



P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

Autonomous -ISO 9001 – 2015 Certified

Title of the Paper: INTRODUCTION TO APPLIED BIOLOGY

Offered to: Botany Honors, Zoology Honors with Programme code

Course Type: Theory

Year of Introduction: 2023-2024

Year of Revision:

Percentage of Revision: Semester: I

Credits: 04

Hours Taught: 60 hrs. per Semester

Max. Time: 5 Hours

Course Prerequisites: Knowledge of Introduction to Applied Biology at +2 level.

Course Description: This course will provide one with a basic and comprehensive understanding of the key attributes of living things. Enable the student with depth of topics and helps them to gain an appreciation in the range of application in forensics, immunological techniques, eugenics and gene therapy. On the other hand, importance of understanding the data collection and sampling, measures of dispersion, introduction of genomics and proteomics provide an extensive knowledge to the student.

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

1. History, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology and Immunology

(12Hrs)

- 1.1. History and Major Milestones of Microbiology, Contributions of Louis Pasteur, Robert Koch, Edward Jenner and Joseph Lister.
- 1.2. Structure and characteristics of Bacteria, Fungi, Archaea and Viruses.
- 1.3. Applications of microorganisms in Food, Agriculture, Environment and Industry.
- 1.4. Immune system – Types of immunity (Innate and Acquired), Cells and organs of immune system.

Unit 2: Essentials of Biochemistry

(12Hrs)

- 2.1. Biomolecules I – Carbohydrates, Lipids (General Structure, Classification and Biological importance).
- 2.2. Biomolecules II – Amino acids (General Structure, Classification- Essential, Non-Essential and Biological importance), Proteins (General Structure, Classification and Biological importance)
- 2.3. Biomolecules III – Nucleic acids - DNA and RNA (Structure, Types and Biological importance)
- 2.4. Basics of Metabolism – Anabolism and Catabolism (Definition and Examples)

Unit 3: Essentials of Biotechnology (12Hrs)

- 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 Bio pesticides. (Definition and common examples)
- 3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors- P^{BR322}, λ phage . Methods of Gene transfer- Physical- Electroporation, chemical- PEG, and Biological- Transduction.
- 3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salttolerance). Transgenic animals – Animal (Fish) and disease models.(Mice)

Unit 4: Analytical Tools and techniques in biology – Applications (12Hrs)

- 4.1. Applications in forensics – PCR and DNA fingerprinting (Concept and application)
- 4.2. Immunological techniques – Immuno blotting and ELISA. (Concept and application)
- 4.3. Monoclonal antibodies – Applications in diagnosis and therapy.
- 4.4. Eugenics and Gene therapy (Definition and examples)

Unit 5: Biostatistics and Bioinformatics (12Hrs)

- 5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
- 5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance- t- test
- 5.3. Introduction, Genomics, Proteomics, types of Biological data, Biological databases- NCBI,EBI, Gene Bank; Protein 3D structures, Sequence alignment.
- 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.

Web Links:

<https://www.youtube.com/watch?v=sKtoW5cXt14>

<https://www.youtube.com/watch?v=gmFYfCXwg0U>

MODEL QUESTION PAPER FOR SEE

Max. Marks : 70

Max. Time : 3 Hrs

SECTION -A

Answer all Questions.

(5 X 4 =20)

- 1 (a) Describe the contributions of Robert Koch in microbiology. 4M
OR
(b) Explain the applications of micro organisms in food industry. 4M
- 2 (a) Write a short note on biological importance of lipids. 4M
OR
(b) Explain the structure and functions of m RNA. 4M
- 3 (a) List out the applications of biotechnology in plant sciences. 4M
OR
(b) Explain the structure of vector PBR³²². 4M
- 4 (a) Explain the applications of DNA finger printing in forensic sciences. 4M
OR
(b) Define eugenics and briefly explain it. 4M
- 5 (a) Describe the significance of T test. 4M
OR
(b) Explain the NCBI genome work bench. 4M

SECTION –B

Answer all Questions.

(5 X 10 = 50)

- 6 (a) Discuss about structure and charecteristics of bacteria. 10M
OR
(b) Explain the innate immune system types 10M
- 7 (a) Compare and contrast the roles of carbohydrates and lipids in the human body 10M
OR
(b) Describe the krebs cycle and its role in cellular respiration 10M
- 8 (a) Explain the steps involved in bioremediation process. Discuss the advantages of using micro organisms for environmental cleaning 10M
OR
(b) Write an essay in detail about transgenic animal (fish) in scientific research 10M
- 9 (a) Explain the steps involved in PCR technique 10M
OR
(b) Describe the application of monoclonal antibodies in diagnosis and therapy 10M

10 (a) Discuss the mean, median and mode as a measure of central tendency 10M

OR

(b) Explain in detail the genomics and proteomics. 10M
