



Prospectus B.Sc. (Research) Biotechnology

**Department of Life Sciences
School of Natural Sciences
Shiv Nadar University
Gautam Buddha Nagar
UP-201314**

B.Sc. (Research) Biotechnology

Overview

The Department of Life Sciences at Shiv Nadar University imparts teaching and research that expand knowledge of biology and biotechnology. By introducing undergraduate students through B.Sc. (Research) Biotechnology program to the fundamentals and advances of biology, the Department prepares students with in-depth and wide knowledge related to biology and applications, as well as the next generation of scholars and teachers. The Department's teaching and research fields of specialization include Biochemistry, Bacteriology, Cell biology, Cell signalling, Molecular biology, Genetics, Neuroscience, Parasitology, Plant science, Virology and Bioinformatics. Several faculty members have interdisciplinary research interests in Chemistry, Physics and Engineering. The overall aim of the Biotechnology Major program is to effectively engage students in learning, enhance their problem solving skills, to get deeper understanding of the discipline.

Program outcomes:

- Apply knowledge of biology fundamentals and biotechnology specialization to the solution of complex biology questions.
- Skills to design and conduct appropriate experimentation, analyze and interpret data, and use rationale judgement to draw conclusions.
- An ability to apply biotechnology to produce solutions for public health and welfare.
- Acquire skills and knowledge of bioethics, biosafety and environmental norms.
- Carryout research and write effective scientific reports.
- To function effectively in diverse and multidisciplinary research setups.
- An ability to interact positively with global research and teaching community.

Laboratory Experience

The research going on in the Department of life sciences is multifaceted and interdisciplinary which includes Virology, Oncology, Vascular Biology, Malaria, Bacteriology, Systems and Synthetic Biology, Computational biology, Plant biology, Bioinformatics and Drug discovery. The Department of Life Sciences has state of the art laboratories equipped with advanced instruments like FACS Aria, Fluorescent and Confocal Microscopes, Real time PCR machines and 2D gel electrophoresis. In addition to these there are Biosafety level 2 culture laboratories,

and animal and bacterial cell culture facilities equipped with Biosafety hoods, incubators, circulating water baths, liquid nitrogen Cylinders, -70°C and -20°C deep freezers.

Research Focus:

B.Sc. (Research) Biotechnology program is research driven and equips students with research experience in academic setup. The program requires each student to engage in a research project for six months to one year in their chosen topic. Students learn to formulate hypothesis, design and performs experiments, analyze data and write scientific reports. Students also have a choice to perform a semester of research in another university/ industry too.

Credit Requirements for Major in Biotechnology

Core Courses: Within the duration of UG program, a student is expected to complete 111 credits of courses, including core and electives.

UWE: Within the duration of UG program, a student is expected to complete a minimum of 18 credits of UWE offered by other departments of science, engineering, and humanities.

CCC: Within the duration of UG program, a student is expected to complete a minimum of 18 credits of CCC courses offered by all the departments of science, engineering, and humanities. A total of 42 credits of combined CCC and UWE must be completed for UG program.

Life Sciences Course Catalog

Course Code	Name of the Course	No. of Credits
I Semester		L:T:P
BIO101	Fundamentals of Computers	2:0:1
CHY111	Chemical Principles	3:1:1
BIO102	Plant Sciences I	2:0:1
BIO103	Animal Sciences I	2:0:1
BIO104	Ecology and Environmental Sciences	2:0:1
MAT020	Basic Calculus	3:1:0
	Total Credits for I semester	21
II Semester		

CHY122	Basic Organic Chemistry I	2:1:1
MAT084	Basic Probability and Statistics	3:1:0
PHY108	Physics for Life	3:0:1
BIO105	Plant Sciences II	2:0:1
BIO106	Animal Sciences II	2:0:1
	Total Credits for II semester	18
III Semester		
BIO201	Cell Biology and Genetics	2:0:1
BIO202	Microbiology	2:0:1
BIO203/PHY255	Biophysics	2:0:1
BIO204	Biochemistry	2:0:1
	Total Credits for III semester	12
IV Semester		
BIO205	Bio-Analytical Techniques	2:0:1
BIO 206	Fundamentals of Molecular Biology	2:0:1
BIO 207	Immunology	2:0:1
BIO 208	Bioinformatics	2:0:1
	Total Credits for IV semester	12
V Semester		
BIO301	Animal Biotechnology	2:0:1
BIO302	Plant Biotechnology	2:0:1
BIO303	Recombinant DNA Technology	2:0:1
BIO 304	Industrial Biotechnology	2:0:1
	Total Credits for V semester	12
VI Semester		

BIO305	Genomics ,Proteomics & System Biology	3:0:0
BIO310	Biology of Infectious Diseases	3:0:0
BIO307	IPR, Patent Laws & Bioethics	3:0:0
Elective1 BIO308	Drug Design and Drug Development *	2:0:1
Elective2 BIO309	Cancer Biology *	3:0:0
Elective3 BIO313	Cell Signaling and Neurosciences*	2:0:1
Elective4 BIO314	Host Pathogen Interaction & Vascular Dysfunction*	2:0:1
	* any one of the elective from the above 4 can be selected	
	Total credits for VI semester	12
VII semester		
BIO401	Research Methodology	3:0:0
BIO402	Internal Project Dissertation	9
	Total Credits for VII semester	12
VIII semester		
BIO403	Project Dissertation	12
	Total Credits for VIII semester	12
	Total course major credits	111
	CCC/ UWE credits	42
	(A minimum of 18 credits of each CCC and UWE are required)	
	Total Credit requirement for B.Sc (Research) Biotechnology	153

***One elective is mandatory for full-filling major degree requirement**

B.Sc. (Research) Biotechnology Program

Learning outcomes of various courses

Semester I

BIO101 Fundamentals of Computers

- (a) Work on linux machines.
- (b) Make programs in PERL.
- (c) Perform sequence analysis of laboratory generated or publically available sequence data.

BIO102 Plant Sciences 1

- (a) Understand and explain the fundamental concepts of plant classification, identification and systematics.
- (b) Use the morphological, anatomical and genetic information to derive phylogenetic relationships or among various plant groups.
- (c) Demonstrate the ability to differentiate various plant-like forms based on their morphology and anatomy.
- (d) Apply the knowledge of plant ecology and economic importance in various biotechnological applications like agriculture, natural products, industry, biomedicine.

BIO103 Animal Sciences 1

- (a) Understand the evolution pattern and importance of different systems in Invertebrates.
- (b) Able to correlate the importance of different physiological processes in invertebrate parasites like malaria, leishmania etc.
- (c) Understand the similarities and differences between invertebrate and vertebrate physiology and anatomy.

BIO104 Ecology and Environmental Sciences

- (a) Obtain an idea about the wild life and conservation methods used.
- (b) Learn the restoration strategies for ecological restoration.
- (c) Learn about Biosphere reserves in India and their detailed method of working.

Semester II

BIO203 Plant Sciences II

- (a) Understand and explain the fundamental concepts of plant metabolism.
- (b) Understand molecular mechanisms of plant development
- (c) Demonstrate ability to differentiate various plant-like forms based on their morphology and anatomy.

Animal Sciences II

- (a) Understand the physiology of cell and tissues.
- (a) Correlate the importance of different physiological processes in invertebrate parasites like malaria, leishmania etc.

- (b) Understand the similarities and differences between invertebrate and vertebrate physiology and anatomy.

Semester III

BIO201 Cell Biology and Genetics

- (a) Discuss and attempt solving problems in most of the basic and advanced topics in Cell Biology and basics of Genetics.
- (b) Conduct basic experiments pertaining to cell biology.

BIO202 Microbiology

- (a) Identify key concepts and skills that are central to microbiology
- (b) Acquired skills for basic microbiology experiments
- (c) Development of scientific competency that would have enduring and lasting value beyond the classroom and laboratory.

BIO204 Biochemistry

- (a) Define the structure and role and importance of biological molecules.
- (b) Describe the major concepts of Biochemistry.
- (c) Student develop skills perform and demonstrate biochemical assays.

Semester IV

BIO205, Bioanalytical Techniques

- (a) Students will be able to learn bioanalytical techniques principles.
- (b) Students can understand and operate standard laboratory equipment.
- (c) Student develop skills perform and demonstrate biochemical assays.

BIO206, Fundamentals of Molecular Biology

- (a) Able to understand molecular mechanisms of replication, transcription, regulation of gene expression and translation.
- (b) Applications of recombinant Gene Technology and its manipulations.

BIO207, Immunology

- (a) Familiarize with basic concepts of immunology.
- (b) Ability to differentiate function of immune system and basic immune cell types.

Semester V

BIO301, Animal Biotechnology

- (a) Understand the application of all the molecular approaches in animal system.
- (b) Learn basics and hands on learning about *in vitro* Cell and tissue culture.

BIO302 Plant Biotechnology

- (a) Understand and explain the fundamental concepts of the plant regeneration and tissue culture and its role in crop improvement.
- (b) Use the available molecular tools to design strategies for genetic improvement of crops and non-crop plant species.

- (c) Demonstrate ability to think analytically by analysing different experimental conditions and creating set of conditions to validate the outcomes.

BIO303 Recombinant DNA Technology

- (a) Design the strategy of making a recombinant DNA
- (b) Make a recombinant DNA for further processing like expressing a recombinant protein, genome editing etc.
- (c) Make genetically modified organisms.
- (d) Design synthetic biological circuits.

BIO304, Industrial Biotechnology

- (a) Acquire skills in basic industrial techniques producing commercially important products.
- (b) Develop the qualities and transferable skills necessary for their employment in biotechnology sector

Semester VI

BIO305 Genomics, Proteomics & System Biology

- (a) Understand advanced techniques such as Next Generation Sequencing and
- (b) Learns proteomics such as mass spectrophotometer, 2D electrophoresis etc.,

BIO306 Biology of infectious diseases

- (a) Will understand the biology behind infection, pathogenesis and role of innate immune and adaptive immune system in infectious diseases.

Semester VII & VIII

Internal or external research project

- (a) Learn formulate hypothesis, design and performs experiments, analyze data and write scientific report.
- (b) Can make significant contribution for a journal article.

Minor in Biotechnology

The Department of Life Sciences is offering a minor degree to students pursuing various major degrees across university. The department has 10 seats reserved for students opting for a minor degree. The criteria for selection of students for a minor will be based on the overall CGPA and followed by an interview by the departmental committee.

For getting a minor degree the students have to complete a minimum of 21 credits in Life Science department, which includes some compulsory course work and some optional course work. The four compulsory courses have to be completed by each student to receive the Minor degree. Apart from these each student is required to take a minimum of three optional courses.

Each student opting for a minor degree has to pass in all the compulsory courses. The compulsory courses are as listed below:

CODE	Course Name	Credits
BIO 201	Cell Biology and Genetics	3
BIO 202	Microbiology	3
BIO 204	Biochemistry	3
BIO 206	Fundamentals of Molecular Biology	3

All courses offered to B.Sc. (Research) in Biotechnology Major Students in the II, III, IV, V and VI semesters can be taken as optional courses for the Minor degree. For details please see B.Sc. (Research) Biotechnology syllabus.

The minimal credit requirement for a minor in biotechnology is 21 credits, out of which 12 credits are from compulsory courses

For queries please contact:

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