

॥ सा विद्या या विमुक्तये ॥



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

“ज्ञानतीर्थ” परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

“Dnyanteerth”, Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade



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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील प्रथम वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक ०८ जून २०१९ रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र.११/४४-२०१९ च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील प्रथम वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्यात येत आहेत.

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|---|---------------------------------------|
| 1. Agricultural Microbiology | 18. Dyes and Drugs |
| 2. Agrochemicals & Fertilizers | 19. Electronics |
| 3. Analytical Chemistry | 20. Environmental Science |
| 4. B.C.A. | 21. Fishery Science |
| 5. B.Voc. (Food Processing, Preservation and Storage) | 22. Food Science |
| 6. B.Voc. (Web Printing Technology) | 23. Geology |
| 7. Biochemistry | 24. Horticulture |
| 8. Bioinformatics | 25. Industrial Chemistry |
| 9. Biophysics | 26. Information Technology (Optional) |
| 10. Biotechnology (Vocational) | 27. Mathematics |
| 11. Biotechnonology | 28. Microbiology |
| 12. Botany | 29. Network Technology |
| 13. Chemistry | 30. Physics |
| 14. Computer Application (Optional) | 31. Software Engineering |
| 15. Computer Science (Optional) | 32. Statistics |
| 16. Computer Science | 33. Zoology |
| 17. Dairy Science | |

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

‘ज्ञानतीर्थ’ परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.: शैक्षणिक-०१/परिपत्रक/पदवी-सीबीसीएस अभ्यासक्रम/
२०१९-२०/२९२

दिनांक : ०३.०७.२०१९.

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

स्वाक्षरित / -

उपकुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

Swami Ramanand Teerth Marathwada University, Nanded.

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

B.Sc. Biophysics (UG) Program under Faculty of Science

(Affiliated Colleges)

(W.E.F. Academic Year 2019-20)

Name of the Faculty	Total credit	Average credits per semester
Science	44	08

Note:

- Assessment shall consist of Continuous assessment (CA) and End of Semester Examination (ESE).
- **Weightage:** 80% for ESE & 20% for CA.
- The Biophysics as optional in each of Semester consists of Two Theory papers each of 50 marks [40 External + 10 Internal] and One Practical paper of 50 marks.
- This workload is inclusive of test, tutorial to be conducted as mandatory UG activities as part of internal assessment.
- **Paper- (Elective):** Transfer of Credit as per Student choice.

Distribution of Credits for B.Sc. Biophysics under Science faculty

(All Affiliated Colleges)

CBCS pattern for B.Sc I

Sem.	Code & Paper Code	Period/week	Title of the paper	External (ESE)	Internal (CA)	Total	Credits
I	CCBP-I	A/03	Molecular Biophysics	40 Marks	10 Marks	50	02
	CCBP-II	B/03	Biostatistics & Computer Fundamentals	40 Marks	10 Marks	50	02
II	CCBP-III	A/03	Cellular Biophysics	40 Marks	10 Marks	50	02
	CCBP-IV	B/03	Basic Biophysical Techniques	40 Marks	10 Marks	50	02
(Annual Practical)	CCBPP-I	--	Lab Course Work (Practical's based on theory papers CCBP-I, II, III, IV)	80 Marks	20 Marks	100	04
Total for B.Sc. I Year: Sem. I + Sem. II + Lab Course work (Annual)							12

The syllabus is based on six (3x2) theory periods and 4 practical periods per batch per week. Candidates should require to pass separately in theory and practical examination.

Marks distribution:

- 1) Theory exam (ESE): 40 marks
- 2) Internal (CA) evaluation: 10 marks

CBCS pattern B.Sc. II Year

Sem.	Code & Paper Code	Section & Period /week	Title of the paper	External (ESE)	Internal (CA)	Credits
III	CCBP-V	A/03	Membrane Biophysics	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks))	02
	CCBP-VI	B/03	Molecular Biology	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks))	02
	SECBP-I	A/B	(A- Protein purification / B- Bioanalytical QC & QA Techniques	25 Marks: (Report:10,Exam:10,Viva:5)	25 Marks (Tests/Assignments: 15, overall Judgment:10)	02
IV	CCBP-VII	A/03	Molecular Enzymology	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks))	02
	CCBP-VIII	B/03	Physiological Biophysics	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks))	02
	SECBP-II	A/B	(A- Preparation of Protein crystal / B-Cell & tissue culture)	25 Marks: (Report:10,Exam:10,Viva:5)	25 Marks (Tests/Assignments: 15, overall Judgment:10)	02
Annual Practical	CCBPP-II	--	Lab Course Work Practical's based on theory papers CCBP-VI & VII	50 Marks	-----	02
(Annual Practical)	CCBPP-III	--	Lab Course Work Practical's based on theory papers CCBP-VIII & IX	50 Marks	-----	02
Total for B.Sc. II Year: Sem. I + Sem. II + Lab Course work (Annual)						16

CBCS pattern B.Sc. III Year

Sem.	Code & Paper Code	Section & Period/ week	Title of the paper	External (ESE)	Internal (CA)	Credits
V	DSEBP-IX	A/03	Radiation Biophysics	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks)	02
	DSEBP -X	B/03	Bioinformatics & Structural Biology	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks)	02
	SECBP-I	A/B/03	Communication Skills/ Enzyme Immobilization techniques	25 Marks: (Report:10,Exam:10,Viva:5)	25 Marks (Tests/Assignments: 15, overall Judgment:10)	02
VI	DSEBP -XI	A/03	Immunology	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks))	02
	DSEBP - XII	B/03	Medical Biophysics	40 Marks	10 Marks (Attendance: 5Marks & Tests/Assignments: 05 Marks))	02
	SECBP-II	A/B/03	Research Methodology / Medical Diagnostic techniques	25 Marks: (Report:10,Exam:10,Viva:5)	25 Marks (Tests/Assignments: 15, overall Judgment:10)	02
(Annual Practical)	CCBPP-IV	--	Lab Course Work (Practical's based on theory papers CCBP-XII & XIII & Visit to National research lab/medical imaging center)	50 Marks	-----	02
(Annual Practical)	CCBPP-V	--	Lab Course Work (Practical's based on theory papers CCBP-XIV & XV and Visits to & National research lab /Radiotherapy Center)	50 Marks	-----	02
Total for B.Sc. III Year: Sem. I + Sem. II + Lab Course work (Annual)						16

Swami Ramanand Teerth Marathwada University, Nanded
B. Sc. Biophysics CBCS Pattern effective from -2019-20
First year (Semester – I)

Paper CCBP-I: Molecular Biophysics

[Total Marks: 50](40Ext. +10 Int.)

[Exam Duration: 2 hrs]

[Total Workload: 45 hrs]

Objectives:

- To impart basic knowledge of biochemistry.
- To make familiar with physico-chemical foundation of biophysics.
- To know the structure and properties of macromolecules that interacts to maintain and perpetuate the living systems.

Unit 1: Atomic & Molecular structure

Structure of atom-Models & theories, Quantum numbers, Hund's rule, Periodic table, Concept of bonding; valence of carbon; hybridizations of carbon, nitrogen & oxygen; molecular orbital theories, polar & non polar molecules; inductive effect.

Secondary bonding: weak interactions, hydrogen bonding; dipole-dipole & dipole-induced dipole interactions; London dispersion forces.

Bonds within molecules-Ionic, covalent, Hydrogen, Electrostatic, Van-der Waals forces, Bond lengths & Bond energies, Bond angles, Structural isomerism; optical isomerism & optical activity.

Unit 2 : Physico-chemical Foundations

Biophysics of Water: Physicochemical properties of water, Molecular structure, Nature of hydrophobic interactions, Water Structure.

Small-Molecule Solutes: Hydrophiles, Hydrophobes, Aqueous Environment of the Cell,

Acid & Bases: Acid-Base theories, Mole concept, Molarity, Molality & Normality, Ampholyte, concept of pH, measurements of pH, Henderson-Hasselbatch equation, Titration curve & pK values, numerical problems.

Unit 3 : Physical Foundations of Biophysics

Thermodynamics of Biological system: First and second laws of thermodynamics, activation energy. Biological systems as open, non-equilibrium systems, Concept of free energy, entropy, Enthalpy, Negative entropy as Significant to biological systems. biological clocks.

Bioenergetics: Concept of energy coupling in biological processors, structure and role of mitochondria, high energy phosphate bond, Electron-transport chain, Oxidative Phosphorylation including chemiosmotic hypothesis.

Unit 4. Biomolecules as molecular alphabets of life

Nucleic acids: Purine and Pyrimidine bases, nucleosides, nucleotides, basic differences in structure and function of RNA and DNA

Amino acids & Proteins: Amino acid **general structure &** types, peptide bond, Structure of Proteins - primary, secondary, tertiary and quaternary,

Carbohydrates: Structure and function carbohydrate, Structure and conformation of cellulose, amylopectin & glycogen, Chitin.

Lipids : Definition: Types of lipids and Function.

Vitamins & hormones: Structure, classification & function.

Outcomes: Students will able

- ➔ To understand the basics of Biophysics.
- ➔ To understand the relationship between biology and concepts of physics.
- ➔ To interpret the biochemistry fundamentals and mechanisms in terms of building blocks of life.

Swami Ramanand Teerth Marathwada University, Nanded

B. Sc. Biophysics CBCS Pattern effective from -2019-20

First year (Semester – I)

Paper CCBP-II: Biostatistics & Computer Fundamentals

[Total Marks: 50] (40Ext. +10 Int.)

[Exam Duration: 2 hrs.]

[Total Workload 45 hrs.]

Objectives:

- To develop basic statistical operations required for biological studies and rationalization of experimental designs.
- To understand the applications in collection, processing and presentation of data.
- Demonstrate an understanding of the central concepts of statistical theory and their probabilistic foundation.
- To develop basic computing skills and application.

Unit 1 –Introductory Biostatistics

Statistics, Biostatistics and Biometry, Aims of Biostatistics, Applications of Biostatistics. Data Collection, Sampling, Classification of Data, Tabular Representation of Data, Graphic Representation of Data: Line Diagram, Histogram, Frequency Polygon, Frequency Curve, Cumulative Frequency Curve or Ogive, Scatter or Dot Diagram, Bar Diagram, pie diagram, Pictogram and Cartogram.

Unit 2- Central Tendency, Dispersion, Correlation & regression

Average, Objectives of Averages, Characteristics of an Ideal Measure of Central Tendency Types of Averages, Mean, Median, Mode, Measures of Dispersion, Range, Standard Deviation, Standard Error. Correlation, Types of Correlation, Measures of Simple Correlation, Regression,

Unit 3- Probability, Test of Hypothesis and Significance

Important Terms and Concepts, Sample point, Sample space, Trial and Event; Classical Definition of Probability, Frequency Definition of Probability, Rules of Probability (Addition Rule and Multiplication Rule), Probability Distributions: Binomial Distribution, Poisson Distribution and Normal Distribution. Test of Significance.

Unit 4: Computer Fundamentals

Computer system at a glance processor (CPU, ALU) Memory (ROM, RAM,) Storage, Input & Output devices, Computer peripherals, Binary code and binary system, Algorithms and Flow charts, Software & Hardware, Operating systems (Dos, Windows) Application software's (MS-office) Types of computers, **Network concepts** (LAN, WAN, MODEM,). Internet protocols WWW (World wide web) Internet connectivity, search engines, biological databases.

Outcomes: Students will be able

- ➔ To fulfill the data manipulation practices.
- ➔ To learn, use and interpret results of descriptive statistical methods effectively.
- ➔ To apply statistical approaches in solving biological data processing
- ➔ To make appropriate use of statistical software and computer.

Swami Ramanand Teerth Marathwada University, Nanded
B. Sc. Biophysics CBCS Pattern effective from -2019-20
B. Sc. Biophysics First year (Semester – II)

Paper CCBP-III: Cellular Biophysics

[Total Marks: 50] (40Ext.+10 Int.) [Exam Duration: 3 hrs] [Total Workload 45 hrs]

Objectives:

- To understand the knowledge of cell biology of changes or losses in cell function..
- Students will understand how cellular components are used to generate and utilize energy in cells.
- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
- Students will understand the cellular components underlying mitotic cell division.

Unit 1: Cell Organization

Cell as the basic structural unit, Origin & organization of Prokaryotic and Eukaryotic cell, Cell size & shape, Fine structure of Prokaryotic & Eukaryotic cell organization Internal architecture of cells, cell organelles, Ribosome, Polysomes, Lysosomes & Peroxisomes, Connection between cell & its environment, Extracellular Matrix.

Unit 2: Cell Cycle & Growth

The Cell Cycle, Interphase-G₁,S,G₂,M molecular events at different cell cycle phases, A cytoplasmic clock times, Growth Factors & Control of cell proliferation.

Mitosis & Cell division-Molecular mechanism, Events in mitosis, significance of mitosis, Meiosis & Sexual reproduction, Molecular mechanism of meiosis, significance of meiosis.

Unit 3: Cell differentiation & Interactions

General characteristics of cell differentiation, cytoplasmic determinants, Molecular mechanism of cell differentiation,

Connection between the cell and its environment, Glycocalyx, Extracellular Matrix, collagen, Elastin, Fibronectin, Lamin, Integrins, Cell Junctions, Desmosomes, Gap junction, connexins, Tight Junctions, Plasmodesmata.

Unit 4: Basics of Cell Signaling

Cell Signaling, General principle of cell signaling, Paracrine, Autocrine, Endocrine & synaptic signaling, Heat Shock Proteins, G-Protein structure and role in signaling, Intracellular Cyclic AMP, Role Ca⁺⁺ in cell signaling, CAM Kinases, (Calmodulin/Ca⁺⁺ dependent protein kinases), Interaction between cyclic AMP & Ca⁺⁺, bacterial chemotaxis.

Outcomes: Students will enable

- ➔ To gain knowledge in Cellular Biophysics as an important prerequisite in understanding the various branches and emerging areas of Life Sciences
- ➔ To identify cellular structures and function
- ➔ To distinguish different cells in terms of structure-function relationship.

Swami Ramanand Teerth Marathwada University, Nanded

B. Sc. Biophysics CBCS Pattern effective from -2019-20

B. Sc. Biophysics First year (Semester – II)

Paper CCBP-IV: Basic Biophysical Techniques

[Total Marks: 50](40 Ext. + 10 Int.)

[Exam Duration: 3 hrs]

[Total Workload 45 hrs]

Objectives:

- To develop the skills of the application of basic and advanced techniques employed in quantitative and qualitative analysis of biomolecules.
- To impart the principle and working of Biophysical Techniques
- To make able for manipulation of technical troubleshooting.

Unit 1. Optical Techniques:

Light: Reflection, Refraction, Diffraction, Interference phenomena,

Light microscopy: Principle, design, resolution, numerical aperture: Simple, compound optical microscope, **Polarimetry:** optical activity of some biomolecules and its significance.

Refractometry: Refraction of light and snell's law, Abbe's refractometer,

Unit 2. Centrifugation and Viscometry

Concept of sedimentation Basic principles, Forces involved RCF, Centrifugation techniques-Differential centrifugation, principle, design, types and applications of different Centrifuges.

Viscometry: factors affecting viscosity, Oswald's viscometer, applications of viscometry.

Unit 3. Physico-chemical techniques:

Chromatography: Adsorption, Partition, Partition Basic principles of Adsorption & Partition Chromatography, Principle. Methodology & Applications of all types of Adsorption & Partition Chromatography methods-chromatography using paper, thin layer, Column (gel filtration, ion exchange, affinity).

Unit 4. Spectroscopy

Electromagnetic spectrum, properties of electromagnetic radiations, concept and types of spectroscopy, absorption spectrum, energy characteristics of spectrum, fundamental laws of photometry, Lamberts law, Beer's law and its deviation ,concept of λ_{\max} , chromophoric shifts, Colorimeter, spectrophotometer - design, working and application

Outcomes: Students will

- ➔ learn the underlying principles of isolation, purification, quantification and characterization of biomolecules.
- ➔ understand the outcome of results from techniques.
- ➔ Identify, diagnose faults and repair the instruments.

Swami Ramanand Teerth Marathwada University Nanded

B. Sc. Biophysics First year CBCS Pattern effective from -2019-20

Practical Paper No: CCBPP-V (Annual Theory Based Practicals)

[Practical syllabus requires **four periods per batch per week for B. Sc. First year practical**]

Maximum Marks: 100 [80+20]

[Exam Duration: 4 hrs]

Credits: 04

Practicals based Molecular Biophysics

1. Preparation of buffers (acetate, phosphate, citrate, borate buffers). Preparation of Normal, molar and standard solutions, serial dilutions
2. To study the principle of spectrophotometer. To verify the Lambert Beer's law.
3. To determine the beer's limit and measurement of molar and percent extinction coefficient.
4. To estimate the percent purities of dyes and inorganic compounds.
5. To establish the absorption spectrum and determine the absorption maxima of p-Nitro phenol.

6. To plot absorption spectrum of DNA and protein (BSA/Egg Albumin) and find λ_{max}
7. Estimation of ascorbic acid in lemon juice by titration with 2,6-DichlorophenolIndophenol
8. Estimation of Glycine or any other by formal titration method.
9. Estimation of Glucose by ortho-Toluidine method
10. Estimation of DNA by DPA method
11. Estimation of RNA by Orcinal method.
12. Estimation of reducing sugars by Benedict's Method
13. To estimate proteins by Biuret assay, Folin's-Lowry method
14. Spot test for carbohydrates.
15. Qualitative tests for Glucose, Fructose, Ribose, Maltose
16. Spot tests for Amino Acids.
17. Test for cholesterol.
18. To Isolate of Casein from milk
19. To isolate the Phospholipids from Egg Yolk
20. Estimation of protein from animal and plant sources.
21. Isolation of Starch from potato
22. Acid – Base titration using pH meter and Determine the pK values: - Strong acid Vs Strong base, Weak acid Vs Strong base, Mixture of Strong and Weak acid Vs Strong base..
23. To determine the pH titration curve of amino acids & calculate the pKa values.
24. To determine the pH titration curve of Proteins & calculate the pI values
25. To study the biomolecular structures by using ball & stick models
26. To construct the structures of biomolecules using balls & sticks.
27. To Study the simple molecular structures using DTMM or other basic molecular modeling software.

Practicals based on Biostatistics & Computer Fundamentals

1. Presentation of Statistical data by Histogram, Ogive curves, Pie diagram. frequency tables, graphs (5 assignments)
2. Measurement of central tendencies: - Arithmetic & Geometric mean, Mode and Median. (5 assignments)
3. To calculate the measures of dispersion.:(6 assignments) Mean deviation. Quartile deviation ,Standard deviation and Coefficient of variation.
4. Test of Significance. (6 assignments):Chi-Square test, t- test.
5. Calculating the Correlation coefficients.
6. Finding Regression coefficients and Regression lines
7. Basic operating procedures of computer.Basic commands – File creation, Copying and deleting in Linux and Windows
8. To create File, Folder, Directories. (2 assignments)
9. Familiarity with the Basic operations of MS-office. (7 assignments)
10. Familiarity with use of Internet, Search engines, Web sites, Surfing, Browsing websites such as NCBI,EMBL,DBT,DDBJ, Ethics in Internet surfing, Downloading text and Graphics. (4 assignments)
11. Creating Email account, Using Email, Sending and Receiving mails.

Practicals based on Cellular biophysics

1. To learn a) use of microscope b) principles of fixation and staining;
2. To familiarize with bright field, phase contrast, fluorescence & polarizing microscopes. and micrometry.

3. Microscopic observation of bacteria, microalgae, fungi, lichen and protists; Cell staining – Staining of Plant cell (onion epidermal cell), Animal cell (Squamous epithelial cell), Blood cell, Microbial cells (Bacteria & Yeast).
4. To study cell structure from onion leaf peels ; Shape and size of the cell–simple & differential staining
5. Cell division- Examination of various stages of mitosis and meiosis -mitosis (Onion root tip)& Meiosis (Tradescantia flower buds / grasshopper testes)
6. Polytene chromosome (Chironomus larvae)
7. Separation of chloroplast & flower pigments by paper chromatography
8. Microbiological Techniques:
9. Preparation of Media (Media preparation: Nutrient agar and Nutrient broth), Cotton Plugging and Sterilization, Pure culture and maintenance of culture, Dilution and pour plate techniques. Standard plate count, Gram staining, other staining methods
10. Bacterial growth curve- To raise the culture of E. coli and estimate the culture density by turbidity method. Draw a growth curve from the available data. determination of generation time

Practicals based on Basic Biophysical techniques

1.Refractometry

- i. Use of Refractometer and determine RI of biofluids, biomolecular solutions
- ii. To obtain relation between concentration & Refractive Index for solutions of proteins and sugars and estimation of specific refraction increment for proteins
- iii. Determine refractive index of a given liquid as a criterion for its purity (Benzene i.e. commercial benzene + A.R. acetone)

2.Polarimetry

- i. Use of polarimeter and determination of observed rotation α , specific rotation $[\alpha]$ and molar rotation $[\m']$ for amino acids and sugars
- ii. Determination of the percentage composition of optically active solution.

3. Conductometry

- i. Determination of cell constant
- ii. Determination of specific and equivalent conductance of electrolyte (NaCl and HCl) and Bio-fluids

4.Absorption & Fluorescence Spectroscopy

- i. To study the principle of colorimeter and spectrophotometer and determine suitable filter for light absorption studies of inorganic salts. Verify Beer-Lambert law.
- ii. Determine molar Extinction coefficient
- iii. To plot absorption spectrum of DNA and protein and find λ_{\max}
- iv. Effect of different solvents on UV absorption spectra of proteins
- v. Study of structural changes of proteins at different pH using UV Spectrophotometry
- vi. Study of structural changes of proteins at different temperature using UV Spectrophotometry.
- vii. Differentiate single stranded DNA from double stranded DNA
- viii. Quantitative estimation of DNA/RNA using spectroscopy.
- ix. Fluorescence spectrum of protein and Nucleic acids

5.Viscometry

- i. Use of Ostwald viscometer. & Determination of coefficient of viscosity η of biofluids.
- ii. Determination of relative viscosity of a macromolecule (Protein & DNA) in native and altered state of the biomolecule.

6. Electrophoresis

- i. Separation of Biomolecules (amino acids, proteins) by paper electrophoresis.

7. pH meter

- i. Use of pH meter and measuring the pH of the buffer solutions
- ii. Acid base titration of HCl vs. NaOH
- iii. To obtain pH titration curve for amino acids and estimate their pK value
- iv. Determination of ionization of a weak acid (CH₃COOH)

8. Chromatography

(i) Separation of amino acids and sugars using paper and Thin layer chromatography. Estimate their R_f value

(ii) Fractionation of mixture of amino acids and sugars using Paper & TLC

Recommended Books and Journals.

1. Bloomfield V.A. and Harrington R.E. (1975), Biophysical chemistry, W.A. Freeman
2. Cantor C.R. and Schimmel P.R. (1980), Biophysical chemistry, W.A. Freeman and Co.
3. De Robertis E.D.P. and De Robertis E.M.P. (1981), Essentials of cell and molecular Biology, Holt sounders International Editions.
4. Lehninger A. (1981), Biochemistry, Butter Worth Publication.
5. Pesce A.J., Rosen C.G and Pasty T.L., Fluorescence Spectroscopy: An introduction for Biology and Medicine, Marcel Dekkar.
6. Pullman B. (1978), Molecular Association in Biology, Academic Press.
7. Saenge W. (1984), Principles of Nucleic acid structure, Springer-Verlag.
8. Schule G.E. and schirmer R.H. (1984), Principles of protein structure, Springer-Verlag.
9. Setlow R.B. and pollard E.L. (1962), Molecular Biophysics, Pergamon Press.
10. Sheelk P. and Birch D.E. (1983), Cell Biology Structure, Biochemistry and function, John willey and sons.
11. Spragg S.E. (1980), Physical Behavior of macromolecules with biological functions, John willey and sons.
12. Stanford J.R. (1975), Foundation of Biophysics Academic press.
13. Stryer L. (1981), Biochemistry, W.A. Freeman and Co.
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Nature
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Scientific American
Current Science.
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