KUVEMPU UNIVERSITY
BIOTECHNOLOGY

Bachelor of science (B.Sc.) Semester scheme
Curriculum structure for upgraded programme – 2024-25
In accordance with SEP

Sl. No	Course/ Paper Code	Title of Paper	Subject Category	Teaching hours	Semester end exams	Internal assessment	Total marks	Credits	Examination duration
Semester - 1									
1	BT – MC - I	**Biomolecules and metabolism**	MC – T	03	80	20	100	03	3Hrs
	Practical -1		MC – P	04	40	10	50	02	3 Hrs
Total				**07**	**120**	**30**	**150**	**05**	**--**
Semester - 2									
2	BT –MC - II	**Cell and molecular biology**	MC – T	03	80	20	100	03	3Hrs
	Practical - II		MC – P	04	40	10	50	02	3 Hrs
Total				**07**	**120**	**30**	**150**	**05**	**--**
Semester - 3									
3	BT –MC - III	**Microbial technique, biophysics and biostatistics**	MC – T	03	80	20	100	03	3Hrs
	Practical - III		MC – P	04	40	10	50	02	3 Hrs
4	Elective/ Optional	**Immunology and Immonotechniques** **Genomics and Proteomics**	EL/ OP -1	02	40	10	50	02	2 Hrs
Total				**09**	**160**	**40**	**200**	**07**	**--**
Semester - 4									
5	BT – MC -IV	**Genetic Engineering and Bioinformatics**	MC – T	03	80	20	100	03	3Hrs
	Practical - IV		MC – P	04	40	10	50	02	3 Hrs

6	Elective/ Optional	**Environmental Biotechnology** **Medical Biotechnology and Bionanotechnology**	EL/ OP -2	02	40	10	50	02	2 Hrs
Total				**09**	**160**	**40**	**200**	**07**	**--**
Semester - 5									
7	BT –MC - V	**Plant and Animal Biotechnology**	MC – T	03	80	20	100	03	3Hrs
	Practical - II		MC – P	04	40	10	50	02	3 Hrs
Total				**07**	**120**	**30**	**150**	**05**	**--**
Semester - 6									
8	BT –MC - II	**Bioprocess Technology**	MC – T	03	80	20	100	03	3Hrs
	Practical - II		MC – P	04	40	10	50	02	3 Hrs
9	Project/ Dissertation/ internship			02	40	10	50	02	--
Total				**09**	**160**	**40**	**200**	**07**	**--**
Grand Total				**48**	**840**	**210**	**1050**	**36**	

III Semester B.Sc. Degree (SEP Scheme)
BIOTECHNOLOGY

Program Name	**B. Sc Biotechnology**		Semester	**Third**
Course Title	**Microbial technique, biophysics and biostatistics**			
Course No.	**BT -MC – III T**	**Theory**	No. of Credits	**03**
Contact hours	**48 hrs**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**20**		Summative Assessment Marks	**80**

Unit I **12 Hrs**

Introductory Microbiology, Microscopy and Sterilization techniques:

History and scope. Contribution of Edward Jenner, Antonie Van Leeuewenhoek, Dmitry Ivanovsky, Louis Pasteur and Robert Koch. An outline of Morphology and taxonomy of Microorganisms.

Introduction to Microscopy: Principles of microscopy- resolving power, numerical aperture. Working principle and applications- Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence microscope, Confocal microscope, Electron microscopes- TEM and SEM

Sterilization techniques: Physical- Moist heat, dry heat and Filtration; Radiation- Ionizing and non-ionizing radiation methods; Chemical methods-alcohols, aldehyde, phenols, halogens.

Unit II **12 Hrs**

Microbiological techniques:

Culture Media: Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential and enriched media.

Pure culture methods: Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, Growth curve. Methods of enumeration of microorganisms.

Stains and staining techniques: Types of stains-simple stains, structural stains and differential stains. Principles and procedure of staining techniques - simple, differential and acid fast.

Unit III

Biophysics: **12 hrs**

Definition and scope of Biophysics.

Thermodynamics: Laws of thermodynamics, concept of enthalpy, entropy, and Gibbs free energy. Energy transformations in biological systems. High-energy compounds and group transfer reactions.

Diffusion, osmosis, and active transport, Membrane potential and ion channels.

Viscosity, surface tension, and their role in biological systems.

Unit IV **12 hrs**

Biostatistics:

Collection, classification, tabular representation of data, graphic representation of data.

Measures of central tendency-Meaning and working examples on Mean, Median and Mode.

Measure of dispersion- definition and working examples on Range, Mean deviation, Variance, Standard deviation and Coefficient of variation.

Correlation- Definition, Types and its importance.

Suggested Readings:

1. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
2. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
3. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition, Tata McGraw Hill.
5. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
6. K R Aneja (2023). Experiments in Microbiology, Plant Pathology and Biotechnology, Sixth Edition, New Age International Publishers
7. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
8. Vivek Kumar. 2011. Laboratory Manual of Microbiology. Scientific Publishers, USA.
9. Guyton and Hall, Text book of Medical physiology
10. Lindsay. M. Biga, Text book of anatomy and physiology, 1st Edition, Open stax publishers
11. N. Gautham and V Pattabhi, Biophysics, 2nd Edition, Narasa Publication

Program Name	**B. Sc Biotechnology**		Semester	**Third**
Course Title	**Microbial technique, biophysics and biostatistics**			
Course No.	**BT-MC – III P**	**Practical**	No. of Credits	**02**
Contact hours	**64 hrs**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

1. To study principle and different parts of a compound microscope
2. Preparation of culture media for bacteria, fungi
3. Plating techniques: Spread plate, pour plate and streak plate.
4. Isolation of bacteria by serial dilution technique
5. Isolation of fungi from soil by Warcup method
6. Simple staining of bacterial culture.
7. Differential staining technique of bacterial culture.
8. Lactophenol cotton blue staining of fungi
9. Bacterial cell motility - hanging drop technique
10. Determination of quality of milk sample by methylene blue reduction test.
11. Diffusion of Methylene Blue in Agarose
12. Solving of Biostatistics problems

Model Practical Examination Scheme
B.Sc. Biotechnology
PRACTICAL: III
III-SEMESTER (**Microbial technique, biophysics and biostatistics**)

(Formative Assessment Marks: 10; Summative Assessment Marks: 40)

Time: 3 Hrs **Max Marks: 40**

Q1. Conduct any one of the following experiment **15 M**

a.

b.

c.

Scheme of Valuation

- Writing Principle -3M
- Conducting experiment -5M
- Calculation/Tabular column /observation -5M
- Result-2M

Q2. Conduct any one of the following experiment **10 M**

a.

b.

Scheme of Valuation

- Conducting experiment -5M
- Calculation/Tabular column /observation and report -5M

Q3. Identify and comment on A and B **2.5X2=5 M**

- Identification - 1M
- Comment/Description- 1.5 M

Q4. Record **5 M**

Q5. Viva **5 M**

III Semester B.Sc. Degree Examination (SEP Scheme)
BIOTECHNOLOGY

Time: 3 Hrs **Max. marks: 80**

Instructions: 1. Answer all the questions.
2. Draw neat labelled diagrams wherever necessary

PART-A

1.Answer all the five questions **2 x 5 = 10**

a.
b.
c.
d.
e.

PART-B

Answer any six of the following: **5 x 6 = 30**

2.
3.
4.
5.
6.
7.
8.
9.

PART-C

Answer any four of the following: **10 x 4 = 40**

10.
11.
12.
13.
14.
15.

Program Name	**B. Sc Biotechnology**		Semester	**Third**
Course Title	**Immunology and Immonotechniques**			
Course No.	**BT –EL/OP– 1**	**Theory**	No. of Credits	**02**
Contact hours	**32 hrs**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

Unit I: Cells and Organs of the Immune System **08 hrs**

Immune System: History, Types of immunity: first and second line of defense, innate and adaptive immunity, Humoral and cell-mediated immunity. Cells of the immune system: Hematopoiesis, Lymphoid and Myeloid lineage, Organs of the Immune system: primary and secondary lymphoid organs; Thymus, Bone marrow, Spleen, Lymph Node.

Unit -II Molecules of the Immune System **08 hrs**.

Antigens and Antibodies: Antigen-structure and properties, specificity, foreignness, molecular size, heterogeneity; Adjuvants, Antigenicity and Immunogenicity. Affinity and Avidity. Haptens. Antibodies: Classification, structure, and function. Antibody diversity, Vaccines: Conventional vaccines, Recombinant vaccines.

Unit-III Immune consequences: **08 hrs**

Immunodeficiency- acquired immunodeficiency syndrome and SCID, Cancer immunology and immunotherapy. Autoimmune diseases: Definition, causes and pathogenesis of autoimmune diseases, Classification of autoimmune diseases, common autoimmune diseases. Hypersensitivity: Factors causing hypersensitivity, common reactions, classification, Types of Hypersensitivity, type-I, type-II, type-III, type-IV.

Unit -IV Immunotechniques: **08 hrs.**

Antigen–antibody interactions, Precipitation reaction - Radial immunodiffusion, Ouchterlony technique, Immunoelectrophoresis, and Rocket electrophoresis. Agglutination reactions – hemeagglutination. RIA and ELISA – principle, methodology and application. Immunofluorescence, Immunoblotting. Hybridoma technology and applications.

Suggested Readings:

1. Arvind Kumar. 2013. Text Book of Immunology. TERI Press, India.
2. Meyers. 2007. Immunology. Wiley–VCH, USA. 16
3. Goding, J.W. 1983. Monoclonal Antibodies: Principles and Practices. Academic press, New York.
4. Mayfforth, F.D. 1993. Designing Antibodies. Academic press. New York.
5. Abbas, A.K., A.H. Lichtman, J.S.Pober, 1994. Cellular and Molecular mmunology. W.B.Saunders Co., Philadelphia.
6. Kubey. I.M. 1990. Essential Immunology. 6thed. Blackwell Scientific Publication, New York.
7. Roitt, I. et al., 1993. Immunology 3rd ed. Mosby Year Book Europe Ltd., London.
8. Janewny, et al. 1994. Immunobiology, The Immune System in Health and Disease. CBS, New Delhi.
9. Rotti, I. 1994. Essential Immunology. Blackwell, London.
10. Chakravarthy AK. Immunology & Immunotechnology. Oxford University Publishers. 2nd Ed. 2009
11. Gosling J P, Reen D J. Immunotechnology. Portland Press Ltd. UK. 6th Ed. 2009 18. Pandian. Immunology and Immunotechnology. Panima Publishers. 2nd Ed. 2009.

Program Name	**B. Sc Biotechnology**		Semester	**Third**	
Course Title	**Genomics and Proteomics**				
Course No.	BT-EL/OP-1	**Theory**	No. of Credits	**02**	
Contact hours	**32**		Duration of Exam	**2 Hours**	
Formative Assessment Marks		**10**	Summative Assessment Marks		**40**

Unit I

Introduction to Genomics and Structural genomics: **08 Hrs**

Introduction, Definition, Genome structure and organization in prokaryotes and eukaryotes.

Structural genomics- DNA sequencing techniques, Whole genome sequencing strategies- Map-based sequencing, Whole-genome shotgun sequencing; Human Genome Project: goals, outcomes, and significance.

Unit II **08 Hrs**

Functional Genomics:

Overview of transcriptomics, Gene expression analysis: overview of microarrays- Basic working principle of microarrays, Sample Preparation and Hybridization, Fluorescent labeling of targets, Detection and data acquisition. RNA-Seq: Principles and Workflow of RNA-Seq, Applications of RNA-Seq. Functional gene analysis: knockouts, RNAi, CRISPR/Cas9, Comparative genomics, and metagenomics

Unit III **08 Hrs**

Proteomics

Concept and scope of proteomics, Types of proteomics: Structural, functional, and expression proteomics, Protein structure and post-translational modifications (PTMs), Protein-protein interactions. Applications of proteomics.

Unit IV **08 Hrs**

Proteomics Techniques

Protein extraction and purification techniques, 2D-Gel Electrophoresis-Concept of two-dimensional separation, Isoelectric point (pI). SDS-PAGE, Mass Spectrometry (MALDI-TOF), Quantitative proteomics (iTRAQ)

Suggested Readings:

1. Daniel C Liebler. 2006. Introduction to Proteomics. Humana Press, New York.
2. Jonathan Pevsner. 2009. Bioinformatics and Functional genomics, Second Edition. Wiley-Blackwell Publisher, UK.
3. Jörg Reinders and Albert Sickmann. 2009. Proteomics: Methods and Protocols, Springer – Verlag.
4. Reiner Westermeier, Tom Naven. 2008. Proteome in Practice, WILEY-VCH publication, Germany.
5. P Michael Conn. 2003. Hand Book of Proteomic Methods. Humana Press Inc., New York
6. David P Clark and Nanette J Pazdernilc. 2013. Molecular Biology, 2nd Edition. Academic Press is an Imprint of Elsevier, USA.
7. Jocelyn E Krebs, Elliott S Goldstein Jones and Bartlett. 2014. Lewin's Genes XI, Student Edition. Jones and Bartlett India Pvt Ltd, New Delhi.
8. Parihar and Parihar. 2010. Advances in Biotechnology. Agrobios, India.
9. L Veera Kumari. 2006. Bioinstrumentation. MJP Publishers, Chennai.

III Semester B.Sc. Degree Examination (SEP Scheme)
BIOTECHNOLOGY
Elective paper

Time: 2 Hrs **Max. marks: 40**

Instructions: 1. Answer all the questions.
2. Draw neat labelled diagrams wherever necessary

PART-A

1.Answer all the five questions **2 x 5 = 10**

a.

b.

c.

d.

e.

PART-B

Answer any two of the following: **5 x 2 = 10**

2.

3.

4.

5.

PART-C

Answer any two of the following: **10 x 2 = 20**

6.

7.

8.

9.

IV Semester B.Sc. Degree (SEP Scheme)
BIOTECHNOLOGY

Program Name	**B. Sc Biotechnology**		Semester	**Fourth**
Course Title	**Genetic Engineering and Bioinformatics**			
Course No.	**BT – MC-IVT**	**Theory**	No. of Credits	**03**
Contact hours	**48 hrs**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**20**		Summative Assessment Marks	**80**

Unit I **12 Hrs**

Tools of Genetic Engineering:

Definition, scope, and historical overview of genetic engineering. Importance and applications.
Isolation techniques of DNA and RNA- Techniques for DNA isolation and purification methods and RNA. Methods for quantification and characterization.
Recombinant DNA technology – Introduction to molecular cloning. Enzymes used in recombinant DNA technology- Restriction endonucleases, Polymerases, Ligase, Kinases, and Phosphatases.
Features and applications of cloning vectors - Plasmid, Phage, Cosmid, BAC, and YAC. Expression vectors.

Unit II **12 Hrs**

Techniques in Genetic Engineering:

Gene introduction techniques: Methods of gene delivery- physical, chemical, and biological methods.
Gene manipulation techniques - gene knockout techniques in bacterial and eukaryotic organisms.
Gene library: Types and applications. Polymerase Chain Reaction and its applications.
Screenings of recombinants: Replica plating, Blue-White selection, Colony hybridization, FISH.

UNIT-III **12 Hrs**

Genome Editing and Applications of Genetic Engineering:

Genome Editing - Introduction to genome editing techniques- Principles and applications of genome editing techniques- CRISPR-Cas9 and Site-directed mutagenesis.
Applications of genetic engineering- DNA fingerprinting, Molecular pharming, Transgenic organisms.
Biosafety assessment of transgenic plants: Potential risks and benefits of transgenic plants, Regulatory frameworks for releasing and commercializing genetically modified organisms (GMOs) in India.

UNIT-IV **12 Hrs**

Bioinformatics and Computational Tools:

Introduction to bioinformatics. Genome sequencing techniques, Genome projects- A brief account on Human Genome Project. Role of Bioinformatics in genetic engineering.
Biological Databases-NCBI-GenBank, EMBL- European Nucleotide Archive, DDBJ, PDB, UniProt. Submission of Sequences, Sequence formats, sequence annotation and archival.

Tools for biological sequence analysis – Sequence comparison and phylogenetic analysis- EMBOSS Needle, EMBOSS Water, Clustal Omega, BLAST, FASTA.

Suggested Readings:

1. Gene Cloning and DNA Analysis: An Introduction (2019) 7th ed., Brown, TA, Wiley Blackwell, ISBN: 978-1119072560.
2. Principles of Gene Manipulation and Genomics (2019) 9th ed., Primrose, SB, and Twyman, R, Wiley Blackwell, ISBN: 978-1119163774.
3. Genome 4 (2017) 4th ed., Brown, TA, Garland Science, ISBN: 978-0815345084.
4. Molecular Biology of the Gene (2014) 7th ed., Watson, JD, Baker, TA, Bell, SP, Gann, A, Levine, M, and Losick, R, Pearson, ISBN: 978-0321762436.
5. Genomics: The Science and Technology Behind the Human Genome Project (2019) 2nd ed., Gibson, G, and Muse, SV, Oxford University Press, ISBN: 978-0198786207.
6. Molecular Genetics and Genomics (2020) 1st ed., Krebs, JE, and Goldstein, ES, Jones & Bartlett Learning, ISBN: 978-1284154544.
7. Genetic Engineering: Principles and Methods (2019) 3rd ed., Fowler, MR, CABI, ISBN: 978-1789240605.
8. Sushil Kumar Midda, T Usha and Prashanth Kumar H P. 2012. Bioinformatics. College Book House, Bangalore.
9. Stephan Krawetz. 2009. Bioinformatics for System Biology. Springer, Humana Press, USA
10. M H Fulekar. 2009. Bioinformatics: Application in Life and Environmental Sciences. Capital Publishing Company, New Delhi.

Program Name	**B. Sc Biotechnology**		Semester	**Fourth**
Course Title	**Genetic Engineering and Bioinformatics**			
Course No.	**BT-MC – IV P**	**Practical**	No. of Credits	**02**
Contact hours	**64 hrs**		Duration of Exam	**3 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

1. Extraction and purification of DNA from plant sample
2. Extraction and purification of DNA from animal sample
3. Extraction and purification of DNA from bacterial sample
4. Quality assessment of DNA by spectrophotometry
5. Quantification of nucleic acids by Agarose gel electrophoresis
6. PCR setup and cycling conditions
7. Retrieve the sequence of DNA/RNA from Genbank
8. Retrieve the sequence of protein from UniProt and view using Rasmol
9. Perform sequence similarity search using BLAST
10. Perform the local alignment between two sequences using EMBOSS NEEDLE
11. Perform the global alignment between two sequences using EMBOSS WATER
12. Conduct multiple sequence alignment and construct Phylogenetic tree using CLUSTA OMEGA

Model Practical Examination Scheme
B.Sc Biotechnology
PRACTICAL: 1V
IV-SEMESTER (Genetic Engineering and Bioinformatics)
(Formative Assessment Marks: 10; Summative Assessment Marks: 40)

Time: 3 Hrs **Max Marks: 40**

Q1. Conduct any one of the following experiment **15 M**

a.

b.

c.

Scheme of Valuation

- Writing Principle -3M
- Conducting experiment -5M
- Calculation/Tabular column /observation -5M
- Result-2M

Q2. Conduct any one of the following experiment **10 M**

a.

b.

Scheme of Valuation

- Conducting experiment -5M
- Calculation/Tabular column /observation and report -5M

Q3. Identify and comment on A and B **2.5X2=5 M**

- Identification - 1M
- Comment/Description- 1.5 M

Q4. Record **5 M**

Q5. Viva **5 M**

IV Semester B.Sc. Degree Examination (SEP Scheme)
BIOTECHNOLOGY

Time: 3 Hrs **Max. marks: 80**

Instructions: 1. Answer all the questions.
2. Draw neat labelled diagrams wherever necessary

PART-A

1.Answer all the five questions **2 x 5 = 10**

a.

b.

c.

d.

e.

PART-B

Answer any six of the following: **5 x 6 = 30**

2.

3.

4.

5.

6.

7.

8.

9.

PART-C

Answer any four of the following: **10 x 4 = 40**

10.

11.

12.

13.

14.

15.

Program Name	**B. Sc Biotechnology**		Semester	**Fourth**
Course Title	**Environmental Biotechnology**			
Course No.	**BT –EL/OP –2**	**Theory**	No. of Credits	**2**
Contact hours	**32 hrs**		Duration of Exam	**2 Hours**
Formative Assessment Marks	**10**	Summative Assessment Marks		**40**

UNIT-1 **08 Hrs**

Introduction to environment:

Concept of environment, Biotic and abiotic factors, Natural resources: Renewable and non-renewable resources, Biodiversity: Threats to biodiversity- habitat loss, poaching of wildlife; Environmental legislations – Environmental protection Act, Air and Water (prevention and control of pollution) Act, Wild life protection Act, Forest conservation Act.

UNIT-2 **08 Hrs**

Environmental pollution and Biotechnology:

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, nuclear pollution. Sampling techniques, Biological analysis of pollution: Use of biosensors in pollution monitoring. Biotechnological Methods in Pollution Abatement-Reduction of CO_2 emission.

UNIT-3 **08 Hrs**

Bioremediation:

Importance of bioremediation in environmental cleanup. Types of contaminants suitable for bioremediation. Microorganisms used in bioremediation. In-situ Bioremediation Methods – Bioaugmentation, Biostimulation, Bioventing, Phytoremediation. Ex-situ Bioremediation Methods – Composting, Land farming, Biopile and Bioslurry systems. Advantages and disadvantages of bioremediation. Bioleaching.

UNIT-4 **08 Hrs**

Waste Management:

Waste water Management. Waste water characterization and composition. Biological Processes in waste water treatment, Anaerobic Digestion and Biogas Production. Xenobiotics – Definition, Features of xenobiotics, Types and their microbial degradation of xenobiotics. Biofuels: Biomass as energy source, Biodiesel production. Vermicomposting.

Suggested Readings:

1. Bruce E. Rittmann & Perry L. McCarty, 2020, Environmental Biotechnology: Principles and Applications**,** 2nd Edition, McGraw-Hill Education
2. S.N. Jogdand, 2015, Environmental Biotechnology, 4th Edition, Himalaya Publishing House
3. Debajit Borah, 2019, Environmental Biotechnology: Theory and Lab Practices, 2nd Edition, Om Publications
4. Sukanta Mondal, Shivesh Pratap Singh, Yogendra Kumar Lahir, 2022, Emerging Trends in Environmental Biotechnology, 1st Edition, CRC Press
5. P. Dwivedi, S.K. Dwivedi, M.C. Kalita, 2019, Biodiversity and Environmental Biotechnology, 1st Edition, Scientific Publishers
6. Arora, S. 1991. Fundamentals of Environmental Biology. Kalyani Publisher, New Delhi.
7. Bernard R. Glick and Jack J. Pasternak (2003) Molecular biotechnology: principles and applications of recombinant DNA. 3rd Ed. ASM Press, Washington, D.C.

8. Chatterji, A.K. 2002. Introduction to Environmental Biotechnology. Printice Hall of India, New Delhi
9. Nathanson, J.A.2003. Basic Environmental Technology, 4th ed. Prentice Hall of Indial, New Delhi.

Program Name	**B. Sc Biotechnology**		Semester	**Fourth**
Course Title	**Medical Biotechnology and Bio-nanotechnology**			
Course No.	**BT –EL/OP –2**	**Theory**	No. of Credits	**2**
Contact hours	**32 hrs**		Duration of Exam	**2 Hours**
Formative Assessment Marks	**10**		Summative Assessment Marks	**40**

Unit-I Human Genetics and gene therapy: 08 Hrs

Structure and organization of the human genome, Mutations, types of mutations, cause for mutations and their effects. Sickle cell anemia, Down's syndrome. Genetic testing; Sex determination by Amniocentesis and Ultra-sound. Genetic counseling. Gene Therapy: Definition and salient features. Approaches for gene delivery; Gene therapy strategies.

Unit-II: Therapeutic vaccines and proteins: 08 Hrs

Introduction to vaccines, types- subunit vaccines, newer vaccines; Peptide vaccines, Minicells as Vaccines, Recombinant DNA (rDNA) vaccines, Attenuated vaccines. Vector vaccines, edible vaccines. Monoclonal Antibody in Therapy; Targets in Therapy, Immunotherapy, Stem cell technology and regenerative medicine.

Unit-III Bioethics, Biosafety and IPR: 08 Hrs

Definition and need for bioethics, Public perception of Biotechnology; Socio-economic, legal and ethical issues. Biosafety: Definition and need for biosafety, Levels and criteria used for biosafety, Intellectual Property Rights (IPR): Introduction and forms of IPR, IPR related legislation in India. Patent- Definition and characteristics, patenting application in India, requirements for patenting, International patents, Patenting genetically modified organisms (GMOs).

Unit-IV Bionanotechnology: 08 Hrs

Introduction, Nanomaterial in biotechnology -nanoparticles, quantum dots, nanotubes and nanowires; Nanobiosensors, Nanobots, Nanobiotechnological applications in health, environment and food.

TEXT AND REFERENCE BOOKS:

1. Prathibha N and Venugopal Rao V. 2010. Medical Biotechnology, 1st ed. Oxford Univ. Press, New Delhi.
2. Gery Walsh. 2007. Pharmaceutical Biotechnology Concepts and Applications 1st ed., John Wiley &Sons.Ltd, England. 3. Stryer B. 2006. Biochemistry, 5th ed., W. H Freeman & Co. USA.
3. Strachen and Read.2011. Human Molecular Genetics. 4th Edition. Garlan Science Publications.
4. Pearson and Benjamin. 2006. i. Genetics, 2nd edition. A Molecular Approach (Peter Russel)
5. David.P.C. Clark Nanitte J Pazdernik.2009. Biotechnology Applying the Genetic Revolution. Elsevier Academic Press.
6. Roland W. Herzog.2009. Gene therapy Immunology, Willey Blackwell Publications.
7. Mountain. A, U.M Ney. Vol 5. 2010D.Schomburg. Biotechnology.2nd Edition. V.C.H & Wiley Company.
8. Kuby. Kindt. Goldsby. Osborne. 2007. Immunology. 6th Edition. W.H. Fruman & Company.
9.Fisher. Mikos Bronzino. 2007. Tissue Engineering. C.R.S Press.

IV Semester B.Sc. Degree Examination (SEP Scheme)
BIOTECHNOLOGY
Elective paper

Time: 2 Hrs **Max. marks: 40**

Instructions: 1. Answer all the questions.
2. Draw neat labelled diagrams wherever necessary

PART-A

1.Answer all the five questions **2 x 5 = 10**

a.

b.

c.

d.

e.

PART-B

Answer any two of the following: **5 x 2 = 10**

2.

3.

4.

5.

PART-C

Answer any two of the following: **10 x 2 = 20**

6.

7.

8.

9.