**St. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM**

**Pathway 2 Course**

**w.e.f. AY 2023-24**

**I Semester**

**INTRODUCTION TO APPLIED BIOLOGY**

Code- BSC 1502

Credits: 4 Hours/Week: 5

**Course Objectives: By the end of this course the learner can:**

1. Narrate the basics of Microbiology and Immunology

2. Illustrate outlines of Biomolecules and their physiological role

3. Explain contributions of Biotechnology in various fields

4. Describe the principles of advanced Immunotechniques

5. Perform Data collection, basic concepts of data interpretations, retrieval of biological data from few databases and their interpretation.

**Course Outcomes: On completion of this course students will be able to:**

1. Comprehend characteristics of the classes of microorganism and their importance and learn outline concepts of immunology and the defence system

2. Learn importance of biomolecules and identify few of them

3. Recognize the role of Biotechnology in various fields

4. Identify the applications of immunotechniques in diagnostics

5. Collect data, interpret it and also perform retrieval of biological data from listed sources

**Unit 1: Essentials of Microbiology and Immunology**

1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.

1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi and Virus.

1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.

1.4. Immune system – Immunity, types of immunity, outlines of immune cells and organs of immune system.

**Unit 2: Essentials of Biochemistry**

2.1. Biomolecules I – general introduction to Classification and biological role of carbohydrates and lipids

2.2. Biomolecules II – Amino acids- classification, Essential amino acids and importance & Proteins- Classification, basics of the levels of organization and biological importance

2.3. Biomolecules III – Nucleic acids -DNA and RNA- Types and importance

2.4. Basics of Metabolism – Anabolism and catabolism- Outlines

**Unit 3: Essentials of Biotechnology**

3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.

3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.

3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

**Unit 4: Analytical Tools and techniques in biology – Applications**

4.1. Applications in forensics – PCR and DNA fingerprinting

4.2. Immunological techniques – Immunoblotting and ELISA.

4.3. Monoclonal antibodies – Applications in diagnosis and therapy.

4.4. Eugenics and Gene therapy

**Unit 5: Biostatistics and Bioinformatics**

5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.

5.2. Measures of dispersion – range, standard deviation and variance (definitions and Biological data applications). Probability and tests of significance (definition and Bioliogical applications).

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment outlines.

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

**REFERENCES**

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.

6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.

7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.

8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.

10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

**ACTIVITIES**

1. Identification of given organism as harmful or beneficial.

2. Observation of microorganisms from house dust under microscope.

3. Finding microorganism from pond water.

4. Visit to a microbiology industry or biotech company.

5. Visit to a waste water treatment plant.

6. Retrieving a DNA or protein sequence of a gene

7. Performing a BLAST analysis for DNA and protein.

8. Problems on biostatistics.

9. Field trip and awareness programs on environmental pollution by different types of

wastes and hazardous materials.

10. Demonstration on basic biotechnology lab equipment.

11. Preparation of 3D models of genetic engineering techniques.

12. Preparation of 3D models of transgenic plants and animals.

[NOTE: In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty