Department of Biotechnology

Dr. Harisingh Gour Vishwavidyalaya, Sagar

Scheme of M.Sc. Program in Biotechnology under CBCS System

Objectives and Learning Outcomes of M.Sc. Biotechnology

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	I	BIT CC 121	Cell Biology	Mid Sem 40 End Sem 60	04

Course Objectives: The major objective of this paper is to build a strong foundation in the cell structure and function of both types of cells including prokaryotic and eukaryotic cells, general structure of cells, techniques of cell biology, cell signaling and cell division.

Course Learning Outcomes: Upon successful completion of the course, the student:
Unit 1: Will be able to describe the ultra structure and function of Cell organelles in prokaryotic and eukaryotic cells.
Unit 2: Will get knowledge about the general Techniques in cell biology including, microscopic techniques cytochemical methods.
Unit 3: Will get an in depth knowledge about the Cellular Energy Transactions and pathway involved such as Glycolysis, Kreb's cycle and role of mitochondria and chloroplast, peroxisomes.
Unit 4: Will get an understanding about the mechanisms of signal transduction, cell surface and intracellular receptors, classes of cell surface receptors.
Unit 5: Will understand concept of various cell division, Cell cycle- steps and control of cell cycle.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	I	BIT CC 122	**Biochemistry**	Mid Sem 40 End Sem 60	04

Course Objectives: The main objective of this paper is to apply concepts and principles of biochemistry, importance of carbohydrates, nucleic acids and lipids. Major properties and structures of macromolecules.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be able to understand Nucleotides, DNA, RNA Structure, types and functions Chromosome organization & histone proteins.

Unit 2: Attains knowledge about the classification, structure, properties and major functions of carbohydrates and lipids.

Unit 3: Will have gained insight on amino acids and proteins. How these are necessary for various body functions. Also they will gain concepts about the uses of amino acids and proteins.

Unit 4: Will get an understanding about the Enzymes and their classification, Vitamins and cofactors, Mechanism of enzyme action

Unit 5: Will understand concept various anabolic reactions including photosynthesis, glycogen metabolism in details.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	I	**BIT OE 126**	**Scientific Writing and Presentation**	Mid Sem 40 End Sem 60	02

Course Objectives: Students will be able to understand the techniques for scientific literature searching and scientific writing as well as PowerPoint presentation. The students should be able to read, interpret and present scientific data.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be able to learn Searching and reviewing scientific articles

Unit 2: Will get knowledge about the Art of scientific presentations. PowerPoint presentations

Unit 3: Will have gained insight on Making Posters. Presenting a poster in record time

Unit 4: Will get an understanding on dissertation writing method

Unit 5: Will understand Reading - understand scientific texts in science.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	I	**BIT SE 127**	**Bioentrepreneurship**	Mid Sem 40 End Sem 60	04

Course Objectives: To teach students about concepts of entrepreneurship including identifying a business opportunity in the area of biotechnology through resource generation and launching a biotech business, growing and nurturing the organization as well as harvesting the rewards. The course is discussion and experimental based.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be able to learn about Introduction to bioentrepreneurship and advantages of being entrepreneur.

Unit 2: Will get knowledge about the Innovation – types, out of box thinking

Unit 3: Will have access to Industry visits to successful biotech-enterprises

Unit 4: Will get an understanding on Business Strategy

Unit 5: Will understand business feasibility analysis by SWOT

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	**Biotechnology**	II	BIT CC 221	**Molecular Biology**	Mid Sem 40 End Sem 60	04

Course Objectives: To teach students the fundamentals of central dogma, gene expression, in-depth knowledge of various mechanism involved in regulation.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be able to understand the Flow of genetic information, anatomy of gene structure and genome organization.
Unit 2: Will get the advanced concept of DNA replication and regulation in the prokaryotes and eukaryotic cells as well as DNA damage and repair mechanism.
Unit 3: Will gain detailed insight transcription, and their regulation in the prokaryotes and eukaryotic cells.
Unit 4: Will get an understanding of protein translation mechanism in cells, its regulation mechanism and various mechanisms involved in the protein folding.
Unit 5: Will understand the details mechanism of the control of gene expression in the living cells.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	**Biotechnology**	II	BIT CC 222	**Bioinstrumentation & Bioinformatics**	Mid Sem 40 End Sem 60	04

Course Objectives: The major objective of this course is to provide training in sophisticated instrumentation and bioinformatics and biostatistics techniques. Students will be trained in instrumentation, bioinformatics tools as well as use of bioinformatics in biological studies..

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Be familiar with the microscopy principles involved in various types of microscopy and their applications.
Unit 2: Acquires knowledge about centrifugation, chromatography and characterization of proteins and enzyme
Unit 3: Will gain detailed information and instrumentation principle of spectroscopy .
Unit 4: Will get an understanding of Introduction of biostatistics, types of data, types of variables, tabulation of data and its graphical representation,
Unit 5: Know about variety of databases information available for alignment various aspects of macromolecules structure and function. Role of bioinformatics tools in gene analysis and optimization of bioprocess.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	**Biotechnology**	II	BIT CC 223	**Immunology**	Mid Sem 40 End Sem 60	04

Course Objectives: To introduce the students to the basics of immunology. The course will provide an overview of coordinated functioning of immune organs, cells and cytokines to protect the body from infections. The course also introduces student to the basics of immune tolerance and autoimmunity.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Be familiar with immune system. Innate immunity, innate immune cells and mechanism.
Unit 2: Acquires knowledge about Antigen capture and presentation: major histocompatibility complex (MHC) and its classification, processing and presentation of antigen proteins.
Unit 3: Will gain detailed information Antigen and Antibody structure, types of antibodies and function, production of diverse and B cell, T Cell maturation process.
Unit 4: Will get an understanding of T-cell activation mechanism, clonal expansion and development of memory T cells, helper T cells and cytotoxic T cells, B cell activation mechanism.
Unit 5: Will Know about Immune regulation and their significance and mechanisms, autoimmunity and hypersensitive response

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	**Biotechnology**	III	BIT CC 321	**Animal Biotechnology**	Mid Sem 40 End Sem 60	04

Course Objectives: Animal Biotechnology is fast growing area, therefore knowledge of DNA technology, cell, tissue, organ and embryo culture, transgenic animals, knock-out, knock-in and gene editing, functional genomics will help students for future Endeavour. The students should be able to analyze and comprehend the requirement and principles of animal cell and tissue culture.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be familiar with the Animal cell and tissue culture, Equipments and materials for animal cell culture technology as well as scaling up of monolayer and suspension cultures.

Unit 2: Will acquires knowledge about Primary culture, Subculture, Cell lines, their maintenance, large scale cell culture and their applications,

Unit 3: Will gain detailed information Organ culture, *In-vitro* fertilization, artificial insemination and embryo transfer as well as Animal cloning Methods and applications.

Unit 4: Will get an understanding of Transgenic animals and Production methods, their commercial applications as well as Regulation of GE animals.

Unit 5: Will know about various aspects of Gene therapy, Aquaculture: Animal biodiversity and Animal Genetic Resources (AnGR), Intellectual Property Rights (IPR) and Patents

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	III	BIT CC 322	Plant Biotechnology & Genetic Engineering	Mid Sem 40 End Sem 60	04

Course Objectives: To familiarize the students about the fundamentals of plant biotechnology and their applications with various approaches to conduct plant genetic engineering will help for future career in biological research as well as in biotechnology industries. The students would be able to make changes at the genetic level of organisms for the development of novel genetically modified organisms.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be familiar with principle and various methods, techniques of plant tissue culture.
Unit 2: Will acquires knowledge about various types of cloning vectors used in the genetic engineering as well as cloning methods of the genes.
Unit 3: Will gain detailed information on various methods of genetic transformation of the plant cells.
Unit 4: Will get an understanding of *Agrobacterioum* mediated transformation of plant.
Unit 5: Will gain the knowledge on the DNA sequencing, GM crops and regulation as well as IPR and Patents regulation.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	III	BIT CC 322	Plant Biotechnology & Genetic Engineering	Mid Sem 40 End Sem 60	04

Course Objectives: To familiarize the students about the fundamentals of plant biotechnology and their applications with various approaches to conduct plant genetic engineering will help for future career in biological research as well as in biotechnology industries. The students would be able to make changes at the genetic level of organisms for the development of novel genetically modified organisms.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be familiar with principle and various methods, techniques of plant tissue culture.
Unit 2: Will acquires knowledge about various types of cloning vectors used in the genetic engineering as well as cloning methods of the genes.
Unit 3: Will gain detailed information on various methods of genetic transformation of the plant cells.
Unit 4: Will get an understanding of *Agrobacterioum* mediated transformation of plant.
Unit 5: Will gain the knowledge on the DNA sequencing, GM crops and regulation as well as IPR and Patents regulation.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	III	BIT CC 323	**Bioprocess Engineering and Technology**	Mid Sem 40 End Sem 60	04

Course Objectives: The course is designed to introduce students to Bioprocessing with emphasis on importance of microbes in bioprocessing, growth of these microbes, fermentation, downstream processing, and applications of bioprocessing and effluent treatment.
The student would be able to demonstrate the ability to conceptualize various aspects that are involved in bioprocessing. The ability to understand important aspects of bioprocessing such as isolation of industrially important microbes and their preservation, fermentation, product isolation, effluent treatment, scope and economics of bioprocessing plant.

Course Learning Outcomes: Upon successful completion of the course, the student:

Unit 1: Will be familiar with the principle of bioprocess engineering, Isolation, preservation and maintenance of industrial microorganisms.
Unit 2: Will acquires knowledge about Fermentation, Design and construction of fermenter, and Types of bioreactor.
Unit 3: Will gain detailed information on downstream cell disruptions, liquid-liquid extraction, membrane process, drying and crystallization.
Unit 4: Will get an understanding of Enzyme immobilization and their industrial applications
Unit 5: Will gain the knowledge on the Effluent Treatment, Plant design and economics, Cost of production.

Department of Biotechnology						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc	Biotechnology	IV	**BIT CC 421**	**Semester Long Dissertation/Project Work/Practical Training/Field Work, and Technical Writing**:	Periodic assessment 40 Final evaluation 60	12
Course Objectives: To provide students to conceptualize, design, plan and performed a short term research project. Course Learning Outcomes: Upon successful completion of the course the student should be able to answer a research questions.						