DEPARTMENT OF CHEMISTRY

Chemistry department was founded as the part of undergraduate science faculty inaugurated by Jathedar S. Gurcharan Singh Tohra ji, (Pardhan S.G.P.C.) on 2nd March, 1996 under the leadership of Principal Prof. Jaswant Singh Sandhu. Later on, in August, 2014 the department has introduced Post Graduate Programme, M.Sc. Chemistry under the leadership of Principal Prof. Preet mohinder Pal Singh. The department furnishes the opportunity for students to obtain comprehensive fundamental knowledge of all fields of chemistry such as organic, inorganic, physical, biophysical and analytical. It also provides students with laboratory experience in inorganic and organic synthesis, analytical methods and physical chemical measurements. Thus department of chemistry offers both theoretical and practical knowledge of chemistry. Chemistry plays a key role in the studies of medicine, biology and technology. Chemistry department has close cooperation with other disciplines such as physics, mathematics and biology. Faculty members are available as academic advisors for consultation about their courses. They have a good rapport with the students. Faculty members motivate and guide students about various career opportunities. Frequent seminars, webinars have been organized for the benefit of teachers as well as students. Currently the department has three chemistry laboratories which are equipped with latest chemicals, apparatus and instruments.

VISION

The Department of Chemistry aspires to excel in chemical education and services. The faculty members are dedicated to excel in teaching. They are deeply engaged in production and dissemination of knowledge using modern pedagogy in the classroom. It is a goal of a faculty to instill in the student a sense of scientific enquiry that employs systematic and experimental approach.

MISSION

The Department of Chemistry is committed to prepare competitive and professional graduates within an innovative and intellectually stimulating environment by offering high quality chemistry experiments, conduct basic and applied research of national and international impact

and build proactive partnership with industries and offer effective training and technical services to the society. The Department of Chemistry pledges itself to encourage in the broadest and most liberal manner, the advancement of chemistry in all the branches through education, research and service mission.

OBJECTIVES

- To furnish a comprehensive foundation in chemistry that emphasizes scientific reasoning and analytical problem solving capability
- To provide student with the requisite skills for achieving success in academics and in forthcoming careers opportunities
- To provide a broad exposure to students about various experimental techniques
- To make the department a thriving center of excellence in teaching and promoting chemistry
- Department aims at chemistry outreach in the form of books and other chemistry education activities that illustrates role of chemistry as central science
- To make the students aware of the application of scientific principles, chemistry in particular, to societal issues

Programme run by department:

1. M.Sc. (CHEMISTRY) (Programme code: MSCCHEM)

M.Sc. (CHEMISTRY)

Programme Outcomes (POs) of M. Sc. (Chemistry)

Purpose of post-graduate education in Science is to create highly skilled manpower in specific areas, which will lead to generation of new knowledge and creation of wealth for the country. Chemistry is a fundamental science and has contributed immensely to the improvement of the life of human beings by providing many of human requirements and essentialities. Chemistry is important to the world economy as well. The developments in Chemistry during last few decades are phenomenal. It is also seen that these developments are crossing the traditional vertical boundaries of scientific disciplines; the more inclination is seen towards biological sciences. New branches of chemistry are emerging and gaining importance, such as bioorganic chemistry, materials chemistry, computational chemistry, etc.

The practice of Chemistry at industrial scale also is undergoing radical changes and is more or more based on deep understanding the chemical phenomena. The emerging Chemical Technologies are highly science based. The aid of computers has not only accelerated growth in the practice of Chemistry, but revolutionized the entire field. A Chemist cannot isolate himself from other disciplines. Thus, after a long span of more and more specialization in graduate and post-graduate syllabi, a symbiotic interdisciplinary approach now seems to be more relevant. The practice of Chemistry, as is witnessed, over a span of more than a century has also created concomitant and perhaps unavoidable impacts of human environment. The adverse effects were particularly noted during last few decades. The concept of sustainable development is now well accepted. Though not a separate branch of Chemistry, Green Chemistry has emerged as a new approach to the practice of Chemistry on the background of sustainability. The Chemical Industry is now pressurized from both the Government and the Society to develop ecofriendly processes and products which will reduce waste and prevent toxic substances from entering the environment. The principles and applications of Chemistry should be learnt on this background. M.Sc. Chemistry is a Post-Graduate Degree that is pursued by a student who has an Under Graduate Degree in the relevant field. The duration of the course is 2 years with 4 semesters included in the course. A bachelor's degree of 3 years in the relevant field from a recognized university with a minimum of 50% is eligible for this course. This course deals with Chemistry as a major subject with more concerned with physical, organic, inorganic Chemistry. This course allows you to specialize in a specific field of chemistry. MSc Chemistry has a wider range of scope in various fields such as pharmaceuticals and various research-based industries. Learning Outcome based Approach to Curricular Planning Nature & Extent of M.Sc. Chemistry Programme Chemistry is a branch of science which deals with matters and it's composition. In doing a Master of Science in Chemistry the students will dive into the subatomic level of particle creation, how synthetic compounds can be created and implemented. The specialized course of Chemistry will deal with the composition, behaviour, structure, and properties of Matter and other specific technical aspects with a detailed explanation. Chemistry is the science of matter and the changes effected by it. The science of matter is also a part of the discipline of Physics, but while Physics is more practical and applies a fundamental approach, Chemistry is more specialized and deals with topics such as the composition, behaviour, structure, and properties of matter. Chemistry provides an understanding of the physical and chemical process of atom and molecules and it focuses on the practical methods of creation of new molecular structures and its useful applications. Chemistry contains the basic principles of structural bonding between atoms and bonds. This subject contains a wide range of chemical reactions and shows how energy is being created. Chemistry is a physical science and is used in the investigation and assemblages of matter which could either be isolation and combination incorporating concepts of

energy and entropy in relation to the chemical process. The specific course will be divided into four semesters and the nature of the course will be oriented more towards nature and also to a lot of lucrative job opportunities. Aim of M.Sc. Chemistry Programme Highly qualified chemists are crucial to help develop tomorrow's solutions. By taking a Master (M.Sc.) degree in chemistry, you will gain fundamental insights into chemical compounds with applications in medicine, catalysis, alternative energy sources and many other areas. Maybe you want to develop better solutions for a sustainable future or to understand more about global environmental issues affecting today's society? Accept the challenge and join us in creating a better future. The objective of the 2-year MSc in chemistry is to educate chemists to work independently with chemistry at a high level. Through lectures, laboratory work, exercises, and project work, as well as excursions, and you will gain knowledge about relevant working methods for research, industry, administration and education. The Master's degree in Chemistry also forms the foundation for doctoral programmes in Chemistry. You'll enter into a professional environment that is scientifically strong within all three specializations. The two-year Master's degree programme in chemistry provides academic specialization within the following areas: Inorganic, Organic and Physical chemistry.

The main objectives are:

- To impart training in Chemistry at advanced level in a more holistic way and enthuse the students for the subject.
- To train the students to make them confident and capable of accepting any challenge in Chemistry.
- To give a flavour of research in Chemistry and train the students for research career.
- To abreast the students about the current status and new developments in Chemistry.
- To make the students aware of the impact of Chemistry on environment and imbibe the concept of sustainable developments.
- To educate the students with respect to skills and knowledge to practice chemistry in ways that are benign to health and environment.
- To provide flexibility in selecting some of the courses as per the interest and also to provide space for fast learners.
- To make the students aware of resources and make them capable of mining the data

Program Outcomes

On successful completion of M.Sc. (CHEMISTRY) programme, the students will be able to develop following attributes, qualities and skills:

PO 1	**Disciplinary knowledge**	LOCF based curriculum M.Sc. Chemistry Course helps students to develop in depth knowledge of the areas like inorganic, organic, physical chemistry. The systematic and intensive knowledge will help them to excel in application of chemistry in real life.
PO 2	**Communication skills**	Chemists who engage in public communication: • Increase public appreciation of and excitement for chemistry as a source of knowledge about the world. • Develop scientifically informed consumers (i.e., consumers will be able to use chemistry information to make decisions or solve problems) • Empower informed citizen participation in democratic processes. Encourage workforce development in the chemical sciences. • A broad range of skills are covered, from writing and presentation skills, to working in groups and revising for exams. Frequent examples drawn from chemistry highlight the relevance of the skills being learned.
PO 3	**Critical thinking**	Although it is imperative in chemistry for a student to have the ability to think critically, critical thinking is not the only important skill essential for overall success in chemistry. The students of Course will able to develop skills and attitudes needed for critical thinking which will help them in a comprehensive problem solving approach. They will be exposed to the pedagogy that helps them understand chemistry in real life through class room training and case studies. It aims at building the basic ability to think critically, evaluate dispassionately and solve complex problems creatively. The content is organised in such a way that the students would be able to think from diverse perspectives and suggest solutions according to their own sensibilities.
PO 4	**Problem solving**	It involves an understanding of the language in which the problem is stated, the interpretation of what is given in the problem and what is sought, an

		understanding of the science concepts involved in the solution, and the ability to perform operations if these are involved in the problem. Requiring students to use a worksheet with each problem may help them solve them in a more effective way. The worksheet includes a place for them to plan a problem, that is list what is given and what is sought; to describe the problem situation by writing down other concepts they retrieve from memory (the use of a picture may integrate these); to find the solution; and to appraise their results.
PO 5	**Analytical Reasoning**	Since many Chemistry experiments require Analytical reasoning which give students the ability to look at information, be it qualitative or quantitative in nature, and discern patterns within the information. It includes, comprehending the basic structure of a set of relationships; recognizing logically equivalent statements; and inferring what could be true or must be true from given facts and rules. Analytical reasoning is axiomatic in that its truth is self-evident.
PO 6	**Research-related Skills**	• Course encourages students to gain proper research skills required in Chemistry. • Ability to find research problems. • Statistical Analysis will provide them research tools to identify& solve the research problems. • Course will develop ability to formulate & test hypothesis &research questions so that to find answers.
PO 7	**Collaboration/Cooperation/Team work**	M.Sc. Chemistry practical, seminars are designed in such a manner and are done in groups, in bound time which helps to develop team work and time management skills through application of concept based practices, participative classroom discussion, problem solving task, case studies etc.
PO 8	**Scientific Reasoning using Quantitative/ Qualitative Data**	Inductive reasoning involves getting a collection of specific examples and drawing a general conclusion from them. Deductive reasoning takes a general principle and then draws a specific conclusion from the general concept. Both are used in the development of scientific ideas in M.Sc. Chemistry course.
PO 9	**Reflective Thinking**	This course enables the students for reflective thinking and learning capacity, which is regarded as an essential attribute in the health professions to link theory with application and to address the challenges that arise in clinical

		practice. Through reflective practice, professionals continue to critique their skills, performance, outcomes, and behavior. Reflective writing tools such as statements, essays, diaries, logbooks, portfolios and journals have been used to enhance the reflective thinking process.
PO 10	**Information/Digital Literacy**	The chemistry curriculum covers teaching information literacy, scientific advancement requires chemists to know and build upon what research has been done before. This course encourages the learners to use digital resources by adopting latest technologies to survive and excel in ever-changing global scenario. Sufficient digital literacy can be ensured through smart classrooms and web based learning resources.
PO 11	**Self-Directed Learning**	This course enables the students to have self-directing learning approach. The course has been formulated in such a way that these will help the learners to postulate questions, eliciting responses from various sources and finding out the most suitable solutions to relevant problems. This encourages them towards the self-direction, experimentation and intrinsically motivated research work.
PO 12	**Multicultural Competence**	Since the students of this course come from various states and cultures, pass graduates possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO 13	**Moral and Ethical Awareness/Reasoning**	• Course has been designed in such a manner that it inculcates moral & ethical values in the learners. • These values will help them not only to be successful, skilful professionals but also to be persons having responsible approach towards environment, nation & society. • The course also involve training the students to check unethical behaviour, falsification & manipulation of information in order to avoid debacles which can be seen rising persistently over the period of time. • It would also help in becoming responsible citizens & facilitate character building.
PO 14	**Leadership**	Programme pass graduates has the capability for mapping out the tasks of a

	Readiness/Qualities	team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using scientific skills to guide people to the right destination, in a smooth and efficient way.
PO 15	**Lifelong Learning**	Programme pass graduates has the ability to acquire knowledge and skills, including 'learning how to learn, that are necessary for participating in learning activities throughout life, through self- paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge and skill development.

Program Specific Outcomes (PSOs)

PSO1	An ability to employ the critical thinking and efficient problem solving skills in three basic areas of chemistry (Inorganic, Organic and Physical).
PSO2	An ability to conduct experiments; analyzing data and interpret results; while observing responsible and ethical scientific conduct.
PSO3	Demonstrate; solve and an understanding of the major concepts of all discipline of chemistry.
PSO4	Employ the critical thinking and scientific knowledge to design, carryout, record and analyze results of chemical reactions.
PSO5	Create an awareness of the impact of chemistry on the environment and society.
PSO6	Use of various chemical tools, models, equipment and software like Chemdraw.
PSO7	Understand the good laboratory practical and safety measures.

Course Outcomes (COs) of M.Sc. Chemistry

Semester	**Course Title**	**College Code**	**COURSE OUTCOMES On completion of course student will be able to:**	
Sem. I	**Inorganic Chemistry 1**	**MSCHEM101**	**CO1**	Learn Metal-Ligand Equilibrium in Solution
			CO2	Create awareness about Metal Ligand Bonding
			CO3	Understanding Reaction Mechanism of Transition Metal Complexes.

			CO4	Demonstrate the stereochemistry and Bonding
			CO5	Acquire the knowledge about Bent rule
Sem. I	**Organic Chemistry 1**	**MSCHEM102**	**CO1**	Acquire knowledge of Nature of Bonding in Organic Molecule
			CO2	Inculcate Nature of Bonding in Organic Molecule, Stereochemistry.
			CO3	To learn aliphatic and Aromatic Electrophilic and Nucleophilic Substitution
			CO4	Demonstration of factors affecting the reactivities of aliphatic and aromatic reactions.
			CO5	To understand Von Richter, Sommelet-Hauser and smiles rearrangements.
Sem. I	**Physical Chemistry 1**	**MSCHEM103**	**CO1**	Learn about Quantum Chemistry
			CO2	Demonstration about Angular Momentum
			CO3	Acquire knowledge about Thermodynamics and Statistical Thermodynamics.
			CO4	To acquire knowledge about Huckel theory of conjugated systems.
			CO5	To understand perturbation theory to the Helium atom.
Sem. I	**Computer for Chemists**	**MSCHEM104 (a)**	**CO1**	To understand Computer Programming In FORTRAN/C/BASIC
			CO2	Demonstration of Word processing Software such as WORDSTAR/MS-WORD / EXCEL.
			CO3	To gain knowledge about Linear simultaneous equations to solve secular equations within the Huckel theory.
			CO4	Acquire knowledge of Use of Computer To Programmes
			CO5	To learn Programming in Chemistry
Sem. I	**Biology for Chemists**	**MSCHEM104 (b)**	**CO1**	Learn about Cell Structure and functions, Carbohydrates.
			CO2	Demonstration about Lipids, Amino-acids, Peptides
			CO3	Understanding the structures of Proteins, Nucleic Acids
			CO4	Acquire knowledge about sugars.
			CO5	To demonstrate Purines and pyrimidines bases of nucleic acids.
Sem. I	**Mathematics for Chemists**	**MSCHEM104(c)**	**CO1**	Acquire knowledge of Vectors, Matrix Algebra
			CO2	Inculcate Elementary Differential Equations
			CO3	Demonstration of Differential Calculus, Permutation and Probability.
			CO4	Understanding the Rules for differentiation, applications of differential
			CO5	Awareness about curve sketching.
Sem. I	**Laboratory course (Inorganic**	**MSCHEM105**	**CO1**	To provide Practical knowledge of Gravimetric Estimation of two constituents when present together in a given complex

	chemistry)		**CO2**	Analysis of two cation-system using EDTA
Sem. I	**Laboratory course (Organic chemistry)**	**MSCHEM106**	**CO1**	To determine corrected melting points of an unknown organic compounds.
			CO2	Preparation of various organic compounds by different methods.
Sem. I	**Laboratory course (Physical chemistry)**	**MSCHEM 107**	**CO1**	To provide Practical knowledge of Viscosity, Surface Tension
			CO2	To provide Practical knowledge of Solubility Density
			CO3	Analysis of two cation-system using EDTA
Sem. II	**Inorganic Chemistry 1**	**MSCHEM201**	**CO1**	Inculcate the knowledge of Electronic Spectra and Magnetic Properties Of Transition Metal Complexes.
			CO2	Creating awareness about Metal–Complexes.
			CO3	Elaboration of Metal Cluster.
			CO4	Acquire knowledge about carboranes, metallobranes and metallocarboranes.
			CO5	To understand Spectroscopic method of assignment of absolute configuration in optically active metal chelates.
Sem. II	**Organic Chemistry 1**	**MSCHEM202**	**CO1**	Inculcate the knowledge of Reaction Mechanism.
			CO2	Demonstration of Structure and Reactivity Addition to Carbon-Carbon Multiple Bonds
			CO3	Elaboration about Free Radical Reactions, Pericyclic Reactions, Elimination Reaction.
			CO4	To learn regio and chemo selectivity, orientation and reactivity.
			CO5	Acquire knowledge about Hammond's postulate, Curtin-Hammett Principle.
Sem. II	**Physical Chemistry 1**	**MSCHEM203**	**CO1**	Gain conceptual knowledge of Chemical Dynamics
			CO2	To understand Non-equilibrium Thermodynamics
			CO3	Acquire knowledge about Macromolecules.
			CO4	Demonstration of Surface Chemistry, Electro chemistry.
			CO5	To gain knowledge about Electro catalysis.
Sem. II	**Group Theory, Spectroscopy and Diffraction Methods**	**MSCHEM204**	**CO1**	Gain conceptual knowledge of Symmetry And Group Theory in Chemistry
			CO2	To learn about Microwave, Vibrational Spectroscopy
			CO3	Demonstration of Magnetic Resonance and Molecular Spectroscopy.
			CO4	Understanding representation for the Cn, Cnv, Cnn, Dnnn etc. group.
			CO5	To gain knowledge about Nuclear Quadrupole Resonance spectroscopy
Sem. II	**Laboratory course**	**MSCHEM205**	**CO1**	Gain experimental knowledge of Preparation of various coordination compounds.

	(Inorganic chemistry)		**CO2**	Study of electronic spectrum and magnetic, Properties of various coordination compounds
Sem. II	**Laboratory course (Organic chemistry)**	**MSCHEM206**	**CO1**	Qualitative Analysis of mixtures of two organic solids
			CO2	Gain experimental knowledge of mixtures of two organic solids
Sem. II	**Laboratory course (Physical chemistry)**	**MSCHEM207**	**CO1**	Gain experimental knowledge of Polarimetry
			CO2	Gain experimental knowledge Polarimetry, Flame Photometry
Sem. III	**Applications of Spectroscopy**	**MSCHEM301**	**CO1**	Inculcate the knowledge of Electron Spin Resonance Spectroscopy, Mossbauer and Vibrational Spectroscopy
			CO2	To understand Nuclear Magnetic Resonance of Paramagnetic Substances in Solution
			CO3	Demonstration of Carbon-13 NMR spectroscopy and mass spectroscopy
			CO4	To learn Mode of bonding of ambidentate ligands
			CO5	To acquire knowledge about NMR spectroscopy COSY,NOESY, DEPT, APT, and INADEQUATE technique.
Sem. III	**Organotransition Metal Chemistry**	**MSCHEM302**	**CO1**	To learn Homogeneous Catalysis and catalytic hydrogenation homogeneous
			CO2	Inculcate the knowledge of Compounds of Transition Metal-Carbon Multiple Bonds
			CO3	Demonstration Transition Metal Compounds with Bonds to Hydrogen, Alkyls and Aryls of Transition Metals.
			CO4	To Understand Fluxional organometallic compounds.
			CO5	Acquire knowledge about water gas shift reaction and Fischer–Tropsch Synthesis.
Sem. III	**Heterocyclic Chemistry**	**MSCHEM303**	**CO1**	To understand Dewar resonance energy and Diamagnetic susceptibility exaltations.
			CO2	Acquire the knowledge of Nomenclature of Hetero cycles and their synthesis.
			CO3	To gain knowledge about Aromatic and non Aromatic Heterocycles.
			CO4	Demonstration of Meso-ionic Heterocycles, 1,2-Azoles and 1,3-Azoles
			CO5	To learn Synthesis of pharmaceutical compounds having heterocyclic ring with one or more heteroatom.
Sem. III	**Environmental Chemistry**	**MSCHEM304**	**CO1**	To understand Biogeochemical cycles of C,N,P,S and O. Bio distribution of elements.
			CO2	To gain knowledge about industrial pollution.
			CO3	Demonstration of environmental Toxicology
			CO4	Chemical composition of atmosphere.

			CO5	Chemical composition of water bodies.
Sem. III	**Laboratory course (Inorganic chemistry)**	**MSCHEM305**	**CO1**	Inculcate the experimental knowledge of Colorimetric estimation of cations and anions.
			CO2	Acquire knowledge about separation technique
Sem. III	**Laboratory course (Organic chemistry)**	**MSCHEM306**	**CO1**	Study of organic compounds
			CO2	Extraction of organic compound from natural sources
Sem. III	**Laboratory course (Physical chemistry)**	**MSCHEM307**	**CO1**	Inculcate the experimental knowledge of Colorimetry, Refractometry
			CO2	Inculcate the experimental knowledge of Chromatography, Spectro-photometric analysis
Sem. IV	**Biophysical Chemistry**	**MSCHEM401**	**CO1**	Demonstration about Biological Cell and its Constituents, Enzymes, Mechanism of Enzyme Action.
			CO2	Acquire knowledge about Kinds of Reactions Catalysed by Enzymes,Co-Enzyme, Chemistry Biological Macromolecules.
			CO3	Elaboration about Proteins, Biological Macromolecules, The Nucleic Acids.
			CO4	Understanding the Interactions in Macromolecules, Structural Transition in Biomacromolecules.
			CO5	Inculcate Bioenergetics and ATP cycle, Cell Membranes And Transport Of Ions.
Sem. IV	**Organic Synthesis-I**	**MSCHEM402**	**CO1**	Demonstration about Organolithium and organomagnesium compound and organometallic Reagents.
			CO2	Acquire knowledge about oxidation and reduction reactions.
			CO3	Inculcate Chemoselectivity and Felkin-Ahn Model, Diastereoselectivity, Cram's Rule.
			CO4	Elaboration of rearrangement reactions.
			CO5	Understanding Reterosynthetic Approach, Umpolung and Regeoselectivity
Sem. IV	**Chemistry of Natural Products**	**MSCHEM403**	**CO1**	Acquire knowledge about Terpenoids and Carotenoids.
			CO2	Demonstration about Conine, Nicotine, Atropine, Quinine and Morphine.
			CO3	Elaboration of Testosterone, Estrone Progestrone, Aldosterone, Biosynthesis of Steroids
			CO4	Understanding Plant Pigments, Prostaglandins, Porphyrins.
			CO5	Inculcate Synthesis and reaction of Pyrethroids and rotenones
Sem. IV	**Photo Chemistry and Solid State Chemistry**	**MSCHEM404**	**CO1**	Demonstration about Photochemical Reactions, Photochemistry of Alkenes
			CO2	Elaboration of Photochemistry of Carbonyl compound,

				Photochemistry of aromatic compounds
			CO3	Understanding Solid state reactions, Crystal defects and non-stochiometry
			CO4	Inculcate Acquire knowledge about
			CO5	Acquire knowledge about Electronic properties and Band Theory
Sem. IV	**Laboratory course (Inorganic chemistry)**	**MSCHEM405**	**CO1**	Amperometric determination of Zn+2 with EDTA, Analysis of water hardness.
			CO2	Oxidation-Reduction Titrations, Precipitation Titrations
Sem. IV	**Laboratory course (Organic chemistry)**	**MSCHEM406**	**CO1**	Extraction of organic compound from natural sources.
			CO2	To determine saponification & iodine values of oils and fats.
Sem. IV	**Laboratory course (Physical chemistry)**	**MSCHEM407**	**CO1**	Colorimetry, Spectro-photometric analysis.
			CO2	Refractometry, Chromatography.

Mapping of Course Outcomes(COs) with Programme Outcomes(POs)

Programme Outcome																
College code	**Course Out-comes**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PO 13**	**PO 14**	**PO 15**
SEMESTER-I																
MSCHEM101	**CO1**	2	1	3	2	x	3	x	3	x	x	2	x	x	x	2
	CO2	2	1	x	2	2	3	x	3	x	x	2	x	x	x	2
	CO3	2	1	2	2	3	3	1	3	2	x	1	x	x	x	2
	CO4	2	1	2	1	2	3	2	3	2	x	x	x	x	x	2
	CO5	2	1	2	2	2	3	1	3	2	x	1	x	x	x	3
MSCHEM102	**CO1**	2	1	3	1	3	3	2	3	2	x	2	x	x	x	3
	CO2	3	1	3	2	3	3	2	3	1	x	2	x	x	x	3
	CO3	2	2	3	2	3	3	2	3	2	x	2	x	x	x	3
	CO4	2	2	1	2	3	2	2	3	2	x	2	x	x	x	3
	CO5	2	2	1	2	2	2	3	3	2	x	1	x	x	x	3

MSCHEM103	**CO1**	2	1	3	2	2	2	3	3	2	x	2	x	x	x	3
	CO2	2	1	3	2	3	2	3	3	2	x	2	x	x	x	3
	CO3	2	2	3	2	2	2	3	3	2	x	2	x	x	x	3
	CO4	3	1	2	1	3	1	2	3	1	x	2	x	x	x	3
	CO5	2	1	1	2	3	3	1	3	3	x	1	x	x	x	3
MSCHEM104 (a)	**CO1**	2	x	x	2	1	x	x	3	x	x	x	1	1	1	3
	CO2	3	1	x	3	2	1	1	3	x	x	1	3	x	1	3
	CO3	2	x	x	1	x	x	x	3	x	x	x	2	1	x	3
	CO4	3	1	2	1	x	x	x	3	x	2	x	1	1	1	3
	CO5	2	1	2	1	2	x	1	3	3	x	2	2	1	x	3
MSCHEM104 (b)	**CO1**	2	x	2	3	1	3	1	3	3	x	1	x	x	x	2
	CO2	2	x	2	1	1	3	2	3	2	x	1	x	x	x	2
	CO3	2	2	2	1	1	3	1	3	1	x	1	x	x	x	2
	CO4	3	1	2	1	1	3	2	3	2	x	1	x	x	x	2
	CO5	3	3	2	1	x	3	1	3	2	x	2	x	x	x	2
MSCHEM104 (c)	**CO1**	3	1	2	3	1	2	1	3	1	x	1	1	x	x	x
	CO2	2	1	2	3	2	2	1	3	1	x	1	1	x	x	x
	CO3	3	1	2	3	2	3	1	3	1	x	1	1	x	x	x
	CO4	2	1	2	3	2	1	1	3	1	x	1	1	x	x	x
	CO5	3	1	2	3	3	3	1	3	1	x	1	1	x	x	x
SEMESTER-II																
MSCHEM201	**CO1**	3	1	2	2	2	3	x	3	x	x	2	x	x	x	3
	CO2	3	1	2	2	1	2	x	3	x	x	3	x	x	x	3
	CO3	2	1	2	3	1	3	x	3	x	x	2	x	x	x	3
	CO4	3	1	2	2	1	3	1	3	x	x	3	x	x	x	3
	CO5	2	1	1	3	2	3	x	3	x	x	2	x	x	x	2
MSCH	**CO1**	2	1	2	3	1	3	x	3	x	x	3	x	x	x	3

EM202	**CO2**	2	2	2	2	3	3	x	3	x	x	2	x	x	x	2
	CO3	3	1	1	3	1	2	x	3	x	x	2	x	x	x	3
	CO4	3	2	2	2	3	3	x	3	x	x	3	x	x	x	2
	CO5	2	1	2	*2*	1	3	x	3	x	x	2	x	x	x	2
MSCH EM203	**CO1**	3	2	2	*2*	*3*	2	x	3	x	x	3	x	x	x	2
	CO2	2	2	1	*3*	1	2	x	3	x	x	1	x	x	x	2
	CO3	3	2	2	3	2	2	x	3	x	x	2	x	x	x	2
	CO4	2	1	1	3	3	3	1	3	x	x	2	x	x	x	3
	CO5	2	1	2	3	1	2	1	3	x	x	1	x	x	x	2
MSCH EM204	**CO1**	2	2	1	2	2	2	x	3	x	x	2	x	x	x	2
	CO2	2	2	1	3	2	3	1	3	x	x	3	x	x	x	3
	CO3	3	1	1	2	2	2	x	3	x	x	3	x	x	x	3
	CO4	2	1	2	3	3	2	x	3	x	x	2	x	x	x	3
	CO5	3	1	1	2	3	2	1	3	x	x	3	x	x	x	3
SEMESTER-III																
MSCH EM301	**CO1**	3	1	3	1	3	3	1	3	x	x	3	x	x	x	3
	CO2	3	1	3	2	3	3	1	3	x	x	2	x	x	x	2
	CO3	3	1	2	2	3	3	1	3	x	x	3	x	x	x	3
	CO4	3	1	3	2	3	3	1	3	x	x	2	x	x	x	3
	CO5	2	1	2	2	3	3	x	3	x	x	3	x	x	x	3
MSCH EM302	**CO1**	2	1	3	1	2	3	x	3	x	x	2	x	x	x	3
	CO2	3	1	1	1	2	3	x	3	x	x	2	x	x	x	3
	CO3	2	1	3	2	2	3	x	3	x	x	3	x	x	x	3
	CO4	3	1	3	2	2	3	x	3	x	x	2	x	x	x	3
	CO5	2	2	3	2	2	2	x	3	x	x	3	x	x	x	2
MSCH EM303	**CO1**	2	1	1	1	1	2	x	2	x	x	2	x	x	x	2
	CO2	2	1	3	2	1	2	x	3	x	x	3	x	x	x	2

	CO3	3	1	3	1	1	2	x	3	x	x	2	x	x	x	3
	CO4	3	1	2	1	1	3	x	2	x	x	3	x	x	x	2
	CO5	3	1	3	1	1	3	x	2	x	x	3	x	x	x	3
MSCH EM304	**CO1**	2	2	2	1	2	3	1	2	x	x	2	x	x	x	2
	CO2	2	1	1	1	2	3	1	3	x	x	3	x	x	x	2
	CO3	3	1	3	1	2	3	1	3	x	x	2	x	x	x	2
	CO4	3	1	2	2	1	3	1	2	x	x	3	x	x	x	2
	CO5	3	1	1	2	2	3	1	2	x	x	2	x	x	x	3
SEMESTER-IV																
MSCH EM401	**CO1**	3	2	3	2	1	3	x	2	x	x	3	x	x	x	3
	CO2	2	1	2	2	1	2	x	3	x	x	2	x	x	x	3
	CO3	2	1	1	1	1	2	1	3	x	x	2	x	x	x	3
	CO4	3	1	3	1	1	2	1	3	x	x	2	x	x	x	3
	CO5	3	1	3	1	2	2	x	3	x	x	2	x	x	x	2
MSCH EM402	**CO1**	2	1	3	2	2	2	1	3	x	x	3	x	x	x	3
	CO2	2	1	3	2	2	2	1	3	x	x	3	x	x	x	3
	CO3	2	1	3	1	1	3	1	3	x	x	2	x	x	x	3
	CO4	3	1	2	1	1	3	1	3	x	x	2	x	x	x	2
	CO5	3	2	2	1	1	3	1	2	x	x	2	x	x	x	2
MSCH EM403	**CO1**	2	1	2	1	1	3	x	2	x	x	2	x	x	x	2
	CO2	3	1	2	2	2	3	x	2	x	x	2	x	x	x	2
	CO3	3	1	3	2	1	3	x	2	x	x	3	x	x	x	2
	CO4	3	1	1	2	1	3	1	3	x	x	2	x	x	x	2
	CO5	3	1	1	2	1	3	1	3	x	x	2	x	x	x	2
MSCH EM404	**CO1**	3	1	1	2	1	2	1	3	x	x	2	x	x	x	2
	CO2	2	2	3	2	1	2	1	3	x	x	3	x	x	x	2
	CO3	3	1	3	2	2	3	x	3	x	x	2	x	x	x	2

	CO4	2	1	3	2	2	3	x	3	x	x	2	x	x	x	2
	CO5	3	1	2	1	2	3	x	3	x	x	2	x	x	x	2

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

College code	Course Out-comes	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
MSCHEM101	**CO1**	3	3	3	3	1	1	3
	CO2	2	3	3	3	2	2	3
	CO3	2	3	2	3	1	2	3
	CO4	2	3	2	3	1	1	3
	CO5	2	3	1	3	1	1	3
MSCHEM102	**CO1**	2	2	1	3	1	2	2
	CO2	3	3	2	3	2	2	2
	CO3	3	2	1	3	2	2	3
	CO4	2	3	2	2	2	1	3
	CO5	3	2	1	2	1	1	3
MSCHEM103	**CO1**	3	2	2	3	1	2	3
	CO2	3	2	3	2	1	1	2
	CO3	2	2	2	2	1	2	2
	CO4	3	3	1	2	2	1	2
	CO5	3	3	2	2	2	2	3
MSCHEM104(a)	**CO1**	2	2	3	3	2	1	3
	CO2	2	2	2	3	2	2	3
	CO3	2	2	2	3	1	1	3
	CO4	2	2	2	2	1	2	3
	CO5	2	3	1	2	1	2	3
MSCHEM104 (b)	**CO1**	2	3	1	2	1	2	3
	CO2	2	3	3	2	1	1	2
	CO3	2	3	2	2	2	1	2
	CO4	3	3	2	2	2	1	2
	CO5	3	2	3	3	2	2	2
MSCHEM104	**CO1**	3	2	3	3	2	1	2
	CO2	3	2	3	3	2	2	3

(c)	**CO3**	3	2	2	2	1	1	3
	CO4	2	3	2	2	1	1	3
	CO5	2	3	1	2	1	1	3
MSCHEM201	**CO1**	2	3	1	2	1	1	3
	CO2	2	3	1	3	2	2	3
	CO3	2	2	3	3	2	2	2
	CO4	2	2	3	3	2	2	2
	CO5	3	2	3	3	2	2	2
MSCHEM202	**CO1**	3	2	1	3	1	1	3
	CO2	3	2	2	2	1	1	3
	CO3	3	3	2	2	1	1	3
	CO4	3	3	3	2	1	2	3
	CO5	3	3	3	2	2	2	3
MSCHEM203	**CO1**	3	3	3	2	2	2	3
	CO2	3	3	2	2	2	1	3
	CO3	2	2	2	3	2	1	3
	CO4	2	2	1	3	2	2	3
	CO5	2	2	1	3	1	1	2
MSCHEM204	**CO1**	2	2	2	3	2	2	2
	CO2	3	2	2	3	1	1	2
	CO3	3	2	2	2	2	2	2
	CO4	2	3	1	2	1	1	2
	CO5	2	3	1	2	2	1	2
MSCHEM301	**CO1**	3	2	1	3	2	1	2
	CO2	3	3	2	2	2	1	2
	CO3	3	2	2	3	2	2	3
	CO4	3	3	2	2	2	1	3
	CO5	3	2	3	3	1	1	3

MSCHEM302	**CO1**	3	3	3	2	1	2	3
	CO2	3	2	2	3	1	1	2
	CO3	2	3	1	2	1	1	2
	CO4	2	2	2	2	2	1	3
	CO5	3	2	3	2	1	2	3
MSCHEM303	**CO1**	2	2	2	2	1	2	3
	CO2	2	2	2	3	2	2	2
	CO3	2	3	3	3	1	2	2
	CO4	2	3	2	3	2	2	2
	CO5	3	3	1	3	1	1	3
MSCHEM304	**CO1**	2	3	1	2	3	1	3
	CO2	3	2	3	2	3	1	2
	CO3	2	2	3	2	3	1	2
	CO4	2	2	2	2	3	2	2
	CO5	2	2	2	3	3	2	2
MSCHEM401	**CO1**	2	3	3	3	1	2	3
	CO2	2	2	2	3	2	1	3
	CO3	2	2	3	3	1	1	3
	CO4	2	3	2	3	2	1	2
	CO5	2	2	3	2	2	2	2
MSCHEM402	**CO1**	2	2	2	2	1	2	2
	CO2	2	3	2	2	1	1	2
	CO3	3	3	1	2	2	1	3
	CO4	3	3	1	2	1	1	3
	CO5	3	3	2	3	1	1	3
MSCHEM403	**CO1**	3	3	3	3	1	2	3
	CO2	3	2	2	3	1	2	2

	CO3	3	2	1	3	2	2	2
	CO4	3	2	1	3	2	2	2
	CO5	3	3	2	2	2	2	3
MSCHEM404	**CO1**	3	2	1	2	1	1	3
	CO2	3	2	2	2	1	1	3
	CO3	3	2	2	2	2	1	3
	CO4	3	3	2	2	1	2	2
	CO5	3	3	1	3	2	2	2