

**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
Biotechnology**

**B.Sc. (Honours) Biotechnology
&
M.Sc. Biotechnology
(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

Department of Biotechnology

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

- 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.

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

Predefined Programme Outcomes	<i>Students taking admission to this program of B.Sc. get equipped with following outcomes:</i>
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: <ul style="list-style-type: none"> • 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.

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Programme Specific Outcomes (PSO): Biotechnology (Honours/Major Subject)

Programme Specific Outcomes	<i>The students taking up this program of B.Sc. with Biotechnology (Honours/Major) as a special subject of study, receive the following outcomes:</i>
PSO-1	Acquire knowledge in the biotechnology domain that enables their application in industry
PSO-2	Enable students to understand the emerging and advanced concepts of engineering in life sciences.
PSO-3	Acquire technical know-how by linking biotechnology disciplinary and interdisciplinary aspects.
PSO-4	Recognize importance of bioethics, IPR and entrepreneurship skills.
PSO-5	Inculcate nature care by imparting knowledge of advance modern techniques.
PSO-6	Extensive hands-on experiences in high tech lab techniques.
PSO-7	Students gain marketable skills and qualifications for career opportunities.
PSO-8	Bestow students with all research skills to work independently.
PSO-9	Skill enhancement with the help of laboratory exposure and project activities fostering global competence.
PSO-10	Able to use biotechnology as a tool in solving broad societal and national issues.

Mapping of PSOs (BSc Biotechnology with POs of BSc)

	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		✓				✓							

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Course Outcomes (CO)s

Semester: I

Biochemistry and Metabolism (Paper code: MJS-185) (Major)

Course Outcomes	<i>The students taking up this course of B.Sc. with Biochemistry & Metabolism (Major) as a special subject of study receive the following outcomes:</i>
CO-1	To give fundamental concept of biochemistry
CO-2	Various inter-related physiological & metabolic events and inter-disciplinary aspects.
CO-3	Proteins, carbohydrates, lipids and enzymes involved in various biological processes and their lab protocols.
CO-4	Structure, function and properties of macromolecules and their use in proteomics
CO-5	Use of enzymes in food, Agricultural and pharmaceutical industries

Semester: I

General Microbiology (Paper Code: MNS-186) (Minor)

Course Outcomes	<i>The students taking up this course of B.Sc. with General Microbiology (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Micro-organisms as model system to study basic microbiology.
CO-2	Use of molecular approach to identify and characterize microbes and their application in biotechnology.
CO-3	Cultivation and maintenance of micro-organisms and their use in industry to gain marketable skills.
CO-4	Microbial growth, metabolism and bacterial reproduction in laboratory to enhance research skills.
CO-5	Control of micro-organism, water and food microbiology by means of advance modern techniques.

Semester: I

Ecology and Environment Management (Paper code: GES-185) (Generic Elective)

Course Outcomes	<i>The students taking up this course of BSc with Ecology and Environment Management (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Basic principle of ecology, including population ecology, community ecology and ecosystem function
CO-2	Differentiate and identify biotic and abiotic components of ecosystem and inculcate nature care.
CO-3	Pollution: Type and their health-related issues, its impact on society and environment.
CO-4	Environmental changes, hazardous waste-use of environmental biotechnologies.
CO-5	Biotechnologies in protection and preservation of environment-interdisciplinary approach

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Semester: II

Cell Biology (Paper code: MJS-285) (Major)

Course Outcomes	<i>The students taking up this course of B.Sc. with Cell Biology (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Acquiring knowledge about emerging trends of cell and molecular biology
CO-2	Basic function of cell and cell organelles by learning latest lab techniques.
CO-3	Protein synthesis, genomics, biogenesis - extensive hands-on experiences in high lab techniques.
CO-4	Develop research skills and scientific approach towards cell physiology.
CO-5	Create a wareness regarding cancer promoting agents and solve broad societal issues.

Semester: II

Cell Biology (Paper code: MNS-286) (Minor)

Course Outcomes	<i>The students taking up this course of B.Sc. with Cell Biology (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Acquiring knowledge about emerging trends of cell and molecular biology
CO-2	Basic function of cell and cell organelles by learning latest lab techniques.
CO-3	Protein synthesis, genomics, biogenesis- extensive hands-on experiences in high lab techniques.
CO-4	Develop research skills and scientific approach towards cell physiology.
CO-5	Create a wareness regarding cancer promoting agents & solve broad societal issues.

Semester: II

Biofertilizer Technology (Paper code: GES-285) (Generic Elective)

Course Outcomes	<i>The students taking up this course of BSc with Biofertilizer Technology (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Importance of biofertilizer in agriculture to enhance quality and quantity of crops.
CO-2	Chemical free crop and organic manures by modern techniques.
CO-3	Characteristics and application of biofertilizers to enhance soil fertility and crop growth – entrepreneurship skills.
CO-4	Production of healthy mineral rich food crops - by means of using modern scientific tools.
CO-5	Organic farming, green manuring, recycling of biodegradable waste, vermicomposting - field application, job oriented, marketable skills

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Semester: III

Bioinformatics and Biostatistics (Paper code: S-385 (R-18)) (Honours-I)

Course Outcomes	<i>The students taking up this course of B.Sc. with Bioinformatics and Biostatistics (Honours-I) as a special subject of study receive the following outcomes:</i>
CO-1	Utilize online resources and database to gain access-linking biotechnology
CO-2	Use of bioinformatics software for protein, nucleic acid sequencing in biotechnology domain.
CO-3	Various application of biostatistics in research- an interdisciplinary approach.
CO-4	Focuses on computer-based technologies and services to biological, biomedical and biotechnology research
CO-5	Address vast amount of information in living system by use of modern software.

Semester: III

Genetics (Paper code: S-386 (R-18)) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Genetics (Honours-II/Subsidiary) as a special subject of study receive the following outcomes:</i>
CO-1	Detail understanding of chemical basis of heredity
CO-2	Detail study of genetic methodology - provides insight into cellular and molecular mechanism
CO-3	Genetic concept affects broad societal issues
CO-4	Role of genetics in evolution – bioethics and IPR
CO-5	Role of genetic technology in industry related to biotechnology.

Semester: IV

Life Sciences-I (Botany) (Paper code: S-485 (N-12)) (Honours-I)

Course Outcomes	<i>The students taking up this course of B.Sc. with Life Sciences-I (Botany) (Honours-I) as a special subject of study receive the following outcomes:</i>
CO-1	Knowledge of plant diversity in terms of structure, function and environmental relationship.
CO-2	Evaluation of plant diversity.
CO-3	Anatomy and taxonomy of flora of M.P. to understand and prevent loss of biodiversity.
CO-4	Plant physiology – hands-on lab experiments, project activities which will develop research skills and foster global competence.
CO-5	Role of plants in functioning of global ecosystem - create sustainable environment.

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Semester: IV

Plant and Environmental Biotechnology (Paper code: S-486 (R-19)) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Plant and Environmental Biotechnology (Honours-II/Subsidiary) as a special subject of study receive the following outcomes:</i>
CO-1	Knowledge of tissue culture technique and its application
CO-2	Plant tissue culture techniques and its importance in plants
CO-3	Genetic manipulation of plant using plant transformation technology
CO-4	Use of environmental biotechnologies to remediate environmental problems such as climate change, global warming, waste water treatment.
CO-5	Environment management- bioremediation, biological control, biodegradation and xenobiotics.

Semester: V

Life Sciences –II (Zoology) (Paper code: S-585 (R-18)) (Honours-I)

Course Outcomes	<i>The students taking up this course of B.Sc. with Life Sciences – II (Zoology) (Honours-I) as a special subject of study receive the following outcomes:</i>
CO-1	Acquire knowledge of taxonomy and understand international rules of zoological nomenclature.
CO-2	Conceptual knowledge of animal diversity (invertebrate and vertebrate) and its modern concept
CO-3	Basic concepts of developmental biology and use of modern artificial reproductive technologies (ART)
CO-4	Knowledge of eras and evolution of species for sustainable development.
CO-5	Basic characterization and physiological and biochemistry of organ system to enhance knowledge and research skills.

Semester: V

Immunology and Animal Tissue Culture (Paper code: S-586 (R-18))

(Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Immunology and Animal Tissue Culture (Honours-II/Subsidiary) as a special subject of study receive the following outcomes:</i>
CO-1	Acquire knowledge about immunology and human diseases and their clinical know-how.
CO-2	Humoral and cell mediated immunity- advanced techniques like monoclonal and polyclonal antibodies.
CO-3	Role of immune cells and antigen-antibody interaction- use of modern scientific research techniques.
CO-4	Knowledge of immunodiagnostic method like RIA, FIA and ELISA - career opportunities.

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CO-5	To comprehend the fundamental concept of animal cell culture and its application in biotechnology.
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Semester: VI

Bioprocess and Industrial Biotechnology (Paper code: S-685 (N-14)) (Honours-I)

Course Outcomes	<i>The students taking up this course of B.Sc. with Bioprocess and Industrial Biotechnology (Honours-I) as a special subject of study receive the following outcomes:</i>
CO-1	Understanding about biological and biochemical technology and their application in industry.
CO-2	Focus on biological product with the understanding of parts and functioning of bioreactors – marketable skills
CO-3	The design and operation of industrial practices- career opportunities
CO-4	Acquires knowledge of Intellectual property provision.
CO-5	Able to appraise and conduct practice-based tasks related to bioprocessing using entrepreneurship skills

Semester: VI

Genetic Engineering (Paper code: S-686 (N-14)) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of B.Sc. with Genetic Engineering (Honours-II/Subsidiary) as a special subject of study receive the following outcomes:</i>
CO-1	Understand role of enzymes required for gene manipulation in biotechnology.
CO-2	Learn modern and advanced techniques like PCR, Blotting, mapping, sequencing and preparation of recombinant DNA molecules.
CO-3	Illustrate molecular markers, mechanism such as RFLP, RAPD, AFLP- inculcate research skills among students.
CO-4	Strategize research methodologies employing genetic engineering techniques- extensive hands-on experiences.
CO-5	Serves as a platform for more advanced cutting-edge technologies.

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Programme: BSc (Honours) Biotechnology

Mapping of COs with PSOs for Semester-I

Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
Paper Title: Biochemistry and Metabolism Paper Code: MJS-186	CO1	✓									
	CO2			✓							
	CO3									✓	
	CO4										✓
	CO5							✓			

Mapping of COs and PSOs for Semester-I

Paper Title: General Microbiology Paper Code: MNS-186	CO1			✓							
	CO2	✓									
	CO3							✓			
	CO4									✓	
	CO5					✓					

Mapping of COs and PSOs for Semester-I

Paper Title: Ecology and Environment Management Paper Code: GES-185	CO1	✓									
	CO2					✓					
	CO3										✓
	CO4									✓	
	CO5			✓							

Mapping of COs and PSOs for Semester-II

Paper Title: Cell Biology Paper Code: MJS-285	CO1		✓								
	CO2								✓		
	CO3						✓				
	CO4					✓					
	CO5										✓

Mapping of COs and PSOs for Semester-II

Paper Title: Cell Biology Paper Code: MNS-286	CO1		✓								
	CO2								✓		
	CO3						✓				
	CO4					✓					
	CO5										✓

Mapping of COs and PSOs for Semester-II

Paper Title: Biofertilizer Technology Paper Code: GES-285	CO1	✓									
	CO2					✓					
	CO3				✓						
	CO4					✓					
	CO5							✓			

Department of Biotechnology

Mapping of COs with PSOs for Semester-III

Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
Paper Title: Bioinformatics and Biostatistics Paper Code: S-385 (R-18)	CO1			✓							
	CO2	✓									
	CO3			✓							
	CO4								✓		
	CO5						✓				

Mapping of COs and PSOs for Semester-III

Paper Title: Genetics Paper Code: S-386 (R-18)	CO1	✓									
	CO2		✓								
	CO3										✓
	CO4				✓						
	CO5	✓									

Mapping of COs and PSOs for Semester-IV

Paper Title: Life science-I Botany Paper Code: S-485 (N-12)	CO1	✓									
	CO2			✓							
	CO3							✓			
	CO4									✓	
	CO5							✓			

Mapping of COs and PSOs for Semester-IV

Paper Title: Plant and environmental Biotechnology Paper Code: S-486 (R-19)	CO1	✓									
	CO2		✓								
	CO3				✓						
	CO4									✓	
	CO5										✓

Mapping of COs and PSOs for Semester-V

Paper Title: Life Sciences II - Zoology Paper Code: S-585 (R-18)	CO1	✓									
	CO2					✓					
	CO3						✓				
	CO4									✓	
	CO5								✓		

Mapping of COs and PSOs for Semester-V

Paper Title: Immunology and Animal Tissue Culture Paper Code: S-586 (R-18)	CO1			✓							
	CO2						✓				
	CO3								✓		
	CO4							✓			
	CO5										✓

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Mapping of COs with PSOs for Semester-VI


Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
Paper Title: Bioprocess and Industrial biotechnology Paper Code: S-685 (N-14)	CO1	✓									
	CO2							✓			
	CO3							✓			
	CO4				✓						
	CO5				✓						

Mapping of COs and PSOs for Semester-VI

Paper Title: Genetic engineering Paper Code: S-686 (N-14)	CO1	✓									
	CO2		✓								
	CO3								✓		
	CO4						✓				
	CO5					✓					


 24/03/2021
 (IQAC Coordinator)


 (Convenor, Academic Committee)


 (HOD, Biotechnology)

संयोजक
 अकादमिक समिति
 उच्चशिक्षा उत्कृष्टता संस्थान
 भोपाल

विभागाध्यक्ष
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 (Dr Pragyesh Kumar Agarwal)

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