Government of Karnataka

NATIONAL EDUCATION POLICY 2020

CURRICULUM CONTENTS
IN
BIOTECHNOLOGY
2023-24

Undergraduate Course
B.Sc., (Basic/Honors)
5th and 6th Semester

Davangere University
Shivagangothri
Davangere-577007

04/23

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SEMISTER-V										
Category	**Course Code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (hours)**
			IA	SEE	TOTAL	L	T	P		
DSC	5TBTC105.1	Plant Biotechnology	40	60	100	4	-	-	4	2
	5TBTC105.2	Plant Biotechnology(Practical)	25	25	50	-	-	4	2	3
	5TBTC105.3	Genetic Engineering	40	60	100	4	-	-	4	2
	5TBTC105.4	Genetic Engineering (Practical)	25	25	50	-	-	4	2	3

SEMISTER-VI										
Category	**Course Code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (hours)**
			IA	SEE	TOTAL	L	T	P		
DSC	6TBTC105.1	Medical Biotechnology	40	60	100	4	-	-	4	2
	6TBTC105.2	Medical Biotechnology(Practical)	25	25	50	-	-	4	2	3
	6TBTC105.3	Immunology	40	60	100	4	-	-	4	2
	6TBTC105.4	Immunology (Practical)	25	25	50	-	-	4	2	3

ಅಧ್ಯಕ್ಷರು
ಅಧ್ಯಯನ ಮಂಡಳಿ
ಜೈವಿಕ ತಂತ್ರಜ್ಞಾನ ಅಧ್ಯಯನ ವಿಭಾಗ
ದಾವಣಗೆರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ-577007

Registrar
Davangere University
Shivagangotri, Davangere.

DEAN

Dr. RAMALINGAPPA
Professor and Dean,
Faculty of Science & Technology
Davangere University Shivagangothri
DAVANGERE - 577 007

B.Sc. Biotechnology 5th Semester

Program Name	**B.Sc. Biotechnology**		Semester	**5th Semester**
Course Title	**Plant Biotechnology (Theory + Practical)**			
Course Code:	**BTC5**		No. of Theory Credits	**04**
Contact hours	**60hrs**		Duration of ESA/Exam	**02 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives

1. To understand the fundamental aspects of plant tissue culture.
2. Learn about biotechnological tools and techniques used in plant research and agriculture.
3. Explore methods of introducing foreign genes into plants through transformation techniques.
4. Gain practical skills in plant tissue culture for plant improvement and propagation.
5. To understand the concepts of modern technology pertaining to large-scale production of agricultural products and evaluate several methods for stable and transient plant transformation.
6. Design strategies for plant genetic manipulation against biotic and abiotic stressors.
7. Hypothesize strategies to increase plant yield and fruit/seed quality.

Course Outcomes:

After completing this course, the student is expected to learn the following:

1. Demonstrate a comprehensive understanding of plant biology, physiology, genetics, and molecular biology.
2. Apply biotechnological tools and techniques used in plant research and agriculture, such as plant tissue culture, genetic engineering and transgenics.
3. Execute plant tissue culture techniques for callus induction, somatic embryogenesis, and micropropagation, and apply them in plant breeding and propagation.
4. Perform plant transformation methods and demonstrate the ability to introduce foreign genes into plants using different techniques.
5. Utilize molecular markers and genomic approaches for genetic mapping, marker-assisted selection, and plant breeding programs.
6. Apply molecular biology techniques, including PCR, DNA sequencing, and gene expression analysis, to investigate and analyze plant genetic information.
7. Utilize bioinformatics tools and databases to analyze and interpret plant genomic and transcriptomic data.
8. Apply knowledge about ethical considerations and regulatory frameworks associated with plant biotechnology and genetically modified crops.
9. Apply acquired knowledge and problem-solving skills to address real-world challenges in agriculture, food security, and environmental sustainability using plant biotechnology approaches.

Content of Theory	60 hrs
Unit–I – Plant Tissue culture	**15**
Introduction, history, definition, hypothesis, and concept of totipotency. Principles of plant tissue culture, types of culture, morphogenesis, differentiation, callus, direct and indirect organogenesis. In vitro propagation and micropropagation, Seed culture, embryo culture, bud culture, limitations, applications in horticulture, agriculture, and forestry. Meristem culture, Somaclonal variation. Commercial micropropagation of Banana and Sugarcane. Haploid Production, Anther culture, Pollen culture, Ovary culture, Ovule culture - technique, limitations, and applications. Protoplast culture, Somatic hybridization, cybrids.	
Unit -II *In vitro* secondary metabolite production	**20**
Introduction to secondary metabolites, major secondary metabolites, and applications. *In vitro* secondary metabolite production, Suspension cultures, cell cultures, root cultures, hairy root cultures, growth Vs secondary metabolite production, yield enhancement, elicitation, biotransformation, bioreactors and scaling up of secondary metabolite production, limitations, and applications. Case studies of Shikonin and root cultures of *Panax ginseng.*	
Unit -III Transgenic Plants	**15**
Introduction to Transgenic Plants. Overview of transgenic plants and their significance in agriculture. Historical background and development of plant genetic engineering. Benefits and controversies associated with transgenic plants. Transgenic Plant Technology - Techniques for introducing foreign genes into plants: Agrobacterium-mediated transformation, biolistics, and other methods. Selection and screening of transformed plants. Molecular markers and reporter genes used in transgenic plant research. Transgene Integration and Expression. Mechanisms of transgene integration into plant genomes. Factors influencing transgene expression: promoters, enhancers, and regulatory elements. Methods for analyzing and verifying transgene expression. Applications of Transgenic Plants - Improved crop traits through genetic engineering: pest resistance, herbicide tolerance, disease resistance, and abiotic stress tolerance. Case studies of commercially important transgenic crops.	
Unit -IV Biosafety and Regulatory Considerations	**10**
Safety assessment of transgenic plants: potential risks and benefits. International regulatory frameworks for releasing and commercializing genetically modified organisms (GMOs). Public perception and consumer acceptance of transgenic plants. Ethical considerations of genetic engineering in plants. Socio-economic impacts of transgenic crops on farmers and agricultural systems. Intellectual property rights and access to transgenic technologies. Emerging trends and technologies in plant biotechnology - genome editing (CRISPR-Cas9) and RNA interference (RNAi)	

Pedagogy: Lectures, Seminars, Industry Visits, Debates, Quiz, and Assignments. Case studies highlight successful applications and challenges in transgenic crop development. Group discussion and critical analysis of scientific papers related to transgenic plants.

Summative Assessment = 60 Marks	
Formative Assessment Occasion/ type	**Weightage in Marks**
Attendance	10
Seminar	10
Debates and Quiz	10

Test	10
Total	**60 marks + 40 marks = 100 marks**

Course Title	**Plant Biotechnology**	Practical Credits	**2**
Course No./ **Course Code:**	BTC5–P	Contact hours	**60 hrs**

Content of Practical

1. Laboratory organization of basic and commercial plant tissue culture
2. Media preparation (MS, B5), solid media preparation, and Liquid media preparation
3. Explant preparation – Leaf, bud, rhizome, and meristem
4. Callus culture- Initiation and establishment of different types of callus cultures
5. Micropropagation – Stage 0. 1, 2, 3, and 4
6. Acclimatization and hardening techniques
7. Anther culture and pollen culture
8. Ovary and Ovule culture
9. Isolation and culture of Protoplast
10. Staining, cell viability, and cell count of cell cultures
11. Hairy root culture by Agrobacterium rhizogenic transformation

Practical Assessment

Assessment

Formative Assessment		**Summative Assessment**	**Total Marks**
Assessment Occasion/ type	**Weightage in Marks**	**Practical Exams**	
Record	05	25	50
Test	10		
Attendance	05		
Performance	05		
Total	**25**	**25**	

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B.Sc. Biotechnology 5th Semester

Program Name	**B.Sc. Biotechnology**		Semester	**5th Semester**
Course Title	**Genetic Engineering (Theory + Practical)**			
Course Code:	BTC6–T	No. of Theory Credits		**04**
Contact hours	**60hrs**	Duration of ESA/Exam		**02 Hours**
Formative Assessment Marks	**40**	Summative Assessment Marks		**60**

Course Objectives

1. Understand the fundamental principles and techniques of genetic engineering.
2. Explore the applications of genetic engineering in agriculture, medicine, biotechnology, and environmental science.
3. Develop practical skills in genetic engineering techniques and laboratory procedures.
4. Gain knowledge of gene expression regulation and genetic modification methods.
5. Analyze and interpret genetic data using bioinformatics tools.
6. Enhance critical thinking and problem-solving skills through discussions and case studies.
7. Stay updated on emerging trends and advancements in genetic engineering.

Course Outcomes:

1. Demonstrate a thorough understanding of the fundamental principles and techniques of genetic engineering.
2. Apply the knowledge of genetic engineering to diverse applications in agriculture, medicine, biotechnology, and environmental science.
3. Perform laboratory procedures and develop practical skills in genetic engineering techniques. CO4: Explain gene expression regulation mechanisms and apply genetic modification methods effectively.
4. Analyse and interpret genetic data using bioinformatics tools for a comprehensive understanding of gene function and evolutionary relationships.
5. Evaluate genetic engineering's ethical, social, and legal implications and propose responsible solutions.

6. Stay updated with recent advancements in genetic engineering, critically evaluate emerging trends, and assess their potential impact on various fields.

Content of Theory	60 hrs
Unit I- Fundamentals of Genetic Engineering	**15**
Introduction to Genetic Engineering - Definition, scope, and historical overview of genetic engineering. Importance and applications in various fields. **DNA Structure and Manipulation** - Structure and organization of DNA molecules. Techniques for DNA isolation and purification. Methods for quantification and characterization of DNA samples. **RNA Analysis and Gene Expression-** Types and functions of RNA molecules. Methods for RNA isolation and purification. Analysis of gene expression using techniques such as Northern hybridization. Introduction to Polymerase Chain Reaction (PCR) and its variants for gene expression analysis **Recombinant DNA technology** – Introduction to molecular cloning. Overview of cloning vectors. Plasmids, phage, cosmid, BAC, and YAC. Features and applications of cloning vectors in genetic engineering. Enzymes used in recombinant DNA technology: Restriction endonucleases, DNA modifying enzymes, other nucleases, Polymerases, Ligase, kinases, and phosphatases. Techniques for molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems.	
Unit II- Practices in Genetic Engineering	**15**
Unit 2: Techniques - Protein Expression and Purification. Techniques for expressing recombinant proteins using bacterial, animal, and plant expression systems. Strategies for protein purification and characterization **Gene Manipulation Techniques** - Methods of gene delivery. Physical, chemical, and biological methods. transformation, transfection, electroporation, and micro-injection. Gene knockout techniques in bacterial and eukaryotic organisms. **Genome Editing** - Introduction to genome editing techniques- Principles and applications of genome editing techniques. CRISPR-Cas9, site-directed mutagenesis, and other genome editing methods.	
Ethical and Regulatory Considerations - Discussion of ethical implications associated with genetic engineering. Introduction to regulatory guidelines and safety considerations for genetic engineering research and applications	
Unit III- Applications of Genetic Engineering	**15**
Introduction to Applications. Overview of the diverse applications of genetic engineering. Gene therapy and its potential in treating genetic disorders. Strategies for gene delivery in therapeutic applications. Diagnostic Applications. DNA fingerprinting and its applications in forensics. Molecular diagnostic techniques and their role in disease diagnosis. Use of genetic engineering in the development of therapeutics and vaccines. Production of biopharmaceuticals using recombinant DNA technology. Crop Improvement and Biotechnology in Agriculture. Genetic engineering for crop improvement, including enhanced traits and disease resistance. The role of biotechnology in sustainable agriculture.	

Unit IV- Advances in Genetic Engineering	**15**
Industrial Applications. Industrial applications of genetic engineering, such as enzyme production, biofuel production, and bioremediation. Scale-up techniques and process optimization in industrial settings. Introduction to synthetic biology and its integration with genetic engineering. Design and construction of artificial biological systems Bioinformatics and Computational Tools. Introduction to bioinformatics and its role in genetic engineering. Use of computational tools for sequence analysis, gene prediction, and protein structure analysis.	

Pedagogy: Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

Summative Assessment = 60 Marks	
Formative Assessment Occasion/ type	**Weightage in Marks**
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	**60 marks + 40 marks = 100 marks**

Course Title	**Genetic Engineering**	Practical Credits	**02**
Course No./ **Course Code:**	BTC6–P	Contact hours	**60 hrs**
Practical			

1. **Introduction to Laboratory Techniques -** Safety guidelines and laboratory protocols
   Aseptic techniques and proper handling of materials. Basic equipment and instrument operation
   Preparation of reagents and media
2. **Nucleic Acid Extraction and Quantification-** DNA extraction from different sources (e.g., bacteria, plant, animal). RNA extraction and purification methods. Quality assessment and quantification of nucleic acids (spectrophotometry, gel electrophoresis).
3. **Polymerase Chain Reaction (PCR)**
   Primer design and optimization
   PCR setup and cycling conditions
   Agarose gel electrophoresis for PCR product analysis
4. **Cloning and Plasmid Manipulation**
   Restriction enzyme digestion and ligation reactions
   Transformation of bacterial cells with recombinant plasmids
   Colony selection and screening for successful cloning
5. **Protein Expression and Purification**
   Selection of expression system (e.g., bacterial, yeast, insect cells)
   Plasmid construction for protein expression
   Protein expression induction and optimization
   Protein purification techniques (e.g., affinity chromatography, gel filtration)
6. **Gel Electrophoresis and DNA Analysis**
   Agarose gel electrophoresis for DNA fragment separation and analysis
   DNA size determination using molecular weight markers
   DNA band visualization techniques (e.g., ethidium bromide staining, DNA intercalating dyes)
7. **Gene Knockdown and RNA Interference (RNAi)**
   Design and synthesis of small interfering RNA (siRNA)
   Transfection of siRNA into cells for gene knockdown
   Evaluation of gene knockdown efficiency (e.g., qPCR, Western blot)
8. **Genome Editing Techniques**
   Introduction to the CRISPR-Cas9 system and its applications
   Design of guide RNA (gRNA) for target gene editing
   Transfection of CRISPR-Cas9 components into cells
   Analysis of genome editing efficiency (e.g., T7 endonuclease I assay, Sanger sequencing)
9. **Bioinformatics for Genetic Engineering**
   Introduction to bioinformatics databases and tools
   Sequence analysis (e.g., BLAST, multiple sequence alignment)
   Prediction of protein structure and function

Practical Assessment

Assessment

Formative Assessment		**Summative Assessment**	**Total Marks**
Assessment Occasion/ type	**Weightage in Marks**	**Practical Exams**	
Record	05	25	50
Test	10		
Attendance	05		
Performance	05		
Total	**25**	**25**	

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18. Introduction to Genetic Analysis (2020) 12th ed., Griffiths, AJF, Wessler, SR, Carroll, SB, and Doebley, J, W.H. Freeman, ISBN: 978-1319149609.
19. Genetic Engineering: Principles and Methods (2019) 3rd ed., Fowler, MR, CABI, ISBN: 978-1789240605.

B.Sc. Biotechnology 6th Semester

Program Name	B.Sc. Biotechnology		Semester	6th Semester
Course Title	Medical Biotechnology (Theory + Practical)			
Course Code:	BTC7		No. of Theory Credits	04
Contact hours	60hrs		Duration of ESA/Exam	02 Hours
Formative Assessment Marks		40	Summative Assessment Marks	60

Course Objectives

1. To understand the basic aspects of medical biotechnology, pathogenesis of human diseases, disease diagnosis, management, drug discovery, development and Clinical research.
2. To provide an overview of genetic diseases and the diagnostic techniques used in the medical field.
3. This course focuses on the relationship between microbes and human health. Students will study important diseases emphasizing on etiology, pathogenesis, diagnosis, treatment, and prevention.

Course Outcomes:

After completing this course, the student is expected to learn the following:

1. Understanding the basics of genetic information responsible for disease development
2. Understanding the classical and advanced methods used for the diagnosis of various diseases
3. Students will have a clear understanding of microbial diseases, host pathogen interactions, and the issues associated with drug-resistant microorganisms.
4. Students also comprehend the significance of normal flora associated with human health.
5. They will also learn about drug- Receptor interactions, drug toxicology and its pharmacological significance, conducting clinical trials, ethical issues in clinical research and a preliminary idea about artificial intelligence and personalized medicine as highly emerging areas in medical science.

Content of Theory	60 hrs.
Unit I - INTRODUCTION, MICROBIAL DISEASES & DIAGNOSTICS	**15hrs**
Medical Biotechnology: Scope and Importance. **Microbial diseases in humans:** Mode of infection, symptoms, epidemiology and control measures of diseases caused by Viruses (AIDS, Hepatits-B, Rabies) Bacteria (Typhoid, Cholera, TB, Plague), Fungi (Aspergillosis, Histoplasmosis), Protozoa (Malaria, Amoebiasis). Diagnostics: Applications of immunological and molecular diagnostic methods (RIA, ELISA, PCR, and DNA fingerprinting) in forensic science and disease diagnosis. Clinica proteomics - protein microarray for disease diagnosis. Ethics in molecular diagnosis.	
Unit II- CLINICAL RESEARCH AND NANOBIOTECHNOLOGY	**15hrs**

Introduction to clinical research, history of clinical research, and an overview. Importance of Indian and global clinical research, Regulatory agencies. Scope of clinical research. ICH-GCP- History, objectives, structure, guidelines, and future of ICH. Different phases of clinical research. Ethical Issues in clinical research- Introduction, codes, declaration, and guidelines. **Nanobiotechnology:** Preparation of nanomaterials: Mechanical methods (Grinding – high energy ball milling), Physical Methods (Vapor deposition - pulsed laser deposition), Chemical methods (Sol-gel process, Combustion route), Green synthesis (plant and microbial extracts). Applications of nanotechnology: Nano biosensors, Bioremediation, drug and gene delivery, Biochips- analytical devices, disease diagnostics, and cancer therapy Risk potential of nonmaterial.	
Unit III – STEM CELLS AND CANCER BIOLOGY	**15hrs**
Stem cells: Scope, embryonic and adult stem cells, properties, identification, stem cell culture, techniques and their applications in modern clinical sciences, Cancer stem cells, tissue engineering, and regenerative medicine. **Cancer Biology**: Tumors, types of tumors, pre-disposing factors, cellular changes involved in tumor formation, genes associated with cancer (oncogenes and tumor suppressor genes), methods of tumor detection, tumor markers, treatment of cancer-chemo therapy, radiotherapy, immunotherapy, and gene therapy.	
Unit IV- VACCINOLOGY	**15hrs**
History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Introduction to newer vaccine approaches namely- subunit vaccines, synthetic vaccines, DNA vaccines, virus-like particles, recombinant vaccines, plantibodies, edible vaccines, Cancer vaccines, nanoparticles in vaccine delivery systems, benefits, and limitations.	

Pedagogy: Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

Summative Assessment = 60 Marks	
Formative Assessment Occasion/ type	**Weightage in Marks**
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	**60 marks + 40 marks = 100 marks**

Course Title	**Medical Biotechnology**	Practical Credits	**2**
Course No./ **Course Code:**	**BTC7**	Contact hours	**60 hrs**

Content of Practical

1. Bacteriological examination of blood and pus from clinical samples
2. Separation of mononuclear cells by Ficoll hypaque method
3. Haemoglobin estimation using a haemometer
4. Haemagglutination test - Blocd Typing
5. Commercial kits-based diagnosis - Widal test, VDRL test
6. Kirby Bauer's Antibiotic Sensitivity test (bacterial)
7. Molecular genotyping of Human Papilloma Virus using PCR technique
8. Liver Functioning tests – Serum albumin and Serum bilirubin tests
9. Cytological examination of normal and tumorous cells
10. Estimation of serum cholesterol
11. Blood glucose estimation by folin wu method

Practical Assessment

Assessment

Formative Assessment		**Summative Assessment**	**Total Marks**
Assessment Occasion/ type	**Weightage in Marks**	**Practical Exams**	
Record	05	25	50
Test	10		
Attendance	05		
Performance	05		
Total	**25**	**25**	

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B.Sc. Biotechnology Sixth Semester

Program Name	**B.Sc. Biotechnology**		Semester	**6th Semester**
Course Title	**Immunology (Theory + Practical)**			
Course Code:	**BTC8**		No. of Theory Credits	**04**
Contact hours	**60 hrs**		Duration of ESA/Exam	**02 Hours**
Formative Assessment Marks		**40**	Summative Assessment Marks	**60**

Course Objectives:

1. To understand the various aspects of immunity, elicitation of immune responses, factors determining the outcome of immune responses and major players of immunity, relevance between nutritional support and immunity, and immunological techniques.
2. To provide knowledge on essential features of antigens and antibodies and their types and different theories of Antibody formation.
3. To acquire knowledge on types of immunity, phagocytosis, interferons, and the complement system.
4. To explain the concept of hypersensitivity, autoimmunity, and transplantation.
5. To provide knowledge on immune deficiencies and several immunological techniques

Course Outcomes:

At the end of the course, the student should be able to:

1. Demonstrate comprehension of the underlying structure and function of the immune system and related disorders.
2. Demonstrate an understanding of the role of cells and molecules in immune reactions and responses
3. Demonstrate technical skills in immunological tools and techniques
4. Apply the domain-specific knowledge and skills acquired in immunology for innovative therapies and Immunotechnologies
5. Understand the fundamental concepts of immunity, and the contributions of the organs and cells in immune responses.
6. Realize how the MHC molecule's function and host encounters an immune insult.
7. Understand the antibodies and complement system
8. Understand the mechanisms involved in the initiation of specific immune responses
9. Differentiate the humoral and cell-mediated immune mechanisms
10. Comprehend the overreaction by our immune system leading to hypersensitive conditions and its consequences
11. Understand unique properties of cancer cells, immune recognition of tumors, immune evasion of cancers

Content of Theory	60 Hrs
Unit–I Cells and Organs of the Immune System	**15**
Introduction to the Immune System: History of Immunology, Clonal Selection Theory. Defense against pathogenic organisms – viruses, bacteria, fungi. Types of Immunity: first and second line of defense, innate and acquired/adaptive immunity, specificity, diversity, Self and non-self-recognition. Cells of the immune system: Antigen-presenting cells (APCs), Role of B and T-lymphocytes in Humoral immunity and cell-mediated immunity, primary and secondary immune response, Immunization, memory. Organs of the Immune system: Thymus, bone marrow, spleen, Lymph Node, peripheral lymphoid organs	
Unit -II Molecules of the Immune System	**15**
Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). Adjuvants. Antigenicity and Immunogenicity. Affinity and Avidity. B and T cell epitopes, superantigens Immunoglobulins: Classification, structure, and function. Monoclonal and polyclonal antibodies. VDJ Gene Segments and DNA rearrangements. Major histocompatibility complexes: Classification, structure, and function. Antigen processing pathways – Cytosolic and Endocytic Cytokines: Classification and function Complement: Pathways	
Unit -III Antigen-Antibody Reactions and Immunotechniques	**15**
Structure and properties of antigens- iso- and allo-antigens, antigen specificity, haptens, and adjuvants. Biomolecular association, Cross-reactivity, Precipitation, Immunodiffusion reactions: Radial immunodiffusion, Ouchterlony double diffusion, Immunoelectrophoresis. Agglutination: Agglutination reactions. ELISA, ELISpot Assay, RIA. Immunocytochemistry, Fluorescent Techniques, FACS. Hybridoma Technology	
Unit - IV	**15**
Vaccines: Conventional, peptide vaccines, subunit, DNA vaccines. Toxoids, antisera, edible vaccines, plantibodies, ISCOMs, recombinant antibodies, and Cancer vaccines. Transplantation immunology: Phases in graft rejection and immuno-suppressors. Hypersensitivity: Reactions – Types I, II, and III. Delayed Type Hypersensitive Response. Autoimmune Disorders: Systemic and Organ-specific Autoimmune disorders with examples Immunodeficiencies: Primary and secondary immunodeficiencies; acquired immunodeficiency syndrome Cancer and the immune system – immune surveillance, immunological escape, cancer antigens, cancer immunotherapy	

Pedagogy: Lectures, Seminars, Industry Visits, Debates, Quiz and Assignments

Summative Assessment = 60 Marks	
Formative Assessment Occasion/ type	**Weightage in Marks**
Attendance	10
Seminar	10
Debates and Quiz	10
Test	10
Total	**60 marks + 40 marks = 100 marks**

Course Title	**Immunology**	Practical Credits	**02**
Course No.	**BTC8**	Contact hours	**60 hrs**

Content of Practical

1. Hemagglutination of ABO Blood groups
2. Determination of Rh factor
3. Whole Count of WBC using Hemocytometer
4. Cells of the Immune System
5. Radial immunodiffusion
6. Ouchterlony double diffusion
7. ELISA – Demonstrate
8. Serum Immunoelectrophoresis
9. Western Blotting

Practical Assessment			
Assessment			
Formative Assessment		**Summative Assessment**	**Total Marks**
Assessment Occasion/ type	**Weightage in Marks**	**Practical Exams**	
Record	05	25	50
Test	10		
Attendance	05		
Performance	05		
Total	**25**	**25**	

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