

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: IV

**BIOTECHNOLOGY PAPER IV
BIOPHYSICS AND BIOSTATISTICS**

Course Code: 18IVBT4

No. of Hours: 60

COURSE OBJECTIVES:

- To provide a fundamental background on Instrumentation and applications of various analytical and biochemical techniques commonly used in biology.
- To apply statistical concepts in academia and in research.

LEARNING OUTCOMES: After successful completion of the course the students will be able to

- Identify and differentiate working principle, instrumentation and applications of various bio-analytical instruments
- Reproduce and design an experiment using various analytical techniques such as chromatography, electrophoresis, spectroscopy and radioactive techniques with step-by-step instructions to address a research problem or bio-analytical practical/project.
- Organize, summarize and display quantitative data and design to address public health and clinical problems.
- Calculate summary estimates, measures of variability and confidence intervals and also to manipulate probabilities, normal and binomial distributions.

UNIT I PREPARATIVE TECHNIQUES

08 HRS

Introduction and scope of Biophysics, Perfusion, Homogenization and cell fractionation methods. Precipitation methods (*salting in and salting out, solvent extraction*). Purification of phytochemicals using Soxhlet apparatus. Concept of osmosis, dialysis and ultra-filtration. Manometry (*Vansylke and Warburg manometer*).

UNIT II BIOANALYTICAL TECHNIQUES

12 HRS

Centrifugation Techniques: Definition, Concept of Relative Centrifugal Force (RCF). Sedimentation rate, Svedberg UNIT (*sedimentation coefficient*). Types of Rotors and centrifuges, Density gradient centrifugation (*Rate zonal and isopycnic centrifugation*), Differential centrifugation, Ultracentrifugation (*Analytical and Preparative*).

Electrophoretic methods: Definition. Electrophoretic mobility and factors affecting it. Types: Agarose gel electrophoresis and Native gel Electrophoresis, SDS-PAGE, Isoelectric focusing (IEF), Densitometer [*Principle, Operation and Applications*].

High performance liquid chromatography (HPLC).

UNIT III SPECTROSCOPIC METHODS

10 HRS

Introduction, Electromagnetic radiation, Absorption and emission spectra, Fluorescence and phosphorescence, Stoke's shift, hypo and hyperchromicity, Beer- Lambert's law. Principles, instrumentation and applications of Colorimetry, Spectrophotometry, fluorimetry, flame photometry and Atomic absorption spectrophotometer. Infra-Red (IR) spectroscopy, Mass spectroscopy (MS) and Nuclear Magnetic Resonance (NMR) spectroscopy and X – Ray Crystallography (*a brief note*)

UNIT IV RADIOISOTOPIC TECHNIQUES

06 HRS

Radioactive isotope, Radioactivity and UNIT of radioactivity (*Curie, Rutherford and Becquerel*). Radioactive decay, Geiger – Muller (GM) counters and Scintillation counters, Artificial Radioactivity, Radio dating and Radioactive tracer technique. Autoradiography,

UNIT V BIOSTATISTICS: INTRODUCTION, MEASURES OF CENTRAL TENDENCY & DISPERSION

12 HRS

Introduction, Applications of Biostatistics in biology, genetics, ecology and environment management; Samples & Population; Tabulation and Classification of data, Data presentation – Graphs and tables: dot diagrams, frequency distribution, relative frequency, histogram, Frequency curve and bar diagram; Central tendency: Measures of Central tendency – Mean, Median & Mode & their properties, Mean deviation, Standard deviation & Coefficient of variation.

UNIT VI PROBABILITY & HYPOTHESIS TESTING

12 HRS

Probability: definition, addition and multiplication rules of probability, Conditional probability, Binomial & Normal distribution – Simple correlation & regression, Tests based on normal, Student-t & Chi square test. ANOVA

REFERENCES:

1. Biophysics by VasanthaPattabhi and N Gautham, Narosa Publishing house, (2002).
2. Biophysics: A physiological Approach by Patrick F Dillon, Cambridge University Press, (2012).
3. Essentials of Biophysics by P Narayanan, New Age International, (2010).
4. Principles of Biochemistry and Biophysics by Dr. B.S. Chauhan University Science Press, New Delhi, (2008).
5. Biophysics: Tools and Techniques by Mark C. Leake, CRC Press, (2016).
6. Biophysics: Searching for Principles by William Bialek, Princeton University Press, (2012).
7. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker (Eds.), 7th Edition, Cambridge University press, (2010).
8. Fundamentals of Biophysics by Andrey B. Rubin, Wiley – Scrivener, (2014).
9. Fundamentals of Biostatistics by Bernard Rosner, 7th Edition, Cengage Learning Publishers. (2010).
10. Fundamentals of Biostatistics by Irfan A. Khan, Khan Irfan A, 2nd Edition, Ukaaz Publication. (1994).

PRACTICALS – PAPER IV – BIOPHYSICS AND BIOSTATISTICS **15 UNITS**

1. Precipitation of Total proteins by salting in and salting out and solvent extraction 2UNITS
 2. Isolation and spectrophotometric estimation of plant pigments 1UNIT
 3. Determination of molecular weight of nucleic acids by gel electrophoresis and proteins by SDS – PAGE 2UNITS
 4. Colorimetric estimations – a. Glucose by Anthrone method 1 UNIT
b. Protein by Folin-Ciocalteau method 1 UNIT
 5. Estimation of Sodium and Potassium by Flame photometer 1 UNIT
 6. Isolation and analysis of Phytochemicals 2 UNITS
 7. Biostatistics problems 3 UNITS
 8. Industrial/Academic visit. 1 UNIT
- Tests and Repetition.