (Any Five)

1. Aquabis(acetylacetonato)nitrosylchromium(I), $[Cr(NO)(acac)_2(H_2O)]$
2. cis-Bis (glycinato)copper(II) and trans-Bis(glycinato)copper(II)
3. Preparation of Zn, Cd and Hg thiocyanates from their respective chlorides
4. Bis (benzoylacetonato)copper(II)
5. Bis(acetylacetonato)oxovanadium(IV), $[VO(acac)_2]$
6. $[MoO_2(acac)_2]$
7. Hexaammminenickel (II) tetrafluoroborate, $[Ni(NH_3)_6](BF_4)_2$ and determination of nickel content gravimetrically.
8. Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.
9. Preparation of N, N-bis (salicylaldehyde) ethylenediamine $[salenH_2]$, Co(salen)

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MCH262	M.Sc. Chemistry -Semester-II Organic Chemistry-II (Lab)	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the Students will be:**	
CO1.	**Understanding** mixture of two organic compounds qualitatively.	
CO2.	**Applying** the mechanism of electrophilic substitution to synthesize few organic compounds	
CO3.	**Applying** mechanism of oxidation & reduction to synthesize few organic compounds.	
CO4.	**Applying** mechanism of Cannizzaro reaction & Claisen-Schmidt reaction to synthesize few organic compounds	
CO5.	**Applying** mechanism of Methylation & Sandmeyer reaction to synthesize few organic compounds	
Course Content:		

List of Experiments:

I- Analysis

Separation, purification and identification of compounds of binary mixture (one solid and one liquid/solid) using chemical separation and sublimation/distillation, etc. Their analysis by semi-micro chemical tests and spot tests.

II- Organic Synthesis

Aromatic electrophilic substitutions:

1. Synthesis of m-dinitrobenzene from nitrobenzene
2. Synthesis of 2,4-dinitro-1-chlorobenzene from chlorobenzene
3. Synthesis of 4-bromoaniline from acetanilide

Reduction reaction:

4. Synthesis of m-nitroaniline from m-dinitrobenzene

Oxidation reaction:

5. Synthesis of 9,10-anthraquinone by oxidation of anthracene by chromium trioxide
6. Synthesis of 4-nitrobenzaldehyde by oxidation of 4-nitrotoluene by chromium trioxide

Cannizzaro reaction:

7. Synthesis of benzyl alcohol from benzaldehyde

Claisen-Schmidt reaction:

8. Synthesis of dibenzylideneacetone (1,5-diphenylpenta-1,4-dien-3-one) from acetone and benzaldehyde

Sandmeyer reaction:

9. Synthesis of 2-chlorobenzoic acid from anthranilic acid

Methylation:

10. Synthesis of methyl 2-naphthyl ether (2-methoxynaphthalene, nerolin) by methylation of 2-naphthol by dimethyl sulphate.

Purification of compounds by TLC and column chromatography.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MGP211	M.Sc. Chemistry (Semester-II) **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: TMUPA-201	VAC (Value Added Course) M.Sc. Chemistry (Semester-II) **Progressive Algebra & Data Management**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.	
CO2.	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.	
CO3.	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data	
CO4.	Employing the concept of higher level reasoning in Clocks and Calendars, Set theory and Puzzle Problems.	
Course Content:		
Unit-1:	**Number theory** Classification of Numbers, Divisibility Rules, HCF and LCM, Factors, Cyclicity (Unit Digit and Last Two digit), Remainder Theorem,Highest Power of a Number in a Factorial, Number of trailing zeroes	**7 Hours**
Unit-2:	**Data interpretation** Data Interpretation Basics, Bar Chart, Line Chart, Tabular Chart, Pie Chart, DI tables with missing values	**4 Hours**
Unit-3:	**Permutations and combinations** Fundamental counting, and or, arrangements of digits, letters, people in row, identical objects, rank, geometrical arrangements, combination: - basic, handshakes, committee, selection of any number of objects, identical and distinct, grouping and distribution, de-arrangements	**4 Hours**
Unit-4:	**Probability** Introduction, Probability based on Dice and Coins, Conditional Probability, Bayes Theorem	**3 Hours**
Unit-5:	**Set theory** Introduction , Venn Diagrams basics, Venn Diagram – 3 sets, 4-Group Venn Diagrams	**3 Hours**
Unit-6:	**Problem Solving** Introduction, Puzzle based on 3 variable, Puzzle based on 4 variable	**5 Hours**
Unit-7:	**Clocks and calendars** Introduction , Angle between hands , Gain and loss of Clock, Interchange of hands, Introduction of Calendars, Leap Year , Ordinary Year, Company Specific Pattern	**4 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com	

	• R6:-Logical Reasoning by Nishith K Sinha • R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: TMUPS-201	VAC (Value Added Course) M.Sc. Chemistry (Semester-II) **Managing Work and Others**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Communicating effectively in a variety of public and interpersonal settings.	
CO2.	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.	
CO3.	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.	
CO4.	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.	
CO5.	Handling difficult situations with grace, style, and professionalism.	
Course Content:		
Unit-1:	**Intrapersonal Skills:** Creativity and Innovation Understanding self and others (Johari window) Stress Management Managing Change for competitive success Handling feedback and criticism	**8 Hours**
Unit-2:	**Interpersonal Skills:** Conflict management Development of cordial interpersonal relations at all levels Negotiation Importance of working in teams in modern organisations Manners, etiquette and net etiquette	**12 Hours**
Unit-3:	**Interview Techniques:** Job Seeking Group discussion (GD) Personal Interview	**10 Hours**
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Burne, Eric, Games People Play (2010), Penguin UK 3. Carnegie, Dale, How to win friends and influence people (2004), RHUK 4. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 5. Steinburg, Scott, Nettiquette Essentials (2013), Lulu.com	

	6. https://www.hloom.com/resumes/creative-templates/ 7. https://www.mbauniverse.com/group-discussion/topic.php 8. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression *** Latest editions of all the suggested books are recommended.**	

Course Code: MCH311	M.Sc. Chemistry- Semester-III **Spectroscopy-II**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the participants will be:**	
CO1.	**Understanding** the principles of UV Spectroscopy.	
CO2.	**Understanding** in depth principles of NMR Spectroscopy and to interpret the 1H NMR spectra of unknown organic compounds.	
CO3.	**Understanding** Mass spectrometric techniques, principles, fragmentation patterns for aliphatic compounds, amines, aldehydes, Ketones, esters, amides, nitriles, carboxylic acids ethers, aromatic compounds etc.	
CO4.	**Applying** the knowledge of Photoelectron spectroscopy, Basic principles of photoacoustic spectroscopy (PAS), chemical and surface applications.	
CO5.	**Analyzing** the X-ray diffraction techniques with description of the procedure for an X-ray structure analysis.	
Course Content:		
Unit-1:	**UV and Visible Spectroscopy of organic molecules:** Measurement techniques, Beer – Lambert's Law, molar extinction coefficient, oscillator strength and intensity of the electronic transition, Frank Condon Principle, Ground and first excited electronic states of diatomic molecules, relationship of potential energy curves to electronic spectra, Chromophores, auxochromes, blue shift, red shift, hypo and hyperchromic effect, transitions in organic molecules, Woodward rules for conjugated dienes, unsaturated carbonyl groups, , Quantitative applications.	**8 Hours**
Unit-2:	**Nuclear Magnetic Resonance Spectroscopy:** PMR: The spinning nucleus, effect of external magnetic field, processional motion and frequency, Energy transitions, Chemical shift. Factors influencing chemical shift, anisotropic effect; spin-spin coupling coupling constant, Methods of resolving complex spectra, Applications of PMR in structural elucidation of simple and complex compounds. ^{13}C NMR, Deuterium, fluorine and phosphorus NMR, Structural applications of ^{13}C-NMR. **Electron paramagnetic resonance:** EPR spectroscopy of inorganic and organic compounds with unpaired electrons. Measurement of hyperfine splitting.	**8 Hours**
Unit-3:	**Mass Spectroscopy:** Introduction, methods of ionization EI & CI, Ion analysis methods (in brief), isotope abundance, Metastable ions, general rules predicting the fragmentation patterns. Nitrogen rule, determination of molecular ion peak, index of H deficiency, fragmentation patterns for aliphatic compounds, amines, aldehydes, Ketones, esters, amides, nitriles, carboxylic acids ethers, aromatic compounds etc.	**8 Hours**
Unit-4:	**Photoelectron Spectroscopy:** Basic principles; photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy -basic idea. Photoacoustic Spectroscopy. Basic principles of photoacoustic spectroscopy (PAS), chemical and surface applications	**8 Hours**
Unit-5:	**X-ray Diffraction**. Bragg condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflections, identification of Unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities,	**8 Hours**

	structure factor and its relation to intensity and electron density. Description of the procedure for an X-ray structure analysis.	
Text Books:	**1.** Kemp, W. Organic Spectroscopy, Macmillan. **2.** Dyer, J. R. Application of Absorption Spectroscopy of Organic Compounds, Prentice Hall.	
Reference Books:	**3.** Drago, R. S. Physical Methods in Chemistry, Reinhold Publishing Corporation. **4.** Silverstein, R. M. Bassler, G. C. and Morrill, T. C. Spectrometric Identification of Organic Compounds, Wiley. **5.** Williams, D. H. and Fleming, I. Spectroscopic Problems in Organic Chemistry, McGraw Hill. **6.** Barrow, G. M. Introduction to Molecular Spectroscopy, McGraw Hill. **7.** Banwell, C. N. Fundamentals of Molecular Spectroscopy, McGraw Hill. **8.** Pavia, D. L., Lampan, G. M. and Kriz, G. S. Introduction to Spectroscopy, Hartcourt College Publishers, 2001. **9.** https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/proton-nmr/v/introduction-to-proton-nmr **10.** https://www.digimat.in/nptel/courses/video/104108078/L01.html *** Latest editions of all the suggested books are recommended**	

Course Code: MSC011	**Semester-III** **Industrial Safety & Health hazards**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	Remembering the basic concepts of hazards due to noise, waves and rays, chill and hot environment, various kinds of diseases, toxicity of metals, wastes and allocation of functions.	
CO2.	Understanding the standards of hazards, Cause of diseases, technologies, Control and working conditions of labors in various industries.	
CO3.	Understanding the sampling system, control program, and impacts of toxicity and diseases on human health, treatment of wastes and radiations.	
CO4.	Analyzing the level of health hazards, impact of poisonous gases, hazardous and radioactive wastes.	
CO5.	Applying various techniques to control hazardous effects, toxicity, toxic gases, radioactive waste and personal hygiene.	
Course Content:		
Unit-1:	**Physical and Chemical Hazards:** Noise, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard- non-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control. Recognition of chemical hazards-dust, fumes, mist,Air Sampling instruments, Types, Measurement Procedures.	**8 Hours**
Unit-2:	**Occupational Health and Toxicology:** Concept and spectrum of health - functional Units and activities of occupational health services, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests.	**8 Hours**
Unit-3:	**Hazardous Waste Management:** Hazardous waste management in India-waste identification, characterization and classification technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes-	**8 Hours**

	incineration and vitrification - hazards due to bio-process dilution- standards and restrictions – recycling and reuse	
Unit-4:	**Radiation Control:** Radiation shielding – radiation dose – dose measurements – Units of exposure – exposure limits – barriers for control of radioactivity release – control of radiation exposure to plant personnel – health physics surveillance – waste management and disposal practices – environmental releases.	**8 Hours**
Unit-5:	**Occupational Physiology:** Man as a system component – allocation of functions – efficiency – occupational work capacity –aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters ofmeasurements – categorization of job heaviness – work organization – stress – strain – fatigue – restpauses – shift work – personal hygiene.	**8 Hours**
Text Books:	**1.** Ralph king and John magid, Industrial hazard and safety.	
Reference Books:	**2.** L.M Deshmukh Industrial safety management. **3.** https://www.osha.gov/dsg/hazcom/ghd053107.html **4.** https://1industrial.netlify.app/industrial-hygiene-and-occupational-health-pdf.html *** Latest editions of all the suggested books are recommended**	

Course Code: MCH312	Discipline Specified Elective Course-I M.Sc. Chemistry -Semester-III **Polymer Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Remembering** the composition, classification,& synthesis of polymers.	
CO2.	**Understanding** the molecular weight determination and identification Of functional groups for polymerization.	
CO3.	**Applying** instrumental methods e.g. Spectroscopic , X-ray diffraction method for Structural studies and other properties of the polymers.	
CO4.	**Analyzing** the polymers for molding and industrial applications.	
CO5.	**Analyzing** various products based on physical and chemical properties of polymers.	
Course Content:		
Unit-1:	Basics of Polymers. Repeating Units, degree of polymerization, linear, branched and network polymers. Classification of polymers. Addition, radical, ionic, coordination and condensation polymerization; their mechanism and examples. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.	**8 Hours**
Unit-2:	Polymer Characterization. Significance of molecular weight of polymer. Polydispersive average molecular weight. Number, weight and viscosity average weights. Measurement of molecular weights. End group, viscosity, light scattering, osmotic and ultracentrifugation methods. Chemical and spectroscopic analysis of polymers. X-Ray diffraction study. Thermal analysis, tensile strength, fatique, impact. Tear resistance. Hardness and abrasion resistance.	**8 Hours**
Unit-3:	Structure and Properties. Configuration of polymer chains. Crystal structure of polymers. Morphology of crystalline polymers. Polymer structure and physical properties; crystalline melting point Tm, melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tg relationship between Tm and Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.	**8 Hours**
Unit-4:	Polymer Processing. Plastics, elastomers and fibres. Compounding. Processing techniques, Calendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moudling, thermoforming, foaming, reinforcing and fibre spinning.	**8 Hours**
Unit-5:	Properties of Polymers. Properties of polyethylene, polyvinyl chloride, polyamides, polyesters,phenolic resins, epoxy resins and silicone polymers.Functional polymers. Fire retarding polymers, and electrically conducting polymers.Biomedical polymers. contact lens, dental polymers, artificial heart, kidney, skin and blood cells.	**8 Hours**
Text Books:	**1.** Gowariker, A text book of Polymer Chemistry Wiley	
Reference Books:	**2.** Shashi Chawala, Polymer Chemistry, Dhanpat Rai. **3.** https://nptel.ac.in/content/storage2/courses/103103029/pdf/mod7.pdf *** Latest editions of all the suggested books are recommended**	

Course Code: MCH313	**Discipline Specified Elective Course-I** **M.Sc. Chemistry- Semester-III** **Chemistry of Nano-materials**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Understanding** the nano technology and its challenges.	
CO2.	**Understanding** various methods of preparing nano material and their identification.	
CO3.	**Applying** characterization techniques for the identification of nano particles.	
CO4.	**Applying** nano materials for energy conservation and storage.	
CO5.	**Analyzing** materials for the preparation of nano-particles using bacteria, fungi and virus.	
Course Content:		
Unit-1:	**Introduction:** Definition, Role of Bottom-up and Top-Down approaches in Nano technology, Challenges in Nano technology, History of Nanomaterials, Causes of interest in nanomaterials, Fundamental issues in nanomaterials, Basic concepts of Nano science and technology, Quantum wire, Quantum well, Quantum dot, Properties and technological advantages of Nano materials.	**8 Hours**
Unit-2:	**Processing of nanomaterials-I:** Material processing by Sol-Gel method, Chemical Vapour deposition and Physical Vapor deposition, Microwave Synthesis of materials, Top-down (Nanolithography, CVD), Bottom-up (Sol-get processing, chemical synthesis). Wet Deposition techniques, Self-assembly (Supramolecular approach).	**8 Hours**
Unit-3:	**Processing of nanomaterials-II:** Use of bacteria, fungi, Actinomycetes for nanoparticle synthesis, Magneto tactic bacteria for natural synthesis of magnetic nanoparticles; Viruses as components for the formation of nanostructured materials; Synthesis process and application, Role of plants in nanoparticle synthesis.	**8 Hours**
Unit-4:	**Characterization Techniques:** Crystallography, particle size determination, surface structure, Scanning Prob Microscopy (SPM), AtomicForce Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM), Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.	**8 Hours**
Unit-5:	**Applications:** Solar energy conversion and catalysis, Polymers with a special architecture, Liquid crystalline systems, Applications in displays and other devices, Advanced organic materials for data storage, Photonics, Plasmonics, Chemical and biosensors, Nanomedicine and Nano biotechnology.	**8 Hours**
Text Books:	1.Nano materials by J. Dutta & H. Hofman.	
Reference Books:	**1.** Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press. **2.** A. Nabok, "Organic and Inorganic Nanostructures", Artech House. **3.** https://www.youtube.com/watch?v=MEX4G1X14fM *** Latest editions of all the suggested books are recommended**	

Course Code: MCH314	Discipline Specified Elective Course-I M.Sc. Chemistry- Semester-III **Chemistry of Natural Products**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Remembering** about Coenzyme, Antibiotics, Vitamins, Steroids, Plant Pigments, Terpinoids, Alkaloids & Flavnoids.	
CO2.	**Understanding** structure, stereochemistry & synthesis of Antibiotics, Vitamins.	
CO3.	**Understanding** structure, stereochemistry & synthesis of Steroids.	
CO4.	**Understanding** structure, stereochemistry & synthesis of Plant Pigments, Terpinoids, Alkaloids & Flavnoids.	
CO5.	**Applying** knowledge of structure & activity relationship new synthesis of natural products can be assigned.	
Course Content:		
Unit-1:	Terpenoids. General methods of structure elucidation. Isoprene rule. Structure determination, stereochemistry, and synthesis of the following representative molecules: citral, geraniol, α-terpineol, menthol, α-pinene, camphor, and abietic acid. Biosynthesis of terpenoids.	**8 Hours**
Unit-2:	Alkaloids. General methods of structure elucidation. Structure determination, stereochemistry, and synthesis of the following representative molecules: ephedrine, nicotine, atropine, quinine and morphine. Biosynthesis of alkaloids.	**8 Hours**
Unit-3:	Steroids. Structure elucidation, stereochemistry and chemical synthesis of cholesterol, bile acids, androsterone, testosterone, estrone, progestrone and aldosterone. Biosynthesis of steroids.	**8 Hours**
Unit-4:	Plant Pigments. Carotenoids. Structure and synthesis of β-carotene. Flavonoids. Nature, general methods for structure elucidation and synthesis of anthocyanins and flavones. Structure and synthesis of cyanidin chloride, cyanin, flavone, flavonol and quercetin. Biosynthesis of flavonoids.Chlorophyll. Chemistry of chlorophyll.	**8 Hours**
Unit-5:	Vitamins and Antibiotics. Vitamins. Structure and synthesis of vitamin B_1 (thiamine), B_2 (riboflavin) and B_6 (pyridoxine). Chemistry of Vitamin B_{12}. Antibiotics. Structure and synthesis of penicillins and chloramphenicol.	**8 Hours**
Text Books:	**1.** Finar, I.L. Organic Chemistry, ELBS.	
Reference Books:	**2.** Nogradi, M. Stereoselective Synthesis: A Practical Approach, VCH. **3.** Hostettmann, Kurt, Gupta, M.P. and Marston, A. Chemistry, Biological and Pharmacological Properties of Medicinal Plants, Americas, Harwood Academic Publishers. **4.** Aggarwal, O.P. Chemistry of Organic Natural Products, Goel Publishing House. **5.** Rahman, A. and Choudhary, M.I. New Trends in Natural Product Chemistry, Harwood Academic Publishers. **6.** https://nptel.ac.in/content/storage2/courses/104103067/pdf/mod10.pdf *** Latest editions of all the suggested books are recommended**	

Course Code: MCH315	Discipline Specified Elective Course-II M.Sc. Chemistry- Semester-III **Organometallic Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Understanding** 18 electrons rule of various organic compounds along with the synthesis.	
CO2.	**Applying** organometallic compounds for heavy metal, arsenic poisoning as drugs.	
CO3.	**Analyzing** use of organo metallic compounds as catalyst in various industries.	
CO4.	**Analyzing** fluxional organo metallic compounds for their specific properties and stereochemistry.	
CO5.	**Analyzing** the transition metal π- complexes for various organic molecules and nature of bonding.	
Course Content:		
Unit-1:	The 18-electron rule, counting of electrons and finding metal-metal bonds and related problems. Alkyls & Aryls of Transition Metals: Types & routes of synthesis, stability & decomposition Pathways. Carbenes & carbines: Synthesis, nature of bond, structural characteristics.	**8 Hours**
Unit-2:	**Transition Metal π-Complexes:** Transition metal π-complexes with unsaturated organic molecules, alkenes, alkynes, allyl, dienyl, arene & trienyl complexes, preparation, properties, nature of bonding & structural features.	**8 Hours**
Unit-3:	**Applications of Organometallic Complexes to Catalysis:** Catalysis, Terminology in Hydrogenation catalysts, classification of hydrogenation catalysts, catalytic cycle of Wilkinson's catalyst, catalytic cycles of iridium and ruthenium based catalysts, hydrogenation by lanthanide organometallic compounds, catalytic asymmetric synthesis, Hydroformylation: Cobalt catalysts and phosphine modified cobalt catalysts, Rhodium-phosphine catalysts, Methanol Carbonylation and Olefin Oxidation: Monsanto, Cativa and Wacker Processes,; Polymerisation and oligomerisation of olefins and dienes, carboxylation of olefins, carbonylation of methanol, Synthetic gas.	**8 Hours**
Unit-4:	**Fluxional Organometallic Compound:** Stereo-chemical non-rigidity & fluxionality, stereochemically non-rigid coordination compounds, Trigonal bipyramidal molecules, η2-olefins, η3 –allyl & dienyl compounds, isomerization & racemization of trischelate complexes.	**8 Hours**
Unit-5:	**Bioorganometallic Chemistry:** Role of organometallics in heavy metal poisoning: Mercury and Arsenic poisoning, organometallic compounds as drugs: ruthenium and ferrocene based drugs; Organometallics as radiopharmaceutical, tracers, ionophores and sensors.	**8 Hours**
Text Books:	**1.** Cotton, F. A. and Wilkinson, G. Advanced Inorganic Chemistry, Wiley Inter-Science.	

Reference Books:	**2.** Huheey, J. E. Inorganic Chemistry, Principles of Structure and Reactivity, Harper Inter-Science. **3.** Gupta, B. D. and Elias, A. J. Basic Organometallic Chemistry, Universities Press. **4.** Salzer, C. E. and Elchinbroich, A. E. Organometallics, A Concise Introduction Chemistry, VCH. **5.** https://www.youtube.com/watch?v=v1tMm1cawnY *** Latest editions of all the suggested books are recommended**	

Course Code: MCH316	Discipline Specified Elective Course-II M.Sc. Chemistry- Semester-III **Medicinal Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the participants will be:**	
CO1.	**Understanding** the overall process of drug discovery, and the role played by medicinal chemistry in this process.	
CO2.	**Understanding** relation between structure and physical properties of drugs to their pharmacological activity.	
CO3.	**Understanding** of concepts such as drug metabolism, bioavailability and pharmacokinetics.	
CO4.	**Understanding** the role of medicinal chemistry in improving drug metabolism, bioavailability and pharmacokinetics.	
CO5.	**Applying** the antibiotics, antibacterial, antitubercular, antifungal polyenes, antiviral and Non-steroidal Anti-inflammatory Drugs to treat the different type of diseases.	
Course Content:		
Unit-1:	Structure and activity. Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.	**8 Hours**
Unit-2:	Pharmacodynamics. Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.	**8 Hours**
Unit-3:	Antibiotics and antibacterial. Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular. Streptomycin, Broad spectrum antibiotics. Tetracyclines, Anticancer – Dactinomycin (Actinomycin D)	**8 Hours**
Unit-4:	Antifungal polyenes, Antibacterial. Ciprofloxacin, Norfloxacin, Antiviral. Acyclovir Antimalarial. Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine	**8 Hours**
Unit-5:	Non-steroidal Anti-inflammatory Drugs. Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthma tic agents: Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.	**8 Hours**
Text Books:	**1.** A. Burger, Medicinal Chemistry, Wiley Inter-Science Publications, New York.	
Reference Books:	**1.** W. O. Foye, Principles of Medicinal Chemistry, Lea & Febiger/ Varghese Publishing House, Bombay. **2.** D. Lednicer and L. A. Mitscher, The Organic Chemistry of Drug Synthesis, Wiley Inter-Science. **3.** A. Kar, Medicinal Chemistry, Wiley Eastern Ltd., New Delhi. **4.** N. K. Terrett, Combinatorial Chemistry, Oxford Univ. Press. **5.** https://www.youtube.com/watch?v=DkDCnjrzn6g *** Latest editions of all the suggested books are recommended**	

Course Code: MCH317	Discipline Specified Elective Course-II M.Sc. Chemistry- Semester-III **Quantum Chemistry & Solid State Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Understanding** different method for orbit coupling and applications of theorem.	
CO2.	**Applying** Huckel rule for to identify aromaticity of compounds and also stabilization energy models.	
CO3.	**Applying** various method for the crystal growth techniques and energy Characterization.	
CO4.	**Analyzing** imperfection in crystals and their properties for industrial use.	
CO5.	**Analyzing** metal and semi conductors for working potential and their use in industry.	
Course Content:		
Unit-1:	Term symbols and selection rules, spin –orbit coupling, regular and inverted multiples The variation method, theorem and applications, non-degenerate perturbation method.	**8 Hours**
Unit-2:	Application of LCAO-MO theory on the basis of Huckel approximation to conjugated aliphatic molecules and monocyclic conjugated polyenes. Huckel (4n+2) rule, calculation of resonance stabilization energy from Schaad and Hess model, antiaromatic molecules.	**8 Hours**
Unit-3:	**Properties of metals and semiconductors:** band theory, types of solids, intrinsic and extrinsic semiconductors, p-n junctions, optical properties, photoconductivity of crystals **Imperfections and related phenomenon:** Defects in solids: point defects line defects, diffusion in solids- mechanism, elastic and plastic deformations	**8 Hours**
Unit-4:	Crystal growth techniques: General principles, growth from solution, growth from melts, growth from vapour Solid state reactions: reactions of single solids and their kinetic characteristics, gas -solid, solid -solid, addition and double decomposition reactions, photographic process.	**8 Hours**
Unit-5:	Imperfections and physical properties crystals: Electrical properties, Optical properties: Colour centers in ionic crystals: types, creation, Magnetic properties, Thermal properties and Mechanical properties.	**8 Hours**
Text Books:	**1.** Quantum chemistry (4th edition), Ira N.Levine, Prentice Hall, Englewood Cliffs, NJ.	
Reference Books:	**2.** Introduction of Solids L.V Azaroff, Tata McGraw Hill. **3.** Principles of the solid-state H. V. Keer, Wiley Eastern.	

	4. Defects and diffusion in solids. S. MrowecElseivier publication. **5.** Quantum Chemistry- A.K. Chandra. **6.** D. A. McQuarrie, Quantum Chemistry, Viva Books, New Delhi. **7.** Treatise on solid state chemistry, ED-N.B. Hannay, Plenum Press. **8.** https://www.youtube.com/watch?v=G76H7A6_iyo *** Latest editions of all the suggested books are recommended**	

Course Code: MCH361	M.Sc. Chemistry- Semester-III **Organic Chemistry-II (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	On completion of the course, the participants will be:	
CO1.	**Remembering** the estimation of Glucose with the help of Fehling solution.	
CO2.	**Understanding** the Extraction of caffeine from tea leaves.	
CO3.	**Understanding** the Saponification and Iodine value of the given oil or fat.	
CO4.	**Applying** different reaction mechanism in multistep organic synthesis.	
CO6.	**Analyzing** the pre-recorded UV-Vis, NMR, Mass and IR spectroscopic data of organic compounds.	
Course Content:		

List of Experiments:

I. Analysis

1. Estimation of protein by Lowry's method.
2. Estimation of carbohydrate by Anthrone's method
3. Isolation of caffeine and alkaloids from tea.
4. To determine the iodine value of the given oil or fat
5. To determine the Saponification value of the given oil or fat
6. Estimation of Ascorbic Acid i.e. vitamin C.
7. Estimation of Amino acid by Sorenson's method
8. Spectrophotometric estimation of Glucose with the help of Fehling solution

II. Multi Step Synthesis (Any three)

1. Benzoin- benzal- benzilic acid
2. Benzophenone –benzpinacole- benzpinacolone
3. Ethyl acetoacetate → 3-methyl-1-phenylpyrazol-5-one →antipyrin (phenazone)
4. Benzaldehyde → benzoin →benzil→ 5,5-diphenylhydantoin
5. Phenylhydrazine→ acetophenone phenylhydrazone → 2-phenylindole
6. Chlorobenzene → 1-chloro-2,4-dinitrobenzene → 2,4-dinitrophenylhydrazine

III. Spectral Analysis

Interpretation of pre-recorded UV-Vis, IR, NMR, Mass, Raman spectrum and characterization of one organic compound.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MCH362	M.Sc. Chemistry- Semester-III **Physical Chemistry- II (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the participants will be**	
CO1.	Determining the strength of an acid by using conductivity meter.	
CO2.	Determining the strength of an acid by using potentiometer.	
CO3.	Determining the dissociation constant of weak electrolyte and verify Ostwald's dilution law.	
CO4.	Determining the equivalent conductance of strong electrolyte at the several concentration and verify Onsager equation.	
CO5.	Verifying the Lambert- Beer's Law using UV-VIS spectrophotometer.	
Course Content:		

List of Experiments:

Conductometry

1. To determine the strength of unknown (given weak) acid conductometrically using standard alkali solution (strong).
2. To determine the strength of unknown (given strong) acid conductometrically using standard alkali solution (weak).
3. To determine the dissociation constant of weak electrolyte and to verify Ostwald's dilution law.
4. To determine the equivalent conductance of strong electrolyte at the several concentrations and hence verify Onsager equation.

Potentiometry

5. To determine the strength of unknown (given weak) acid potentiometrically using standard alkali solution (strong).
6. To determine the strength of unknown (given strong) acid potentiometrically using standard alkali solution (weak).

Spectrophotometry

7. To verify Lambert-Beer's law using a spectrophotometer.
8. To determine the basicity of an acid.
9. To study the effect of temperature on invertase enzyme activity and determine its optimum pH
10. To study of the effect of substrate concentration on enzyme activity.
11. Effect of enzyme concentration on enzyme activity.
12. To find the solubility and solubility product of sparingly soluble salt conductometrically.

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MCH392	M.Sc. Chemistry- Semester-III **Industrial Training & Presentation**	L-0 T-0 P-0 C-5
Course Procedure:		
	Students will have to undergo industrial training of six weeks in any industry or reputed organization after the II semester examination in summer. The evaluation of this training shall be included in the III semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the II semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the III semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Director/Principal of the college. The student at the end of the III semester will present his report about the training before a committee constituted by the Director/Principal of the College which would comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director/Principal. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director/Principal. The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial training/ project submission.	
	The marking shall be as follows.	
Internal: **50 marks**	By the Faculty Guide – 25 marks. By Committee appointed by the Director/Principal – 25 marks.	
External: **50 marks**	By Officer-in-charge trainee in industry – 25 marks. By External examiner appointed by the University – 25 marks	
	Technical report will consist five chapter as per given format:	
Chapter 1:	Brief about organization	
Chapter 2:	Detail of business carried out by organization	
Chapter 3:	Specific contribution during the industrial training (not more than 500 words)	
Chapter 4:	Learning during the industrial training (not more than 200 words)	
Chapter 5:	Conclusion	

Course Code: MGP311	M.Sc. Chemistry -Semester-III **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: MCH411	M.Sc. Chemistry- Semester-IV **Bio-Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Remembering** bio-inorganic chemistry of Alkali and Alkaline Earth Metals, Iron and Copper, Essential and trace elements in biological systems.	
CO2.	**Understanding** Structure and functions of biological membranes; Rubredoxin and ferredoxins; metalloporphyrin; metalloenzymes and Bio molecules and their functions.	
CO3.	**Understanding** Structure and Mechanism of hemoglobin, Myoglobin and Cytochrome c.	
CO4.	**Understanding** Structure and Mechanism of Non-heme proteins: hemerythrin and hemocyanin Nitrogen Fixation, Metal poisoning and their treatment.	
CO5.	**Understanding** successive steps in the development of Supramolecular Chemistry.	
Course Content:		
Unit-1:	Bioinorganic Chemistry of Alkali and Alkaline Earth Metals: Essential and trace elements in biological systems; Structure and functions of biological membranes; mechanism of ion transport across membranes; Sodium pump; Ionophores: valinomycin and crown ether complexes of Na^+ and K^+; ATP and ADP; Photosynthesis: chlorophyll a PS I and PS II; Role of calcium in muscle contraction; Blood clotting mechanism and biological calcification.	**8 Hours**
Unit-2:	Bioinorganic Chemistry of Iron and Copper: Iron-Sulphur proteins: Rubredoxin and ferredoxins; Metalloporphyrin; Heme proteins: hemoglobin, Structure and Mechanism of hemoglobin, myoglobin and cytochrome c, Non-heme proteins: hemerythrin and hemocyanin.	**8 Hours**
Unit-3:	Nitrogen Fixation, Metal poisoning and their treatment: Nitrogen in biosphere; Nitrogen cycle, Role of micro-organisms in nitrification; Nitrogen fixation in soils, Metal poisoning and drug action of Inorganic complexes compounds; Metal poisoning, treatment by using chelating agent, mercury, lead & cadmium poisoning & treatment; Platinum complexes in treatment of cancer, metal deficiency.	**8 Hours**
Unit-4:	Metalloenzymes, Copper enzymes, superoxide dismutase, cytochrome oxidase and ceruloplasmin; Coenzymes; Molybdenum enzyme: xanthine oxidase; Zinc enzymes: carbonic anhydrase, carboxy peptidase and interchangeability of zinc and cobalt in enzymes; Vitamin B12 and B12 coenzymes; Iron storage, transport, biomineralization and siderophores, ferritin and transferrin.	**8 Hours**
Unit-5:	Supramolecular Chemistry: Definition and Development of Supramolecular Chemistry, classification of Supramolecular Host-Guest compounds, Pre-organization and Complementarily, Receptors, Nature of Supramolecular interactions. Crown ethers, Lariat ether and Podands, Cryptands, spherands, selectivity, Macro cyclic effects.	**8 Hours**

Text Books:	**1.** Allyn & Bacon Burton. Ochiai: Bioinorganic Chemistry	
Reference Books:	**2.** Eichhorn: Inorganic Biochemistry: Vol I , 2 Elsevier. **3.** Williams: An Introduction to Bioinorganic Chemistry, C.C. Thomos Spring III. **4.** Williams: Metals in Life. **5.** Zagic: Microbial Biogeochemistry, Academic press. **6.** Ahuja: Chemical Analysis of the Environment, Plenum press **7.** . https://www.youtube.com/watch?v=10tLIRG6yDs *** Latest editions of all the suggested books are recommended**	

Course Code: MCH412	M.Sc. Chemistry- Semester-IV **Photochemistry and Disconnection approach**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Understanding** the fundamentals of photochemistry and depth of reaction mechanisms.	
CO2.	**Understanding** of miscellaneous Photochemical Reactions.	
CO3.	**Understanding** organic synthesis and the disconnection approach and functional group interconversions.	
CO4.	**Understanding** general mechanistic considerations-nature of migration, migratory aptitude, memory effects.	
CO5.	**Understanding** of miscellaneous rearrangements and Name reactions in Organic Chemistry.	
Course Content:		
Unit-1:	Photochemistry of Alkene. Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes. Photochemistry of Aromatic Compounds. Isomerization, additions and substitutions.	**8 Hours**
Unit-2:	Photochemistry of Carbonyl Compounds. Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, unsaturated and α, β-unsaturated compounds, cyclohexadiene's. Intermolecular cycloaddition reactions-dimerization and oxetane formation.	**8 Hours**
Unit-3:	Miscellaneous Photochemical Reactions. Photo-Fries reactions of annelid's, Photo-Fries rearrangement. Barton reaction. Singlet molecular Oxygen reaction. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.	**8 Hours**
Unit-4:	Designing organic synthesis. The Disconnection Approach. Basic principles, synthons, functional group interconversions. Order of events in organic synthesis. One group CX disconnections and two group CX disconnections. Chemo electivity. Reversal of polarity (umpolung). Amine synthesis	**8 Hours**
Unit-5:	Rearrangements General mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Benzil-Benzilic acid, Favorskii,Arndt-Eistert synthesis, Neber, Backmann, Hofmann, Curtius, Schmidt, Benzidine, BaeyerVilliger, Shapiro reaction, Witting rearrangement and Stevens rearrangement	**8 Hours**
Text Books:	1. Organic Photochemistry by James Morriss Coxon, Brian Halton, [London, New York] Cambridge University Press. 2. Sykes, Peter. A Guide Book to mechanism in Organic Chemistry, Longman.	
Text & Reference Books:	1. Organic Photochemistry by James Morriss Coxon, Brian Halton, [London, New York] Cambridge University Press. 2. Introduction to Organic Photochemistry John D. Coyle, The Open University. 3. Molecular Reactions and Photochemistry by Charles H. De Puy, Orville Lamar Chapman, Pearson Education, Limited. 4. https://www.youtube.com/watch?v=bIIuEVayJTo *** Latest editions of all the suggested books are recommended**	

Course Code: MCH416	M.Sc. Chemistry- Semester-IV **Environmental Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Understanding** the chemical composition of Air, water & soil.	
CO2.	**Understanding** of miscellaneous chemical & Photochemical Reactions occurring in environment.	
CO3.	**Understanding** general mechanistic considerations-nature of migration, migratory aptitude, memory effects.	
CO4.	**Understanding** various sources of water, Air & soil pollution and its impact over environment.	
CO5.	**Analyzing** water quality parameters & its estimation.	
Course Content:		
Unit-1:	**Environment:** Introduction. Composition of atmosphere, vertical temperature, temperature inversion, heat budget of the earth, atmospheric system, vertical stability atmosphere, Biochemical cycles of C, N, P, S and O. Biodistribution of elements. **Hydrosphere:** Chemical composition of water bodies-lakes, streams, rivers and wet lands etc.Hydrological cycle Aquatic pollution – Inorganic,organic, pesticide, agriculture, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters – dissolved oxygen, biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and microorganisms. Water quality standards. Analytical methods of measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.), residual chloride and chlorine demand. Purification and treatment of water.	**8 Hours**
Unit-2:	**Soils:** Composition, micro and macro nutrients, pollution – fertilizers, pesticides, plastics and metals. Waste treatment. **Atmosphere:** Chemical composition of atmosphere – particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons. Green house effect, acid rain, air pollution controls and their chemistry. Analytical methods for measuring air pollutants. Continuous monitoring instruments.	**8 Hours**
Unit-3:	**Industrial Pollution:** Cement, sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy. Polymers, drugs etc. Environmental disasters – Cherbonyl, Three-mile island, Seveso and minamata disasters, Japan tsunami.	**8 Hours**
Unit-4:	**Environmental Toxicology:** Toxic heavy metals: Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects. Toxic Organic Compound: Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.	**8 Hours**

Unit-5:	**Aquatic Chemistry and Water Pollution**. Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphure and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.	**8 Hours**
Text Books:	**1.** A.K. De, Environmental Pollution.	
Reference Books:	**2.** Wark & Werner Air Pollution. **3.** S.P. Mahajan Environmental Pollution Control in Process Industries **4.** B.K. Sharma & H. Kaur Environmental Pollution. **5.** P.K. Trivedi Introduction to Air Pollution. **6.** https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-biogeochemical-cycles/v/biogeochemical-cycles *** Latest editions of all the suggested books are recommended**	

Course Code: MHM420	M.Sc. Chemistry- Semester-IV **Entrepreneurship**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	**Understanding** the concepts and skills needed to run a business successfully.	
CO2.	**Applying** the steps of project formulation and market research.	
CO3.	**Analyzing** the techno economic feasibility of a project.	
CO4.	**Analyzing** various growth strategies in small scale industry.	
CO5.	**Evaluating** breakeven point, working capital requirements, and taxes.	
Course Content:		
Unit-1:	**Entrepreneurship:** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	**8 Hours**
Unit-2:	**Motivation:** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.	**8 Hours**
Unit-3:	**Business:** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.	**8 Hours**
Unit-4:	**Financing and Accounting:** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.	**8 Hours**
Unit-5:	**Support to Entrepreneurs:** Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	**8 Hours**
Text Book:	1. Khanka. S.S., "Entrepreneurial Development" S. Chand & Co. Ltd., Ram Nagar, New Delhi.	
Reference Books:	1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill.	

	2. Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" 2nd Edition Dream tech. 3. Rajeev Roy, 'Entrepreneurship', Oxford University Press. 4. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", Cengage Learning. ***Latest editions of all the suggested books are recommended.**	

Evaluation Scheme:

Internal Evaluation	External Evaluation	Total Marks
40 Marks	**60 Marks**	**100**
The Internal evaluation will be performed by the internal faculty on the basis of the below mentioned parameters: • Problem Identification • Data Collection and Data Analysis • Case study • Proposal of innovative Business idea	External evaluation will be performed by the external examiner on the basis of following parameters: • Report • Presentation • VIVA	

Course Code: MCH413	Discipline Specified Elective Course-III M.Sc. Chemistry- Semester-IV **Bio-Inorganic Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Understanding** the presence of essential elements in biological system as well as their mechanism.	
CO2.	**Understanding** the role of copper and Iron in the synthesis , structure and mechanism of macromolecules .	
CO3.	**Applying** micronutrients in olants and their biodegradation by micro organisms.	
CO4.	**Applying** supra molecular molecules in the industrial developments and its mechanism.	
CO5.	**Analyzing** the nitrogen fixation and metal poising metal and treatment by chelating compounds.	
Course Content:		
Unit-1:	**Bioinorganic Chemistry of Alkali and Alkaline Earth Metals:** Essential and trace elements in biological systems; Structure and functions of biological membranes; mechanism of ion transport across membranes; Sodium pump; Ionophores: valinomycin and crown ether complexes of Na+ and K+; ATP and ADP; Photosynthesis: chlorophyll a PS I and PS II; Role of calcium in muscle contraction; Blood clotting mechanism and biological calcification.	**8 Hours**
Unit-2:	**Bioinorganic Chemistry of Iron and Copper:** Iron-sulphur proteins: Rubredoxin and ferredoxins; Metalloporphyrins; Heme proteins: hemoglobin, Structure and Mechanism of hemoglobin, myoglobin and cytochrome c; Non-heme proteins: hemerythrin and hemocyanin.	**8 Hours**
Unit-3:	**Nitrogen Fixation, Metal poisoning and their treatment:** Nitrogen in biosphere; Nitrogen cycle; Role of micro-organisms in nitrification; Nitrogen fixation in soils; Metal poisoning and drug action of Inorganic complexes compounds; Metal poisoning, treatment by using chelating agent, mercury, lead & cadmium poisoning & treatment; Platinum complexes in treatment of cancer. metal deficiency.	**8 Hours**
Unit-4:	**Trace Metals in Plant Life:** Micronutrients present in soil and role in plant life; Biodegradation of minerals by bacteria and its applications in treatment of soil and water pollution.	**8 Hours**
Unit-5:	**Supramolecular Chemistry:** Definition and Development of Supramolecular Chemistry, classification of Supramolecular Host-Guest compounds, Pre- organization and Complementarily, Receptors, Nature of Supramolecular interactions. Crown ethers, Lariat ether and Podands, Cryptands, spherands, selectivity, Macro cyclic effects.	**8 Hours**
Text Book:	**1.** Williams: An Introduction to Bioinorganic Chemistry, C.C. Thomos Spring III.	
Reference Books:	**1.** Eichhorn: Inorganic Biochemistry: Vol I , 2 Elsevier. **2.** Ochiai: Bioinorganic Chemistry: Allyn & Bacon Burton.	

	3. Wallace: Decade on synthetic chelating agent in Inorganic plant nutrition, Wallace. **4.** Williams: Metals in Life. **5.** Zagic: Microbial Biogeochemistry, Academic press. **6.** Ahuja: Chemical Analysis of the Environment, Plenum press. **7.** https://www.youtube.com/watch?v=CfCwa1n9MkY *** Latest editions of all the suggested books are recommended**	

Course Code: MCH414	Discipline Specified Elective Course-III M.Sc. Chemistry- Semester-IV **Bio-Organic Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Understanding** biological catalysis, properties and identification of active sites by inhibitors.	
CO2.	**Understanding** the various types of reactions catalysed by enzymes and different types of arrangements.	
CO3.	**Applying** enzymes models, recognition of asymmetrical molecules for catalysis.	
CO4.	**Applying** biotechnological techniques for the purification of compounds.	
CO5.	**Applying** metallo enzymes in the synthesis of biomolecules.	
Course Content:		
Unit-1:	Introduction: Basic Consideration, Proximity effects and molecular adoption. Enzymes: Introduction, Chemical and Biological catalysis, remarkable properties of enzymes, Nomenclature and classification, concept and identification of active site by use of inhibitors, reversible & irreversible inhibition.	**8 Hours**
Unit-2:	Kinds of Reactions Catalyzed by Enzymes: B-cleavage and consideration, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation. Mechanism of Enzyme action: Transition state theory, Orientation and steric effect, acid-base catalysis, covalent catalysis.Co-Enzyme Chemistry: Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes, Structure and biological functions of coenzyme A.	**8 Hours**
Unit-3:	Enzyme Models: Host guest chemistry, Chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality, Biomimetic chemistry, crown ethers, cryptates, cyclodextrins, cyclodextrin based enzyme models, Calixarenes, ionophores, micelles synthetic enzyme or synzymes.	**8 Hours**
Unit-4:	Biotechnological Application of enzymes: Large scale production and purification of enzymes, techniques and methods of immobilization of enzyme activity, application of immobilized enzymes, effect of immobilization on Enzyme activity, application of immobilized enzymes. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.	**8 Hours**
Unit-5:	Metalloenzymes, Copper enzymes, superoxide dismutase, cytochrome oxidase and ceruloplasmin; Coenzymes; Molybdenum enzyme: xanthine oxidase; Zinc enzymes: carbonic anhydrase, carboxy peptidase and interchangeability of zinc and cobalt in enzymes; Vitamin B12 and B12 coenzymes; Iron storage, transport, biomineralization and siderophores, ferritin and transferrins.	**8 Hours**
Text & Reference Books:	**1.** Eichhorn: Inorganic Biochemistry: Vol I, 2 Elsevier. **2.** Ochiai: Bioinorganic Chemistry: Allyn & Bacon Burton. **3.** Williams: An Introduction to Bioinorganic Chemistry, C.C. Thomos Spring III. **4.** Wallace: Decade on synthetic chelating agent in Inorganic plant nutrition, Wallace. **5.** https://www.youtube.com/watch?v=oaWQWB1S5Q4 *** Latest editions of all the suggested books are recommended.**	

Course Code: MCH415	Discipline Specified Elective Course-III M.Sc. Chemistry- Semester-IV **Bio-Physical Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Understanding** the biological membranes and consideration of standard free energy of various reactions.	
CO2.	**Understanding** protein structure and ∞ and β bonding among the protein molecules.	
CO3.	**Applying** thermodynamics in biopolymer solutions and formation of peptides bonds.	
CO4.	**Applying** bio molecular interactions and various types of physical forces.	
CO5.	**Analyzing** mechanism of transport through bio membranes and their thermodynamics.	
Course Content:		
Unit-1:	**Cell membrane and its structure:** The Cell Membrane, lipids in biological membranes, types and arrangements of proteins in membranes, lipo proteins. Danielli and Davson model, Fluid Mosaic Model, permeability of cell membrane. Bio-Energetics: Thermodynamic Considerations: standard free energy change in bio-chemical reactions, exergonic, endergonic reactions, hydrolysis of ATP and its synthesis from ADP.	**8 Hours**
Unit-2:	**Thermodynamics of Biopolymers Solutions:** Osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system. Statistical mechanics in biopolymers chain configuration of macromolecules, statistical distribution end – to – end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures and protein folding.	**8 Hours**
Unit-3:	**Mechanism of Membrane Transport:** Transport through cell membrane, active and passive transport systems, Ping - pong mechanism for transport of diffusion, Macromolecules across the Plasma Membrane, Role of Intercellular spaces in transport process, Homocellular, Transcellular Intracellular transport, Irreversible thermodynamic treatment of membrane transport. Nerve conduction, Donnan effect in Osmosis, its dependence on pH difference across the membrane. Semipermeable membrane and Donnan membrane equilibrium.	**8 Hours**
Unit-4:	**Biomolecular Interactions:** Interactions between biomolecules (proteins), Interaction of biomolecules with small ligands, independent ligand binding sites, the Scatchard plot, forces involved in the stability of proteins, hydrophobic interactions, hydrogen bonding, electrostatic interactions, electron delocalization, van der Waal's forces Scope of Genomics, proteomics and bioinformatics, ribosomes: Site and Function of protein synthesis.	**8 Hours**
Unit-5:	**Protein molecules:** Protein sequence and structure (primary structure), secondary structure: α-Helix, β- Sheet, classification of proteins, torsion angles, tertiary structure, quaternary structure,	**8 Hours**

	Protein folding and refolding, computer simulation: thermodynamic-kinetic approach, statistical mechanics approach, Homolog Modelling, De Novo prediction, Protein misfolding, Biological factors (Chaperones) and chemical factors(Intra and intermolecular interactions) leading folding/refolding/misfolding. Brain diseases associated with it.	
Text Books:	**1.** Principles of Biochemistry: A.I. Leninger	
Reference Books:	**2.** Physical Chemistry of Macromolecules: S.F.Sun **3.** The Enzyme Molecules: W. Ferdinand **4.** Outlines of Biochemistry: E.E. Conn and P.K. Stumph **5.** Biochemistry: Zubay **6.** https://www.youtube.com/watch?v=J6Oka9wsgrU *** Latest editions of all the suggested books are recommended.**	

Course Code: MCH417	Discipline Specified Elective Course-III M.Sc. Chemistry- Semester-IV **Heterocyclic Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course the participants will be:**	
CO1.	**Remembering** the systematic nomenclature and general chemical behavior of heterocycles.	
CO2.	**Understanding** the principles of heterocyclic synthesis involving cyclization and cyclo addition reactions.	
CO3.	**Understanding** the synthesis and reactions of three & four membered heterocycles, Understanding the synthesis and reactions of six membered heterocycles with one & two or more.	
CO4.	**Understanding** the role of medicinal applications of Benzo fused-five membered heterocycles.	
Course Content:		
Unit-1:	Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused and bridged heterocycles. General chemical behavior of aromatic heterocycles. Classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in ^{1}H NMR-spectra, empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations.	**8 Hours**
Unit-2:	Principles of heterocyclic synthesis involving cyclization reaction and cycloaddition reaction.	**8 Hours**
Unit-3:	Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxetanes and thietanes. Synthesis and reaction including medicinal applicatiosn of benzopyrroles. Benzofurans and benzothiophenes.	**8 Hours**
Unit-4:	Synthesis and reaction of pyryllum salts and pyrones and their comparison with pyridinium &thiopyrylium salts and pyridones. Synthesis and reaction of quinolizinium and benzopyrylium salts, coumarins and chromones. Synthesis and reaction of diazines, triazines, tetrazines and thiazines.	**8 Hours**
Unit-5:	Synthesis and reaction of azepines, oxepines, thiepines, diazepines thiazepines, azocines, diazocines, dioxocines and dithiocines.	**8 Hours**
Text Boks:	**1.** Heterocyclic Chemistry Vol.1-3, R.R. Gupta. M. Kumar and V. Gupta, Springer Verlag.	
Reference Books:	**2.** The chemistry of Heterocycles, T. Eicher And S. Hauptmann, Thieme. **3.** Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, Chapman and Hall. **4.** Heterocyclic Chemistry, T.L Gilchrist, Longman Scietific Technical. **5.** Contemporary Heterocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science. **6.** An Introductions to the Heterocyclic Compounds, R.M. Acheson, John Wiley. **7.** https://www.youtube.com/watch?v=dhC-SLQlCeg *** Latest editions of all the suggested books are recommended**	

Course Code: MCH461	M.Sc. Chemistry- Semester-IV **Environmental Chemistry (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the participants will be**	
CO1.	**Applying** the MPN method for count the bacteria.	
CO2.	**Analyzing** various physical parameters of water like Turbidity, TDS, TSSS & TS.	
CO3.	**Analyzing** various physical parameters of water like conductivity & pH.	
CO4.	**Analyzing** various Chemical parameters of water like Total Hardness, Alkalinity & Dissolved oxygen.	
CO5.	**Analyzing** various Chemical parameters of water like Chemical Oxygen Demand & free Chlorine.	
Course Content:		

List of Experiments:

(I) Examination of various physical parameters of water samples

1. Determination of Taste, Colour, pH, Conductivity of water sample
2. Determination of TDS, TSS and TS in water sample

(II) Examination of various chemical parameters of water samples

3. Determination of Turbidity of water sample
4. Determination of temporary, permanent and total hardness of water
5. Determination of calcium and magnesium hardness
6. Determination of hydroxide, carbonate and bicarbonate alkalinity of water
7. Determination of chloride and residual chlorine content in water sample
8. Determination of dissolved oxygen (DO) in water sample
9. Determination of chemical oxygen demand (COD) in water sample
10. Determination of sulphate in water sample
11. Determination of nitrate in water sample

(III) Biological examination of water

12. Understanding of indicators of fecal contamination and the concept of indicator organisms; coliform bacteria count and MPN method

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MCH492	M.Sc. Chemistry- Semester-IV **Project**	L-0 T-0 P-16 C-8

For students to enter into preliminary research field both in theory and experiment the concept of Project has been introduced in the final Semester. In the Project, the student will explore new developments from the books and journals, collecting literature / data and write a Dissertation based on his / her work and studies. The Project Work can also be based on experimental work in industries / research laboratories.

Selection of Topic:

1. Students will make project which should be preferably a working of third thoughts based on their subject.
2. The student will be assigned a faculty guide who will be the supervisor of the students. The faculty would be identified at the end of the III semester.
3. The assessment of performance of the students should be made at least twice in the semester. Internal assessment shall be for 50 marks. The students shall present the final project live using overhead projector PowerPoint presentation on LCD to the internal committee and the external examiner.
4. The evaluation committee shall consist of faculty members constituted by the college which would be comprised of at least three members comprising of the department Coordinator's Class Coordinator and a nominee of the Director/Principal. The students guide would be special in invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each members of the committee.

The Marking shall be as follows.

Internal: 50 marks

By the Faculty Guide – 25 marks

By Committee appointed by the Director/Principal – 25 marks

External: 50 marks

By External examiner by the University – 50

Note: Project will be prepared as per approved project template which included the entire guidelines & format related project.

EVALUATION SHEET

(To be filled by the GUIDE & Internal Examiners only)

Name of Candidate:
Roll No:

Class and Section:

Please evaluate out of five marks each.

S. No.	Details	Marks (5) Guide	Marks (5) Int. Exam. 1	Marks (5) Int. Exam. 2
1.	Objective Identified &Understood			
2.	Literature Review / Background Work (Coverage, Organization, Critical Review)			
3.	Discussion/Conclusions (Clarity, Exhaustive)			
4.	Slides/Presentation Submitted (Readable, Adequate)			
5.	Frequency Of Interaction (Timely Submission, Interest Shown, Depth, Attitude)			
	Total (Out of 25)			
	Average out of 50			

Signature: Signature: Signature:
Date: Date: Date:

EVALUATION SHEET FOR EXTERNAL EXAMINER

(To be filled by the External Examiner only)

Name of Candidate:

Roll No:

I. For use by **External Examiner ONLY**

S. No.	Details	Marks (10) each
1.	Objective Identified & Understood	
2.	Literature Review / Background Work (Coverage, Organization, Critical Review)	
3.	Discussion/Conclusions (Clarity, Exhaustive)	
4.	Power Point Presentation (Clear, Structured)	
5.	Slides (Readable, Adequate)	
	Total (Out of 50)	

Signature:

Date:

Course Code: MGP411	M.Sc. Chemistry- Semester-IV **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd & IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal