Institute for Excellence in Higher Education (IEHE), Bhopal (MP)

NAAC Re-accredited (Third Cycle) Autonomous College
Under the UGC Scheme with 'A' Grade (CGPA-3.10)

Program Outcomes (POs), Program Specific Outcome (PSOs) & Course Outcomes (COs) of Department of Chemistry

B.Sc. (Honours) Chemistry

(Session: 2021-2022)

COURSES OFFERED IN THE INSTITUTE

Under Graduate Courses

- B.Com. Honours (Management/Account)
- B.A. Honours (Economics/History/Psychology/Sociology/Political Science/English Literature/Hindi Literature/Geography/Fashion Designing)
- **B.Sc. Honours** (Physics/**Chemistry**/Mathematics/Electronics/Biotechnology/Geography/Forensic-Science)

Post Graduate Courses

- MA (English)
- MA (Economics)
- MA (Social Work)
- MA (History)
- MA (Public Administration)
- MA (Political Science)
- M.Com. (Management)
- M.Sc. (Physics)
- **M.Sc. (Chemistry)**
- M.Sc. (Biotechnology)
- M.Sc. (Mathematics)

Diploma Programme

- 14 Vocational Programmes

Certificate Programme

- 31 Vocational Programmes

Training Programmes

- 09 Vocational Programmes

Special Programmes

- 03 Vocational Programmes

Program Outcomes (PO) of the Under-Graduate Courses Offered

PO1: **Domain Knowledge:** Capable of demonstrating comprehensive knowledge &understanding of one or more other disciplines that form a part of an undergraduate programme of study.

PO2: **Critical Thinking:** Critically evaluate practices, policies and theories by following scientific approach to knowledge development. Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO3: **Problem Solving and Analytical Skills:** Ability to think rationally, analyse situations and solve problems adequately.

PO4: **Information and Digital Literacy:** Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO5: **Communication Skills:** The capacity to communicate effectively using appropriate media, to present complex information in a clear & concise manner. Acquire the learning abilities by focusing on LSRW (Listening, Speaking, Reading & Writing skill, which provide a stage to the students to sharpen their capacity to learn more.

PO6: **Social Interaction and sensitivity towards the societal issues:** Work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO7: **Self-directed & Life-long Learning**: Acquire the potential to engage in independent & life-long learning in the broadest context socio-technological changes. Critical sensibility to live experiences, with self-awareness and reflexivity of both and society.

PO8: **Environment and Sustainability**: Understand the issues of environmental contexts & sustainable development.

PO9: **Moral and Ethical Awareness:** Ability to embrace moral/ ethical values in conducting one's life, 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.

PO10: **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11: **Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and effective relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Efficiency to apply one's learning to real life situations or in interdisciplinary areas.

PO12: **Leadership and Management Skills:** Competence to use skills in organizing for people to reach a shared goal. During leading a project, ability to motivate others to complete a series of tasks, often according to a schedule.

PO13: **Employability and Entrepreneurial Skill:** Ability to develop employability skills such as, positive attitude, good business sense, willingness to learn, resilience, ability to work under pressure, optimism, adaptability, perseverance and motivation, and a host of similar skills.

PROGRAMME OUTCOMES (PO): **B.Sc. (Honours)**

Predefined Programme Outcomes	*Students taking admission to this program of B.Sc. (Honours) get equipped with following outcomes:*
PO1	**Domain Knowledge:** Acquiring knowledge of fundamentals, basic Mathematics, domain knowledge of proper scientific models and Computing Specialization from defined problems and explaining the basic scientific principles and methods.
PO2	**Scientific thinking:** Inculcating scientific thinking and awareness, getting an ability to use necessary current techniques, skills, and modern tools.
PO3	**Problem Analysis:** Identifying, formulating, &analysing complex problems, reaching substantiated conclusions using first principles of Mathematics, natural sciences and electronic sciences.
PO4	**Communication:** Communicate concepts, designs, and solutions of scientific activities effectively and professionally with society at large.
PO5	**Information & Digital Literacy:** Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
PO6	**Ethical Awareness:** Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to support the values required for collaborative work such as mutual trust & fairness.
PO7	**Environment &Sustainability:** Understanding the impact of scientific solutions on societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO8	**Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life- long learning in the broadest context socio-technological changes. Critical sensibility to live experiences, with self-awareness and reflexivity of both and society.
PO9	**Research-related skills:** • Acquiring familiarity with emerging areas of different subjects in science and their applications in various spheres of sciences and getting appraise of its relevance in future studies. • Getting ability to apply various statistical tools to research problems and ability to build statistical knowledge and knowing the statistical organization in India and abroad. • Developing scientific intuition, ability and techniques to tackle problems either theoretical or experimental in nature.
PO10	**Employability Skill:** Ability to develop employability skills such as, positive attitude, good business sense, willingness to learn, resilience, ability to work under pressure, optimism, adaptability, perseverance and motivation, and a host of similar skills.

Programme Specific Outcomes (PSO): B.Sc. (Chemistry) *(Honours/Major Subject)*

Programme Specific Outcomes	***The students taking up this program of BSc with Chemistry as a special subject of study, receive the following outcomes:***
PSO-1	*Domain Knowledge:* Creating interest in basic and advanced knowledge in the field of chemistry explaining basic scientific principles & methods.
PSO-2	*Scientific Thinking:* Inculcating scientific thinking& awareness, getting an ability to choose necessary current techniques, skills and modern tools.
PSO-3	*Problem Analysis:* Identifying, formulating& analysing complex problems & searching sys-tantiated conclusion by using analytical technique, maths, scientific sciences & natural sciences.
PSO-4	*Communication:* Communicate concepts, designs & solutions of scientific activities effectively & professionally with society at large.
PSO-5	*Information & Digital Literacy:* Capability to use ICT in demonstrative and evaluating the saw data in the field of chemistry
PSO-6	*Ethical & Technical Awareness:* To inculcate the capability of using technical strength in evaluating various prospects and to motivate the value required for collaborative work.
PSO-7	*Environmental & Sustainability:* Understanding the impact of scientific solutions on societal & environmental contexts demonstrate knowledge of need for sustainable development.
PSO-8	*In-hand Practical Expertise:* To acquire knowledge and potential to enhance practical and handling skills.
PSO-9	*Research Related Skills:* Knowing the fundamental techniques to upskill and augur their approach towards research.
PSO-10	*Employability Skills:* Ability to develop positive practical skill, administrative skills, presentations skills, learning skills, adaptability, resilience ability to work under pressure, cooperative skills, etc.

Mapping of PSOs BSc Chemistry *(Honours/Major)* **with POs of Under-Graduate**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
PSO-1	*												
PSO-2		*											
PSO-3			*										
PSO-4				*									
PSO-5					*								
PSO-6													
PSO-7							*						
PSO-8													
PSO-9									*				
PSO-10										*			

Course Outcomes (CO)s

Semester: I

Inorganic Chemistry-I: Atomic Structure & Chemical Bonding (Code: **MJS-181**) (Major)

Course Outcomes	***The students taking up this course of Chemistry BSc with*** *Inorganic Chemistry-I (Major)* ***as a special subject of study receive the following outcomes:***
CO-1	Evolution of various scientific theories related to atomic structure and the concept of wave function.
CO-2	The interaction of and energetic involved in chemical bonding.
CO-3	Basic and fundamental concepts in chemical bonding and knowledge about various elements.
CO-4	Fundamental concepts pertaining to the periodic properties, chemical bonding & molecular geometry based on the accepted model.

Semester: I

Analytical Chemistry – I (Paper Code: **MNS-182**) (Minor)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Analytical Chemistry-I (Minor)* ***as a special subject of study receive the following outcomes:***
CO-1	The fundamentals of analytical chemistry including statistical applied to scientific data compliment the field of Research & Development.
CO-2	Basics of separation techniques and electro- analytical methods and their applications.
CO-3	Basics of spectroscopic techniques including UV. Visible spectroscopy & thermal techniques.
CO-4	Basics of analytical chemistry helps in acquiring knowledge to-enhance handling skills.

Semester: I

Basics of Analytical Chemistry (Paper Code: **GES-181**) (Generic Elective)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Basics of Analytical Chemistry (Generic Elective)* ***as a special subject of study receive the following outcomes:***
CO-1	Basics of statistical treatment to analyse data and grouping of the same data.
CO-2	Studying different types of chromatography helps in the field of Research.
CO-3	Study of different electro analytical techniques helps in the evaluation of row data
CO-4	Analytical tools and techniques help in the scientific thinking

Semester: II

Organic Chemistry-I (Paper Code: **MJS-281**) (Major)

Course Outcomes	***The students taking up this course of BSc with Organic Chemistry-I (Major) as a special subject of study receive the following outcomes:***
CO-1	Provides domain/ Fundamental knowledge in the fields of organic. It also helps in studying the structure & geometry of any molecule
CO-2	Helps in determining the mechanism of any reaction by studies the intermediates along the reaction pathways.
CO-3	Basic structure, bonding hybridization & Stereochemistry of any molecule can be elucidated
CO-4	Nature of electrophiles, nucleophiles, free radicals, electro negativity resonance. etc. Can lead to the determination of organic mechanism
CO-5	Study of reactivity and reaction mechanism & their uses in organic synthesis and development new molecule.

Semester: II

Organic Chemistry-II (Paper Code: **MNS-282**) (Minor)

Course Outcomes	***The students taking up this course of BSc with Organic Chemistry-II (Minor) as a special subject of study receive the following outcomes:***
CO-1	Helps in studying the structure and reaction mechanism of selected polynuclear hydrocarbons.
CO-2	The structure, mechanisms of reaction of selected heteronuclear compounds and nitrogen containing functional groups.
CO-3	Classification structure mechanisms of reactions of few selected alkakoids and terpenses.

Semester: II

Physical Chemistry (Paper Code: **GES-281**) (Generic Elective)

Course Outcomes	***The students taking up this course of BSc with Physical Chemistry (Generic Elective) as a special subject of study receive the following outcomes:***
CO-1	Physical properties of each state of matter and laws related to describe the corresponding state.
CO-2	Kinetic model of gas and its properties Maxwell distribution and kinetic energies
CO-3	Behaviour of real gas, its deviation from ideal gas, equation of is other and law corresponding states.
CO-4	Ionic equilibria and salt hydrolysis, and their applications in chemistry

Semester: III

Natural Products (Honours-I) (Paper Code: **S-381**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Natural Products (Honours-I)* ***as a special subject of study receive the following outcomes:***
CO-1	The concept of Natural Products as secondary metabolites showing therapeutic action, which strengthens the area of Research.
CO-2	In-depth knowledge regarding selected alkaloids, purines, pyrimidines their structure and synthesis give, wider aspects to science & technology
CO-3	Role of vitamins and their function in human body.
CO-4	Classification, structure and functions of Natural Products and their applications.

Semester: III

Physical Chemistry-I (Honours-II/Subsidiary) (Paper Code: **S-382**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Physical Chemistry-I (Honours-II/Subsidiary)* ***as a special subject of study receive the following outcomes:***
CO-1	Basics of physical properties and molecular structure helps in the identification of molecule.
CO-2	Basics of chemical kinetics and catalysis, concept of electrochemistry & their applications.
CO-3	In-depth knowledge of spectroscopy and solutions give wider scope to research.
CO-4	Dilute solution, solid state chemistry and law related to it are necessary to understand the core if the subject.

Semester: IV

Mathematical & Computer Applications in Chemistry (Honours-I) (Paper Code: **S-481**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Maths & Computer for Chemistry (Honours-I)* ***as a special subject of study receive the following outcomes:***
CO-1	Recognition of different techniques of integration (by parts trigonometric integrands partial factions) helps in analysis data.
CO-2	Basics of metrics and applications.
CO-3	Define the derivative and integral of the trigonometric, logarithmic & inverse trigonometric & rational functions.
CO-4	The basic concept associated with C- language & programme designing.

Semester: IV

Inorganic Chemistry – II (Honours-II/Subsidiary) (Paper Code: **S-482**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Inorganic Chemistry-II (Honours-II/Subsidiary)* ***as a special subject of study receive the following outcomes:***
CO-1	Structure and shape of co-ordination compounds along-with their magnetic properties.
CO-2	Studying the role of metal ions in biological system.
CO-3	Trends in properties and reactivity of D-Block element
CO-4	Typical physical & chemical properties of transition metals,

Semester: V

Industrial Chemistry (Honours-I) (Paper Code: **S-581**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Industrial Chemistry (Honours-I)* ***as a special subject of study receive the following outcomes:***
CO-1	Analysis coal for various industrial applications.
CO-2	Basics of polymer chemistry along with their applications.
CO-3	Concept of lubricants and their mode of action.
CO-4	Functioning of paper and pulp industries, sugar manufacturing and metallurgical units.

Semester: V

Organic Chemistry (Honours-II/Subsidiary) (Paper Code: **S-582**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Organic Chemistry (Honours-II/Subsidiary)* ***as a special subject of study receive the following outcomes:***
CO-1	Study of nitrogen compounds and their applications.
CO-2	Functions and reactions of carbohydrates and their applications in daily life.
CO-3	Mechanism and synthesis of various organic compounds.
CO-4	Basic knowledge about spectroscopic techniques their applications in Research and development.

Semester: VI

Biochemistry (Honours-I) (Paper Code: **S-681**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Biochemistry (Honours-I)* ***as a special subject of study receive the following outcomes:***
CO-1	Concept of Biochemistry and role of high energy phosphates in metabolism.
CO-2	Various metabolism pathways, Biochemical pathways related to carbohydrates, proteins and fats-utilization pr gradient to de high energy compounds.
CO-3	Role of manufacture like DNA and enzymes and their structure activity relationships.

Semester: VI

Physical Chemistry (Honours-II/Subsidiary) (Paper Code: **S-682**)

Course Outcomes	***The students taking up this course of*** *BSc* ***with*** *Physical Chemistry (Honours-II/Subsidiary)* ***as a special subject of study receive the following outcomes:***
CO-1	Maxwell Boltzmann law and their applications, distribution laws.
CO-2	Solid State Chemistry and their applications helps in the fields of research.
CO-3	Bonding in various molecules along with their applications gives a wider scope in the fields of research.

Programme: BSc (Major/Honours-I) Subject - **Chemistry**

Mapping of COs with PSOs for Semester-I (Major)

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
Paper Title: ***Inorganic Chemistry-I***	CO1		*								
	CO2	*									
Paper Code: **MJS-181**	CO3	*									
	CO4									*	
	CO5										
Mapping of COs and PSOs for Semester-II (Major)											
Paper Title: ***Organic Chemistry-II***	CO1	*									
	CO2			*							
Paper Code: **MJS-281**	CO3		*								
	CO4		*								
	CO5										*
Mapping of COs and PSOs for Semester-III (Honours-I)											
Paper Title: ***Natural Product***	CO1									*	
	CO2									*	
Paper Code: **S-381**	CO3	*									
	CO4										*
	CO5										
Mapping of COs and PSOs for Semester-IV (Honours-I)											
Paper Title: ***Mathematical & Computer Applications in Chemistry***	CO1			*							
	CO2			*							
	CO3									*	
	CO4			*		*					
Paper Code: **S-481**	CO5										
Mapping of COs and PSOs for Semester-V (Honours-I)											
Paper Title: ***Industrial Chemistry***	CO1							*			*
	CO2		*								
Paper Code: **S-581**	CO3	*									
	CO4									*	
	CO5										
Mapping of COs and PSOs for Semester-VI (Honours-I)											
Paper Title: ***Biochemistry***	CO1	*									
	CO2	*									
Paper Code: **S-681**	CO3									*	
	CO4										
	CO5										

Programme: BSc (Minor/Honours-II/Subsidiary) Subject - **Chemistry**

Mapping of COs with PSOs for Semester-I (Minor)

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
Paper Title: ***Analytical Chemistry-I*** *Paper Code:* ***MNS-182***	CO1									*	
	CO2			*							
	CO3						*				
	CO4								*		
	CO5										
Mapping of COs and PSOs for Semester-I (Minor)											
Paper Title: ***Organic Chemistry- II*** *Paper Code:* ***MNS-182***	CO1										
	CO2									*	
	CO3			*						*	
	CO4										
	CO5										
Mapping of COs and PSOs for Semester-III (Honours-II/Subsidiary)											
Paper Title: ***Physical Chemistry- I*** *Paper Code:* ***S-382***	CO1			*							
	CO2	*									
	CO3									*	
	CO4										
	CO5										
Mapping of COs and PSOs for Semester-IV (Honours-II/Subsidiary)											
Paper Title: ***Inorganic Chemistry-II*** *Paper Code:* ***S-482***	CO1			*							
	CO2	*									
	CO3									*	
	CO4										
	CO5										
Mapping of COs and PSOs for Semester-V (Honours-II/Subsidiary)											
Paper Title: ***Organic Chemistry*** *Paper Code:* ***S-582***	CO1									*	
	CO2		*								
	CO3									*	
	CO4									*	
	CO5										
Mapping of COs and PSOs for Semester-VI (Honours-II/Subsidiary)											
Paper Title: ***Physical Chemistry- II*** *Paper Code:* ***S-682***	CO1	*	*								
	CO2									*	
	CO3									*	
	CO4										
	CO5										

Programme: BSc (Generic Elective) Subject: **Chemistry**

Mapping of COs with PSOs for Semester-I (Generic Elective)

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
Paper Title: ***Basic Analytical Chemistry***	CO1									*	
	CO2									*	
	CO3					*					
Paper Code: ***GES-181***	CO4		*								
	CO5										

Mapping of COs and PSOs for Semester-II (Generic Elective)

Paper Title: ***Basics of Physical Chemistry***	CO1										
	CO2										
	CO3			*							
Paper Code: ***GES-182***	CO4									*	
	CO5										

24/09/2021

(IQAC Coordinator) (Convenor, Academic Committee) (HOD, Chemistry)

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