Progressive Education Society's

Modern College of Arts, Science and Commerce,

Shivajinagar, Pune 5
(An Autonomous College Affiliated to SavitribaiPhule Pune University)

Detailed Syllabus

For B.Sc. Biotechnology

(2019-20 Course)

(with effect from 2019-20)

Semester 1 (First Year)

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-1	19ScBioU101	Fundamentals of Chemistry I	03	02	40	60	100
CCT-2	19ScBioU102	Introduction to Physics I	03	02	40	60	100
CCT-3	19ScBioU103	Basics of Plant Sciences I	03	02	40	60	100
CCT-4	19ScBioU104	Basics of Animal Sciences I	03	02	40	60	100
CCT-5	19ScBioU105	Mathematics and Statistics I	03	02	40	60	100
CCT-6	19ScBioU106	Biological Chemistry I	03	02	40	60	100
CCT-7	19ScBioU107	Biophysics	03	02	40	60	100
CCT-8	19ScBioU108	Microbiology I	03	02	40	60	100
CCP-1	19ScBioU109	Practical In Chemistry & Biochemistry	03	02	40	60	100
CCP-2	19ScBioU110	Practical In Physics & Biophysics	03	02	40	60	100
CCP-3	19ScBioU111	Practical In Biosciences	03	02	40	60	100
CCP-4	19ScBioU112	Practical In Microbiology and Statistics	03	02	40	60	100
SECT-1	19CpPedU101	Physical Education – I	1	0.5	20	30	50
		Total Credits	**-**	**13**			

Semester 2 (First Year)

Course Type	Course Code	Course / Paper Title	Hours / Week	Credit	CIA	End Sem Exam	Total
CCT-9	19ScBioU201	Fundamentals of Chemistry II (2C)	03	02	40	60	100
CCT-10	19ScBioU202	Bio Physics and Instrumentation (2C)	03	02	40	60	100
CCT-11	19ScBioU203	Basics of Plant Sciences II(2C)	03	02	40	60	100
CCT-12	19ScBioU204	Basics of Animal Sciences II(2C)	03	02	40	60	100
CCT-13	19ScBioU205	Mathematics and Statistics II (2C)	03	02	40	60	100
CCT-14	19ScBioU206	Biological Chemistry I (2C)	03	02	40	60	100
CCT-15	19ScBioU207	Microbiology II (2C)	03	02	40	60	100
CCT-16	19ScBioU208	Computers and Applications (2C)	03	02	40	60	100
CCP-5	19ScBioU209	Practical In Chemistry & Biochemistry (2C)	03	02	40	60	100
CCP-6	19ScBioU210	Practical In Microbiology and Bioinstrumentation	03	02	40	60	100
CCP-7	19ScBioU211	Practical In Biosciences (2C)	03	02	40	60	100
CCP-8	19ScBioU212	Practical Computer application and Statistics (2C)	03	02	40	60	100
SECT-2	19CpPedU201	Physical Education – II	1	0.5	20	30	50
		Total Credits	**-**	**13**			

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First Year of B.Sc. Biotechnology (2019 Course)

Course Code: 19ScBioU101
Course Name: Fundamentals of Chemistry - I

Teaching Scheme: TH: 3 Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic chemistry chapters from XI & XII Science.
Course Objectives:
- To Study Basics of chemistry and important reactions which will help various processes in biological system.
- To understand structure of molecule and various chemical reactions.
- To understand basics of thermodynamics and its applications in biochemical reactions.
- To understand basics of chemical bonding.

Course Outcomes:

On completion of the course, the student will be able to–
- Study all basic fundamentals of chemistry
- Extend their analytical thinking in the research field.

Semester I

Course Contents

Chapter-1	Atomic Structure	6 Lectures
	• Historical background, Electronic structure of atom, Atomic & Molecular Orbitals • Shapes of Atomic Orbitals, Molecular Orbital method, Selection rules to find Electronic Configuration of Elements	
Chapter -2	Molecules	7Lectures
	• Diatomic molecules, Valence bond theory, VSEPR theory, Hybridization involving s, p,d orbitals $(sp, sp^2, sp^3, dsp^2, sp^2d, sp^3 d, sp^3 d^2)$ • Homo and heteronuclear diatomic molecules, Bond order, Magnetic properties	
Chapter -3	Chemical Bonding	7 Lectures
	• Types of bond covalent, Ionic, Hydrogen bonding, Inter and Intramolecular Hydrogen bonding • Dipole- dipole, Dipole-induced dipole interaction, Structure of water molecule, Oxidation state. • Hydrophobic & Hydrophilic interaction, Hybridization involving S & P orbitals	
Chapter -4	Thermodynamics	10Lectures
	• Entropy, Enthalpy, free energy, Reaction	

	spontaneity	
	• Laws of thermodynamics, Critical temperature & criticalPressure,	
	• Carnot cycle and Concepts used in Refrigeration Principle, Adiabatic & Isothermal process	
	• Conditions for good refrigerant, Types of systems, Intensive and Extensive properties, Equilibrium and non-equilibrium states, Reversible and irreversible processes	
	• Internal energy, Endo and Exothermic reactions,Free energy and work,	
	• Gibb's Helmholtz equations, ATP and its Role in Bioenergetics, Biological Oxidation Reduction Reactions (in terms ofelectrons)	
	• Enzymatic process	
Chapter -5	Basics of Organic & Stereochemistry	6Lectures
	• IUPAC nomenclature Reactions of functional groups- Alkane, Alkene, Alkyne, Alcohol, Amines, Alkyl Halides, Ether.	
	• Organic reactions- Oxidation, Reduction, Elimination, Addition, Substitution (Electrophilic/ Neucleophilic)	
	• Conformations, configurations, Isomerism(structural and stereoisomers),Newman's & Fisher Projection formula, Epimers , Anomers	
	• Furanose and Pyranose form, Free Radical Reactions.	
	Total Lectures	**36**

References-
- Stereochemistry: Conformation and mechanism by P.S.Kalsi
- Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren
- University General Chemistry by C.N. Rao, 1st edition (2000), Macmillan Publishers, India ,
- Principles of Physical Chemistry, S.H. Maron and C.F. Prutton, Collier, 4th edition (1965)Macmillan Ltd.
- The elements of Physical Chemistry, Atkins P, de Paula J. , W. H. FreemanPublication, 5th edition (2009),USA
- An Introduction to Electrochemistry , Samuel Glasstone, BiblioBazaar, USA edition reprint, 2011,
- Physical Chemistry for biological sciences, Chang R , 1st edition, (2005),University Science Books, USA
- Physical Chemistry, David Ball, Thoson Learning, 1st edition, (2003), USA.
- Essentials of Physical Chemistry, B S Bahl, G D Tuli, ArunBahl, S. Chand Limited, 24th Edition(2000) India.
- Concise Inorganic Chemistry, Author: J. D. Lee, John Wiley & Sons, USA, 5th edition (2008),
- Organic Chemistry, Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.), 6th Edition
- Guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition, (1996), Prentice Hall, India.

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FirstYear of B.Sc.Biotechnology
(2019 Course)

Course Code: 19ScBioU102
Course Name: Introduction to Physics –I

Teaching Scheme: TH: 3Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisites:
- Equilibrium and Elasticity,
- Measurements
- Introductory Classical Physics
- Gravitation
- Introductory Optics
- Heat and thermodynamics

Course Objectives:
- To Study Measurements, Waves and Oscillations, Fluid Mechanics, Electricity and Magnetism

Course Outcomes:

On completion of the course, student will be able to–

- Apply the knowledge of basic physics to Biological Sciences
- Know the relevance of physics in Life Sciences
- Understand the concepts behind a few Biophysical instruments

Semester I

Course Contents

Chapter 1	Measurements	3 lectures
	- Physical quantities: fundamental and derived units. - System of Units. - Order of magnitude. - Length: radius of proton to astronomical distances. - Mass: atomic mass unit to mass of Earth. - Time: fast elementary particle to age of Earth. - Inter-conversion of units.	
Chapter 2	Fluid Mechanics	8 lectures
	- Fluids: Definition, Pressure, Density. Measurement of pressure. Various units of Pressure and their inter conversion. - Compressible and Incompressible fluids. - Archimedes' principle and application. - Streamline and Turbulent flow. Critical Velocity and Reynold's number (physical significance). - Equation of continuity. - Flow of liquids through capillaries. Poiseuille's law (physical significance only). - Bernoulli's theorem and its application to Venturimeter and pitot tube (physical significance only).	

Chapter	Topic	Lectures
	• Viscosity, Newton's law of viscosity, Coefficient of viscosity. Ostwald's viscometer. Relevance to Life Sciences.	
Chapter 3	**Surface Tension**	5 lectures
	• Surface tension and surface energy. • Cohesive and Adhesive forces. • Capillary action, Angle of contact, Wettability • Factors affecting Surface Tension. • Applications of Surface Tension. Relevance to Life Sciences.	
Chapter 4	**Waves and Oscillations**	7 lectures
	• Types of Waves (transverse and longitudinal). • Principle of Superposition of Waves. • Standing and Travelling Waves. • Sound Waves as Pressure Waves. Audible, Ultrasonic, and Infrasonic Waves. • Characteristics of Sound Waves. • Beats. • Doppler Effect. • Applications in Life Sciences.	
Chapter 5	**Geometrical Optics**	5 lectures
	• Reflection, Refraction (Snell's Law). • Types of lenses, Combinational lenses, Radius of Curvature, Focal length, Lens maker equation. • Microscopes. Optical power, Diopter. • Magnification. • Mirrors. • Aberrations	
Chapter 6	**Electricity and Magnetism**	8lectures
	• Electric charge. Quantization and Conservation of charge. • Conductors, Insulators, and Semiconductors. • Coulomb's law, Electric field intensity, Electric lines of force. • Magnetic field, Lorentz force, Poles and Dipoles. • Concept and Definition of Magnetic Induction. • Gauss' Law in Magnetism. • Magnetic Intensity, Magnetic Susceptibility, Magnetization. • Diamagnetism, Paramagnetism, Ferromagnetism. • Nuclear magnetism, Biomagnetism.	
	Total Lectures	**36**

References:

1. Concepts of Physics. Volume I and Volume II. (2010). H. C. Verma.
2. Fundamentals of Physics, 9th edition (2010). David Halliday, Robert Resnick, Jearl Walker.
3. Sears and Zeemansky's University Physics, 13th edition (2012). Hugh Young, Roger Freedman, A. Lewis Ford.
4. A Textbook of Optics (2001). Dr. N. Subrahmanyan, Brij Lal, Dr. M. N. Avadhanulu. By S. Chand publications.
5. Electricity, Magnetism, and Electromagnetic Theory (2018). S. R. Manohara, Shubha A. By S. Chand publications.

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FirstYear of B.Sc.Biotechnology
(2019 Course)**

**Course Code: 19ScBioU103
Course Name: Basics of Plant Science I**

Teaching Scheme: TH: 3Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite:
- To know Basic Botany in 11th and 12th Std.

Course Objectives:
- To Study Morphology and Anatomy, different classes of Plant Groups and also identification of plants on the Basics of their Morphology.
- To learn Plant Taxonomy and Plant Identification

Course Outcomes:
- The student will be able to understand plant group and identify plants on the basis of their Morphology.

Semester I

Course Contents

Chapter 1	Plant as a Life Form	2 lectures
	• Introduction to Plant World and Life Form- General & Unique features of Plants	
Chapter 2	Introduction to Plant Groups and their Classification	10 lectures
	• Algae, • Fungi, • Bryophytes, • Pteridophytes, • Gymnosperms, • Angiosperms with examples	
Chapter 3	Morphology and Anatomy of Vegetative and Reproductive Plant Organs :	10 lectures
	• Leaf • Shoot • Root • Flower • Inflorescence • Fruit	
Chapter 4	Introduction to Plant Taxonomy	7 lectures
	• Fundamental components of Taxonomy,Identification, Nomenclature, Classification • Botanical Nomenclature Principles and Rules of ICBN, Ranks and Names; Binomial System;	
Chapter 5	Plant Tissues	7 lectures

	• Meristems -- Root and Shoot Apical Meristems and their Histological Organization. • Tissues – Meristematic and Permanent Tissues (Simple and Complex)	
	Total Lectures	**36**

References:

1. A textbook of Botany (Algae, Fungi, Virus, Microbiology, Plant pathology, Bryophytes, Pteridophytes and Gymnosperms) V. Singh, Pandey and Jain,Rastogi Publications, Shivaji Road, Meerut.

2.Botany for Degree Students, B.R Vashista, Sinha ,S. Chand and Company Ltd, Ramnagar, New Delhi.

3.College Botany Vol - I.B.P. Pandey Chand and Company Ltd, Ram Nagar, New Delhi.

4. College Botany, Vol -II,S. Sundarajan, Himalaya Publishing House, New Delhi.

5. College Botany (For degree students), AC Datta,Manzar Khan Oxford University, Press Kolkata.

6. College Botany Vol- I Gangulee Das and Dutta, New Central Book Agency, Kolkata.

7. AText Book of Botany Vol II, Pandey and Ajanta Chaddha,Vikas Publication Pvt. Ltd, New Delhi

8. A Classbook of Botany,Dutta A.C., (Oxford University Press, UK)(2000)

9. Taxonomy of Vascular Plants (Scientific Pub.),Lawrence G.H. (2012)

10. Anatomy of Seed Plants (Wiley, USA),Esau K. (1977)

11. Plant Anatomy: An Applied Approach (Blackwell Sci, USA), Cutler, Botha & Stevenson (2007)

12. College Botany Vol I, II and III (New Central Book Agency, Kolkata),Ganguli, Das Dutta (2011)

13. The Morphology of Gymnosperms (The Structure and Evolution of Primitive seed Plants),Sporne K.R. (1971), Hutchinson University Library, London.

14. Vascular Differentiation in Plants. Esau, K. (1965), Holt, Rinehart and Winston, N.Y., Chicago, San Francisco, Toronto, London.

15. An Introduction to Plant Anatomy , Eames, A.J., and Mc Daniels, L.H. (1979) Tata-McGraw Hill Publishing Co., (P) Ltd. Bombay, New Delhi.

16.Plant Anatomy, (2nd Edition) Esau. K. (1980), Wiley Eastern Ltd., New Delhi

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FirstYear of B.Sc.Biotechnology

(2019 Course)

Course Code: 19ScBioU104
Course Name: Basics of Animal Science l

Teaching Scheme: TH: 3 Hours/Week   **Credit:02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite:
- Basics Zoology from XI and XII science

Course Objectives:
- To study basics of Animal Sciences, different types of Animal Tissues, Animal Physiology
- To learn the Morphology of Honey Bee in detail

Course Outcomes:

On completion of the course, the student will be able to–

- Understand the basic classification of Kingdom Animalia, Animal physiology (Respiration and Hormones)
- To understand Morphology of Honey Bee in detail also Apiculture and its Economic importance

Semester I

Course Contents

Chapter 1	Introduction to Kingdom Animalia	7 lectures
	- Outline classification of kingdom Animalia - Non-chordates (characteristic features and representative examples.) - Chordates (characteristic features and representative examples.	
Chapter 2	Animal Tissue Types	8 lectures
	- Tissue types and subtypes with suitable examples - Epithelial tissue - Muscle tissue - Nervous tissue - Connective tissue	
Chapter 3	Respiration	10 lectures
	- Respiration in Water (fish), Air (amphibian, reptiles, birds and mammals), Air breathing fish. - Respiratory pigments: Different types of respiratory pigments. - Oxygen dissociation curves. Effect of temperature, pH, CO2, Organic Phosphate Compounds, Altitude. - Oxygen dissociation curve of Fetal Blood. - Dissociation curves of invertebrates. - Dissociation curve and Body size.	
Chapter 4	Hormones	6 lectures

	• Invertebrates: control and integration: function and role of nervous system, insect endocrinology • Introduction to Endocrine, Paracrine and Autocrine systems • Endocrine system in Vertebrates	
Chapter 5	Type Study: Non-chordate : Honeybee: (visit)	5 lectures
	• Different species of Honey bee (*Apis sp.*) • Morphology: Structure of Head, Mouthparts, Legs, Wings, Sting Apparatus; Social Organization, • Apiculture	
	Total Lectures	**36**

References:

1. Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi. 2. Jordan, E.L. and Verma P.S. 1978
2. Invertebrate Zoology. S. Chand & Company Ltd. Ram Nagar. New Delhi.
3. Modern Text Book of Zoology: Invertebrates.,R.L.Kotpal. Publisher, Rastogi Publications, 2012.
4. Animal Physiology Adaptation and Environment (fifth edition); Knut Schmidt-Nielsen
5. Introduction to general Zoology Vol 1. K. Chaki, G. Kundu, S. Sarkar
6. Principles of Animal Physiology; Pearson Publications; 2nd edition; C. Moyes& P. Schulte

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(2019 Course)

Course Code:19ScBioU105
Course Name: Mathematics and Statistics l

Teaching Scheme: TH: 4 Hours/Week   **Credits: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite:
- XI & XII Science Mathematics
- Knowledge of Complex Numbers

Course Objectives:
- Trigonometry.
- Limit and Continuity
- Set theory
- Introduction to Statistics
- Descriptive Biostatistics

Course Outcomes:

On completion of the course, student will be able to–
- Know about trigonometric applications
- Solve sequence and series problems
- Know about Data sampling, Central limit theorem, Skewness and Kurtosis.

Semester I

Course Contents

Mathematics		
Chapter 1	Pre-requisites	3 lectures
	• Sets: Definition, • Types of sets (empty set, finite sets ,infinite sets, equal sets, singleton sets), with Venn diagram • Subset, • Operations on set(union, intersection) • Number system:$\mathbb{N} \subset \mathbb{Z} \subset \mathbb{Q} \subset \mathbb{R} \subset \mathbb{C}$ • Graphs:$X,1/X,X^2,X^3,|X|,\log x,e^{\{x\}},\sin x, \cos x,$ line, parabola, hyperbola, ellipse, circle, biological graphs	
Chapter 2	Trigonometry	5 lectures
	• Using triangle prove the trigonometric ratios, • Trigonometry table of angles • Trigonometric identities • Pythagoras formula • Trigonometric applications in Physics and Biology	
Chapter 3	Limits and Continuity	7 lectures
	• Definition , Standard examples • Continuity:$\in -\delta$ definition,examples • Differentiation:definition, formula chart of	

	derivatives	
	• Integration:definition(area under the curve concept), formula chart of integration	
	• Sequence:definition, examples	
	• Series:definition, examples	
	• Applications:Fibonacci sequence,Geometric series(finite,infinite),A.P., G.P, Golden ratio	
Statistics		
Chapter 4	Introduction to Statistics	5lectures
	• Need of Statistics in Biology, • collection and organization / Classification, Summarization and Analysis of Biological Data • Data, Variables, Parameters, Populations and Samples, • Types of Sampling Distribution • Representation of data using Frequency Distribution diagram.	
Chapter 5	Descriptive Biostatistics	10 lectures
	• Descriptive Measure, • Measures of Central tendency (A.M., G.M.,H.M. frequency, Median and mode) • Measures of Dispersion(for Ungrouped and Polygon, Grouped data) • Skewness and Kurtosis with interpretation • Scatter diagram, Correlation, Simple Linear Regression	
	Total Lectures	**36**

References-
- Ordinary and Partial Differential Equations by Dr. M.D.Raisinghanhia
- S.Chand all books
- Trigonometry (9th edition) by Lial, Margaret; Hornsby, John; Schneider, David I.
- Trigonometry-4th edition by Marek Dugopolski
- An Elementary Course in Partial Differential Equation by T.Amarnath

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FirstYear of B.Sc.Biotechnology
(2019 Course)

Course Code: 19ScBioU106
Course Name:Biological Chemistry l

Teaching Scheme: TH: 3 Hours/Week   **Credit: 02**

Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic Chemistry from XI & XII Science.
Course Objectives:
- To study basics of Biochemistry and important reactions which will help understand various processes in Biological system.
- To study Chemistry of Biomolecules.
- To understand Structure and Functions of Biomolecules.

Course Outcomes:

On completion of the course, student will be able to–
- Study all basic fundamentals of Chemistry and Biomolecules.
- Understand Structure and Functions of Biomolecules.

Semester I

Course Contents

Chapter-1	Biological Chemistry	5 lectures
	- Introduction to Biochemistry - Historical perspective- cellular and chemical foundation - Genetic and Evolutionary Foundations - Origin of Life - Abiotic Production of Biomolecules	
Chapter-2	Water	8lectures
	- Water as Biological medium - Properties of Water - Anomalous behaviour, Weak Interactions in Water - Interaction of Biological molecules in water, Hydrogen bonding - Ionization of water, Osmosis, - Concept of pH - Titration of weak acids - Buffers - Biological buffers - Types of bond - Covalent and noncovalent interactions in biomolecules with suitable example - Functional groups and modification of functional group relevant to biomolecules.	
Chapter-3	Basic Biomolecule	12lectures

	• Basic Biomolecule: Carbohydrates: sugars and non-sugars • Classification of carbohydrates- mono, oligo, dextrins and polysaccharide. Monosaccharides: classifications of monosaccharide based on functional group (ketoses and aldoses) based on number of carbon atoms • D and L configuration • conformations • Mutarotation • Epimers • Anomers, • Chemical and physical properties ; Alpha, Beta Glycosidic linkage • Oligosaccharides • Reducing and non- reducing sugars • Inversion of sugar • Polysaccharides- its classification based on function (1. Storage polysaccharide eg. Starch, Glycogen and Inulin 2.structural polysaccharides eg. cellulose, chitin) mucopolysaccharide • Functions of Carbohydrate	
Chapter-4	Lipids	11lectures
	• Function of lipids • Classification of lipids • Simple lipids- its structure and classes • Fatty acids • Saturation and unsaturation of fatty acids with examples • Its significance, • Fatty indices, • Chemical and Physical Properties, • Complex lipids: Phospholipids, Sphingo lipids, Cerebrosides, Gangliosides, prostaglandin • Cholesterol (good and bad) Steroids.	
	Total Lectures	**36**

References:

1. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf: John Wiley and Sons, USA

2. Fundamentals of Biochemistry. 3rd Edition, (2008), Donald Voet& Judith Voet , John Wiley and Sons, Inc. USA

3. Principles of Biochemistry, 4th edition (1997), JefforyZubey, McGraw-Hill College, USA

4. Biochemistry: 7th Edition, (2012), Jeremy Berg, LubertStryer, W.H.Freeman and company, NY

5. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.

6. Biochemistry. 5th Edition, (Copyright 2013), Reginald Garett and Charles Grisham, Brook/Cole, Cengage Learning, Boston, USA.

7. An Introduction to Practical Biochemistry.3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India

8. Biochemical Methods.1st, (1995), S.Sadashivam, A.Manickam, New Age International Publishers, India

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(2019 Course)

Course Code:19ScBioU107
Course Name: Biophysics

Teaching Scheme: TH: 3Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic Physics from XI and XII Science
Course Objectives:

- To study different models of Atomic structure, Radioactivity concept and measurement, Biophysical properties of membrane
- To learn Separation techniques , Evaporation, Distillation, Chromatography, Electrophoresis and Microscopy

Course Outcomes:

On completion of the course, student will be able to–

- Understand different models of Atomic structure, Radioactivity concept and measurement, Biophysical properties of membrane

Semester I

Course Contents

Chapter 1	Atomic Structure	6 lectures
	- Historical background up to Bohr model. - Significance of second and third postulate of Bohr's model. - Derivation of Radius and Energy value. - Bohr – Sommerfeld Model. - Vector Atom Model. - Quantum Numbers. - Electronic Configuration.	
Chapter 2	Radioactivity	8 lectures
	- Concept and History. - Atomic number, Mass number, Isotopes, Isotones, Isobars. - Nucleus, Nuclear forces and Properties - Nuclear Models (liquid drop and shell model) - Alpha, Beta & Gamma radiation. - Half-life Concept (numericals) - Biological Applications of Radioactivity. - Measurement of Radioactivity: GM Counter and Scintillation counter.	
Chapter 3	Biophysical properties of Membrane	8 lectures
	- Membrane Models - Membrane transport: active and passive transport, Co-transport (Uniport, Symport	

	and Antiport) Osmosis, Diffusion. • Electrical properties of Membrane • Membrane potential and Action potential (Depolarization, Hyperpolarization and repolarization of Neuronal membrane). • Nernst Equation.	
Chapter 4	**Introduction to Separation Techniques**	8 lectures
	• Basics of Evaporation and Distillation • Chromatography, Electrophoresis, Types & Application	
Chapter 5	**Microscopy**	6 lectures
	• Resolving Power, Numerical Aperture, Image formation • Types- light field & dark field microscopy • Working and Construction of Simple, Compound & Stereo microscope, Inverted microscope, Phase Contrast microscope, Fluorescence microscope Electron microscope, SEM & TEM. Scanning Probe Microscopy, Acoustic Microscopy.	
	Total Lectures	**36**

References:

1. Biophysics, an introduction. 1st edition. (2002) Cotteril R. John Willey and Sons Ltd., USA
2. Biophysics. 1st edition (2002), Pattabhi V and Gautham N. Kluwer Academic Publisher, USA.
3. Textbook of optics and atomic physics, 8th edition (1989) P.P. Khandelwal, Himlaya Publishing House, India.
4. Instrumentation measurements and analysis – 2nd edition (2003). Nakra and Choudhari, Tata Mc Graw Hill, India.
5. Nuclear Physics: An Introduction. 2nd edition (2011). S. B. Patel. Anshan Publication, India

CourseCode:19ScBioU108
Course Name: Microbiology1

Teaching Scheme: TH: 3Hours/Week   **Credits: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite:
- Basic concepts of microbiology

Course Objectives:
- To study in detail the structure and characteristics of Microorganisms
- To learn the different techniques used in Microbiology

Course Outcomes:

On completion of the course, student will be able to–

- Isolate and Preserve the unknown Microorganism
- Understand the role of Microorganisms in Nature

Semester I

Course Contents

Chapter 1	Introduction to Microbial World	9 lectures
	- Bio-complexity of Microorganisms. - Important developments leading to major discoveries. - Path breaking discoveries. Product Development (18th – 20th Century includingpre golden, golden and post golden era)	
Chapter 2	Classification of Microorganisms	9 lectures
	- Five major groups of Microorganisms: Bacteria, Fungi, Cyanobacteria, Archaea and Viruses. - Introduction to Bergey's Manual	
Chapter 3	Prokaryotic Cell Structure	9 lectures
	- Function and Ultra-structure of cell wall (Gram positive and negative) - Structure of Plasma membrane	
Chapter 4	Handling of Microorganisms and Biosafety measures	9 lectures

• Sterilization : Physical Agents - Heat, Radiation, Filtration • Chemicalagents and their mode of action - Aldehydes, Halogens, Quaternaryammonium compounds, Phenol and phenolic compounds, Heavymetals, Alcohol, Dyes, and Detergents, Ethylene oxide.	
Total Lectures	**36**

Reference Books:
1. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY
2. General Microbiology - Stanier R.Y., 5th edition, (1987)Macmillan Publication, UK.
3. Presscott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHil Science Engineering, USA.
4. Brock Biology of Microorganisms 9th ed. (2000), John M. Martinko, Jack Parker. Prentice hall, Upper Saddle River, New Jersey.
5. Presscott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHil Science Engineering, USA.

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Course Code: 19ScBioU109
Course Name: Practical in Chemistry and Biochemistry I

Teaching Scheme: TH: 3 Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic chemistry from XI & XII Science.
Course Objectives:

- To study basics of Chemistry and important reactions which will help various processes in biological system
- To study estimation methods of important biomolecules.

Course Outcomes:

On completion of the course, student will be able to–
Study all basic fundamentals of chemistry and extend their analytical thinking in research field.

Semester I

Course Contents

	Practicals in Chemistry	
Practical-1	Preparation of solutions	1 Practical
	To prepare Buffer solutions having different Concentrations	
Practical -2	Titrations	1 Practical
	a. To study Acid base titration based by conductivity measurement. b. To determine Alkali content in antacid tablet using HCl	
Practical -3	Chemical Kinetics	1 Practical
	To study Kinetics of Ester Hydrolysis	
Practical -4	Thermochemistry	1 Practical
	To determine Enthalpy and Entropy change of a reaction $2FeCl_3 + 3Mg \rightarrow 2Fe + 3MgCl_2$	
Practical -5	Hardness of Water	1 Practical
	To estimate Hardness of Water by using EDTA	
Practical -6	Qualitative Analysis	2 Practical
	To perform Qualitative test for – Hydrocarbons, Alcohols, Aldehyde, Ketones, Aniline, Amide	
	Practicals in Biochemistry	
Practical -1	Biological Buffers	1 Practical
	Preparation of Solutions and Buffers.	
Practical -2	Estimations	2 Practical

	a. To estimate concentration of lipids in given sample b. To estimate concentration of reducing sugar in given sample by DNSA method.	
Practical- 3	Saponification number	1 Practical
	To find out saponification number of given lipid	
Practical -4	Qualitative test for sugar	1 Practical
	To perform Spot tests for sugar and cholesterol	
Practical- 5	Isoelectric point	1 Practical
	To find out isoelectric point p^I of amino acid glycine.	

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Course Code:19ScBioU110
Course Name: Practical in Physics & Biophysics I

Teaching Scheme: TH: 3 Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem:60 Marks**

Prerequisite: Basic physics from XI & XII
Course Objectives:
- To learn separation techniques , evaporation, distillation, chromatography, electrophoresis and microscopy
- To learn the functioning and calibration of few biophysical instruments

Course Outcomes:
On completion of the course, student will be able to–
- Understand all basic working principles of bioinstrumentation and separation techniques
- Measure at scales smaller than 1 mm.
- Calibrate spectrometer

Semester I

Course Contents

Practicals in Biophysics		
Practical-1	Working and Calibration	1 Practical
	• Electronic Balance • Micropipette	
Practical 2	Microscopy	1 Practical
	Components and working of Bright field Compound microscope	
Practical 3	Components and Working	2 Practical
	• Electrophoresis • Chromatography	
Practical 4	Components and Working	2 Practical
	• Distillation unit • Soxhlet unit	
Practicals in Physics		
Practical-1	Measuring Instruments	2 Practical
	Use of Measuring Instruments (Vernier calipers, Micrometer Screw Gauge, Travelling Microscope).	
Practical-2	Coefficient of Viscosity	1 Practical
	To determine the viscosity of a given liquid by Rotating Cylinder Method	
Practical-3	Spectrometer	1 Practical
	To calibrate given spectrometer using Schuster's method	

Practical-4	Electronic Components	1 Practical
	To Study of electronic components	
Practical-5	Plane Diffraction Grating	1 Practical
	To determine the wavelength of given LASER using a Plane Diffraction Grating.	

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**Course Code:19ScBioU111
Course Name:Practicals in Bioscience I**

Teaching Scheme: TH: 3 Hours/ Week   **Credits: 02**
Examination Scheme: CIA:40 Marks   **End-Sem: 60 Marks**

Prerequisite:
*   Basic knowledge of Zoology
Course Objectives:
*   To Study Paramecium, Earthworm and Amphioxus morphology and reproduction
*   To study Honey bee morphology
Course Outcomes:
On completion of the course, student will be able to–
*   Dissect and identify different body parts of Honey bee
*   Understand Paramecium, Earthworm and Amphioxus morphology

Semester I

Course Contents

	Zoology	
Chapter 1	Study of Paramecium	2 practical
	• Morphology • Reproduction: sexual and asexual types	
Chapter 2	Study of Earthworm	1practical
	• Morphology • Habitat • Applications	
Chapter 3	Study of Amphioxus	1 practical
	• Morphology • Habitat • Applications	
Chapter 4	Dissection of Honey Bee: (visit)	1 practical
	• Mounting of Mouth parts, • Pollen basket, • AntennaCleaner, • Sting Apparatus, • Legs and Wings	
Chapter 5	Staging and Staining	1 practical
	• Preparation of vital stain, slide preparation • Sewage water analysis under microscope	

	Botany	
Practical 1	To Study of characteristics features of the following	1 Practical
	- Algae - Fungi - Bryophytes - Pteridophytes - Gymnosperms - Angiosperms	
Practical 2	Study the Anatomy of Monocot	1 Practical
	Study the Anatomy of root, stem and leaf of monocot and dicot plant by taking sections and staining (Single and Double staining.)	
Practical 3	Study of Plant Cell Types	1 Practical
	Study of plant cell types using squash techniques and Maceration.	
Practical 4	Studies of Families	1 Practical
	To study of Plant taxonomy of any Three family	2 Practical
Practical 5	Study of Different Inflorescences	1 Practical

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Course Code:19ScBioU112
Course Name: Practicals in Microbiology and Statistics I

Teaching Scheme: TH: 3 Hours/Week **Credits: 02**
Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Prerequisite:
- Basic concepts of microbiology

Course Objectives:
- To study in detail the structure and characteristics of microorganisms
- To learn the different techniques used in microbiology

Course Outcomes:

On completion of the course, student will be able to–
- Isolate and preserve the unknown microorganism
- Understand the role of microorganisms in nature

Semester I

	Practicals in Microbiology	
Practical 1	Introduction to MicrobiologyPracticals	2 Practical
	Introduction to Microbiology Laboratory and Aseptic Transfer Techniques, Sterility testing	
Practical 2	Preparation of Media	1 Practical
	Preparations of Media for bacterial/fungal culture	
Practical 3	Isolation of Microorganisms	1 Practical
	Isolation of bacteria by streak plate technique and preservation of microorganisms	
Practical 4	Enumeration Techniques	2 Practical
	a) Pour plate method b) Spread plate method	
	Practicals in Statistics	
Practical 1	Data Representation	3Practical
	Data representation using various graphical types	
Practical 2	Correlation and regression analysis	3 Practical
	Correlation and Regression Analysis of data and graphical presentation	

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**Course Code: 19ScBioU201
Course Name: Fundamentals of Chemistry ll**

Teaching Scheme: TH: 3Hours/Week　　　　　**Credits: 02**
Examination Scheme: CIA: 40 Marks　　　　　**End-Sem: 60 Marks**

Prerequisite: Knowledge of Basic chemistry from XI & XII Science.
Course Objectives:
- To study Basics of chemistry
- Important reactions which will help various processes in biological system
- To study importance of pHand buffer in chemical and biochemical reactions
- To understand chemical kinetics of chemical and biochemical reactions
- To expertize students in biochemical calculations

Course Outcomes:

On completion of the course, student will be able to–
- Study all basic fundamentals of chemistry
- Extend their analytical thinking in research field.

Semester I

Course Contents

Chapter-1	Ionic equilibria	12Lectures
	• pH,buffer, Dissociation Constant,pK values Solubility Product, Indicators in titration. Equilibrium constant, Le Chatelier's principle, Acid and bases • Strength of acid &bases, pH of aqueous solutions, Acid–base titrations, Titration curves, Solubility product &Applications • Ionic product • Condition for precipitation, Buffers, Buffer action,Henderson equation & related problems • Osmosis, law of osmotic pressureand its measurement, determination of molecular weight from osmotic pressure • Properties of water, water as a reactantinteraction of biomolecules withwater	
Chapter-2	Chemical kinetics	9Lectures
	• Rates of reactions, order & molecularity, zero, first & second order reactions, • Differential and integrated rate equation, half-lifeperiods,Arrheniusequation,collision theory of reaction rate, temperaturedependent reaction rates	
Chapter-3	Electrochemistry	9Lectures
	• Electrochemical cell,half cell, reaction, reduction	

	potential, electrochemical series,	
	• Thermodynamic potential function from cell potential measurement,	
	• Liquid junction potential, Huckel theory, overvoltage/ overpotential	
Chapter-4	Basics of mole concept	6Lectures
	• Mole concept, Determination of molecular weight by gram molecular volumerelationship,	
	• Problems based on mole concept, Solutions,colligative properties	
	• Methods of expressingconcentrations, strength, Normality, Molarity and Molality, ppm,Standardization ofsolutions, pH, buffer systems, dissociation constant, pK value,	
	• Preparation ofstandardsolution of acids and bases, Problems related to acid base titrations,volumetricexperiments,acidimetry, alkalimetry, permanganometry, dichrometry, iodometry.	

References-
- Stereochemistry: Conformation and mechanism by P.S.Kalsi
- Organic chemistry by Jonathan Clayden, nick Greeves and Stuart Warren
- University General Chemistry by C.N. Rao, 1st edition (2000), Macmillan Publishers, India ,
- Principles of Physical Chemistry, S.H. Maron and C.F. Prutton, Collier, 4th edition (1965) Macmillan Ltd.
- The elements of Physical Chemistry, Atkins P, de Paula J. , W. H. Freeman Publication, 5th edition (2009),USA
- An Introduction to Electrochemistry , Samuel Glasstone, BiblioBazaar, USA edition reprint, 2011,
- Physical Chemistry for biological sciences, Chang R , 1st edition, (2005),University Science Books, USA
- Physical Chemistry, David Ball, Thoson Learning, 1st edition, (2003), USA.
- Essentials of Physical Chemistry, B S Bahl, G D Tuli, ArunBahl, S. Chand Limited, 24th edition(2000) India.
- Concise Inorganic Chemistry, Author: J. D. Lee, John Wiley & Sons, USA, 5th edition (2008),
- Organic Chemistry, Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.), 6th edition
- Guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th edition, (1996), Prentice Hall, India.

Progressive Education Society's
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First Year of B.Sc. Biotechnology
(2019 Course)

Course Code: 19ScBioU202
Course Name: Biophysics& Instrumentation

Teaching Scheme: TH: 3 Hours/Week   **Credits: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic Biology and Physics from XI and XII Science
Course Objectives:

- To study basics of instrumentations: Spectroscopy, Centrifugation, pH meter, Refrigeration.
- To learn Thermometers

Course Outcomes:

On completion of the course, student will be able to–

- Understand basics of instrumentations: Spectroscopy, Centrifugation, pH meter, Refrigeration.

Semester II

Course Contents

Chapter 1	Spectroscopy	10 lectures
	- Nature of light and EMR - Characteristics of EMR, Electromagnetic spectrum - Interaction with matter: Absorption, Excitation, Emission. - Absorption spectroscopy, Beers & Lambert's Law. - Construction, working principle and applications (Biomolecules) of Colorimeter, Spectrophotometer, Flurometer.	
Chapter 2	Biophysical techniques II	8 lectures
	- Centrifugation, Sedimentation, Principle of Centrifuge, RCF, Types of Centrifuge and Centrifugation. - Solubility & Precipitation, Dialysis, Reverse Dialysis, Precipitating agent, Factors affecting Solubility.	
Chapter 3	pH meter	7 lectures
	- pH concept - Electrodes - Acid base titration of amino acid - Isoelectric pH - Conductometer& its application.	
Chapter 4	Thermoregulation	5 lectures

	• Homeostasis • Temperature measurement. • Different types of Thermometers	
Chapter 5	Refrigeration	6 lectures
	• Temperature & critical pressure, • Carnot cycle and concepts used in refrigeration, • Refrigeration principle, • Adiabatic & Isothermal process, conditions for good refrigerant. • Introduction to Cryopreservation	

References:

1. Biophysics, An Introduction. 1st edition. (2002) Cotteril R. John Willey and Sons Ltd., USA

2. Biophysics. 1st edition (2002), Pattabhi V and Gautham N. Kluwer Academic Publisher, USA.

3. Textbook of Optics and Atomic Physics, 8th edition (1989) P.P. Khandelwal, Himlaya Publishing House, India.

4. Instrumentation measurements and analysis – 2nd edition (2003). Nakra and Choudhari, Tata McGraw Hill, India.

5. Nuclear Physics: An Introduction. 2nd edition (2011). S. B. Patel. Anshan Publication, India

Course Code: 19ScBioU203
Course Name: Basics of Plant Science ll

Teaching Scheme: TH:3Hours/Week   **Credit: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite:
- Knowledge of plant physiology

Course Objectives:
- To study Plant physiology
- To learn Coordination manner and how internal structure functions in Coordination manner

Course Outcomes:
- On completion of the course, student will be able to–understand how the plant does all the processes in coordination manner.

Semester II

Course Contents

Chapter 1	Major Pathways in Plant Metabolism	6Lectures
	- Photosynthesis: Introduction Light reaction, Cyclic and non-cyclicphotophosphorylation. Dark reaction – C3, C4 cycle. Factors affecting photosynthesis - Respiration: Introduction, definition, types of respiration (aerobic and anaerobic). Mechanism of glycolysis, Kreb's cycle and terminal oxidation.	
Chapter 2	Physical Process of Water Absorption	8 Lectures
	- Physical properties of water, Importance of water to plant life. - Diffusion,: – Definition, - Significance, - Mechanism, - Laws and - Factors affecting diffusion - Osmosis; Definition, -Mechanism, Significance , - Types of osmosis – Endosmosis, Exosmosis, - Osmotic pressure (OP), - Turgor pressure (TP) and wall pressure (WP) - Relation between OP, DPD (Suctionpressure) and TP	

Chapter 3	Ascent of Sap and Transpiration	6 Lectures
	• Ascent of sap.Introduction, meaning, mechanism and theories. • Transpiration – Definition, Types of transpiration, • Stomata : Structure and mechanism of opening and closing mechanism of stomata	
Chapter 4	Mineral Nutrition of Plants	4 Lectures
	• Essential elements (macro and micronutrients) and their role in plant metabolism, deficiency symptoms.	
Chapter 5	Physiology of flowering	4 Lectures
	• Photoperiodism and • Vernalisation • Role of phytochrome in flowering	
Chapter 6	Plant growth regulators.	5 Lectures
	• Introduction, Physiological effects of - Auxins, Gibberellins, Cytokinins, ABA, Ethylene and Brassinosteroidsin plant development	
Chapter 8	Photo-biology	3 Lectures
	• Metabolism, movement and photo-morphogenesis(vegetative)	

References:
1. Fundamentals of Plant Physiology (Mac. Millan, New York), Devlin R.M. (1983)
2. A Classbook of Botany (Oxford University Press, UK), Dutta A.C. (2000)
3. College Botany Vol I, II and III (New Central BookAgency, Kolkata),Ganguli, Das Dutta (2011)
4.) Introductory Plant Physiology Prentice Hall of India. Noggle, R. and Fritz (1989
5. Photosynthesis, metabolism, Control and Physiology ELBS/Longmans - London. Lawlor. D.W. (1989)
6. Introduction to Plant Physiology. Mayer, Anderson and Bonning (1965)
D. Van Nostrand Publishing Co., N.Y.
7. Plant Physiology, Tata McGraw Hill Publishers (P) Ltd., New Delhi. Mukherjee, S. A.K. Ghosh (1998)
8. Plant Physiology CBS Publishers and Printers, New Delhi. Salisbury, F.B and C.W. Ross (1999)
9. Biochemistry–the Chemistry of life, McGraw Hill Book Co., London, N.Y., New Delhi, Paris, Singapore, Tokyo. Plummer, D.(1989)
10. Plant Biochemistry. . Harcourt Asia (P) Ltd., India and Academic Press, Singapore. Day, P.M. and Harborne, J.B. (Eds.,) (2000)
11. Fundamentals of Plant Physiology. V. K. Jain, S. Chand & Co. New Delhi.
Private Limited, New Delhi
12. Plant Physiology by Verma V. ,Emkay Publications, New Delhi

**Course Code: 19ScBioU204
Course Name:Basics of Animal Sciences ll**

Teaching Scheme: TH: 3 Hours/Week   **Credits:02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**
Prerequisite:
- Basic Zoology from XI and XII Science

Course Objectives:
- To study: Animal physiology, Parasitology and Economic zoology
- Introduction to the concept of Animal Model Organism.

Course Outcomes:

On completion of the course, student will be able to understand–

- Animal physiology (Circulation, excretion in vertebrates and invertebrates), basics of Parasiotology (*Plasmodium sp., Taeniasp, Fasciola sp.,)*
- Applications of Zoology (Aquaculture, Vermiculture, Sericulture and Animal Tissue Culture)
- Animal model organisms (Hydra, Drosophila and *C. elegans)*.

Semester II

Course Contents

Chapter 1	Circulation	8 lectures
	- Introduction to circulatory system - Invertebrate circulation - Vertebrate circulation: Fish, amphibian, reptiles, birds and mammals. - Regulation of heart beat - Circulation during exercise - Blood coagulation.	
Chapter 2	Excretion	8 lectures
	- Organs of excretion in invertebrates: Protonephridia and metanephridia, molluscan kidney, antennal gland of crustaceans and Malphighian tubules of insects. - Nitrogen excretion: Ammonia, Urea and Uric acid with suitable examples. - Organs of excretion in vertebrates: Kidneys. Excretion in fish, amphibian, reptiles, birds and mammals.	
Chapter 3	Type Study : Chordate : Frog / Toad	8 lectures

	(Anatomy and Physiology) • Circulatory System (Heart,Arterial and Venous Systems), • Nervous System (CNS and PNS), • Sense Organs • Urinogenital System • Reproductive system	
Chapter 4	Introduction to Parasitology	5 lectures
	• Study of *Plasmodium sp.* • Study of *Taenia sp.* • Study of*Fasciola sp.*	
Chapter 5	Applications of Zoology: (visit)	4 lectures
	• Aquaculture • Sericulture • Vermiculture • Animal tissue culture	
Chapter 6	Introduction to animal model organism	3 lectures
	• What are model organisms, need and characteristics of model organisms • Hydra • *Drosophila*	

References:

1. Economic Zoology, Shukla &Upadhyaya, 4th Edition.,Rastogi Publications, 2009.

2. Modern Parasitology: A Textbook of Parasitology, 2nd edition, (1993) F. E. G. Cox, Wiley & Sons, USA

3. Sericulture: www.csb.gov.in/publications/books by Central Silk Board, Ministry of Textiles – Govt. of India

4. Animal Physiology Adaptation and Environment (fifth edition); Knut Schmidt-Nielsen

5. Introduction to General Zoology Vol 1.:K. Chaki, G. Kundu, S. Sarkar

6. Principles of Animal Physiology; Pearson Publications; 2nd edition; C. Moyes& P. Schulte.

Course Code:19ScBioU205
Course Name: Mathematics and Statistics ll

Teaching Scheme: TH: 4 Hours/Week **Credits:02**
Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Prerequisites: Limit,Continuity,Differentiation

Course Objectives:
- Matrices and System of Linear equations
- Partial Derivatives
- Differential Equation
- Probability and Probability distribution
- Hypothesis Testing and Correlation

Course Outcomes:
On completion of the course, student will be able to–
- Solve differential equations
- Solve system of linear equations
- Find maxima and minima of the function.
- Find probability and probability distribution
- Find Hypothesis testing and correlation

Course Contents

Semster II

Chapter 1	Matrices	7 lectures
	- Definition, - Types of matrices (zero, identity, square, unit, scalar, triangular, diagonal, upper triangular, lower triangular, symmetric) - Addition of matrices - Multiplication of matrices, - Determinant(singular, non-singular) - Minor, cofactor, adjoint, - Inverse of a matrix - System of linear equations: - Row echelon form, - Rank of matrix, - Homogeneous and non-homogeneous system AX=B. - Eigenvalues, eigenvectors,	
Chapter 2	Partial Differentiation	4 lectures

	• Definition in limit form, • Properties:(u.v rule, u/v rule) • Chain rule, • Partial derivatives of higher order, • Stationary points, Saddle points, • Necessary and sufficient condition for maxima and minima. • Applications: Wave equation, heat equation, Laplace equation.	
Chapter 3	Differential Equation	4 lectures
	• Types (ordinary, partial) • Order and degree of differential equation, • Homogeneous and non-homogeneous equation differential equation, • Variable separable form (M dx+Ndy=0), • Exact d.e., solution, • Integrating factor for non-exact d.e. • lineard.e. • Applications: growth and decay, Law of Cooling	
	Statistics	
Chapter 4	Probability and probability distribution	8 lectures
	• Basics of Probability theory- Definitions and simple problems • Bionomial distribution and the Poisson distribution, Normal distribution and their application in biosciences	
Chapter 5	Hypothesis testing and correlation	7 lectures
	• Null and alternate hypothesis, significance level, types of errors, Test statistics, Testing mean, proportion,testing variance distribution of test statistics (t and z) • Chi square test, Introduction to (one way and two way) ANOVA	

References:

1. Ordinary and Partial Differential Equations by Dr. M.D.Raisinghanhia
2. S.Chand all books
3. Trigonometry (9th edition) by Lial, Margaret; Hornsby, John; Schneider, David I.
4. Trigonometry-4th edition by Marek Dugopolski
5. An Elementary Course in Partial Differential Equation by T.Amarnath

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(2019 Course)

Course Code: 19ScBioU206
Course Name: Biological Chemistryll

Prerequisite: Basic chemistry from XI & XII Science.
Course Objectives:
- To understand amino acids, proteins, nucleic acid and their chemical basis for life.
- To understand enzymes as biological catalyst and their role in life science.

Course Outcomes:
>   On completion of the course, the student will be able to–
- Understand all basic fundamentals of biochemistry and extend their analytical thinking in research field.

Course Contents

Chapter 1	Protein	12 lectures
	- Proteins: Introduction, - Polymer of Amino acids, - Classification of amino acids, - Essential amino acids, - Configuration, properties, zwitterion , titration of amino acid, isoelectric point pI, - Properties of peptide bond, - Primary structure, - Reactions of oligopeptide with trypsin and chymotrypsin, - Secondary structure (alpha helix, beta pleated sheets, pitch value) - Secondary repeats - Tertiary and quaternary structure with example. Denaturation and renaturation	
Chapter 2	Vitamins	8 lectures
	- Fat soluble (A,D,E,K) and water soluble Vit. C, - Thiamine - Riboflavin, - Niacin - PlP - CoenzymeA, - Lipoic acid - Folic acid and B12	
Chapter 3	Enzymes	10 lectures

	• Biocatalyst • Specificity • Active site • Energy of activation, • Lock and key • Induced fit hypothesis • Prosthetic groups • Cofactors • Coenzyme • Holoenzyme • Apoenzyme, • IUB system of enzymes classification. • Enzyme inhibition • Basics of enzyme kinetics • Parameters affecting enzyme activity (temp, pH, substrate, cofactor,enzyme con.)	
Chapter 4	Nucleic Acid	6 lectures
	• Chemical names and structures of nitrogen bases • Nucleosides • Nucleotides • Polynucleotide • DNA and • RNA, • Forces stabilizing nucleic acid structure, concept of reannealing of DNA	

References:

1. Outlines of Biochemistry: 5thEdition, (2009), Erice Conn & Paul Stumpf ; John Wiley and Sons, USA
2. Fundamentals of Biochemistry. 3rdEdition, (2008), Donald Voet& Judith Voet , John Wiley and Sons, Inc. USA
3. Principles of Biochemistry, 4th Edition (1997), JefforyZubey, McGraw-Hill College, USA
4. Biochemistry: 7thEdition, (2012), Jeremy Berg, LubertStryer, W.H.Freeman and company, NY
5. Lehninger , Principles of Biochemistry. 5thEdition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.
6. Biochemistry. 5th Edition, (copyright 2013), Reginald Garett and Charles Grisham, Brook/Cole, Cengage Learning, Boston, USA.
7. An Introduction to Practical Biochemistry.3rdEdition, (2001), David Plummer, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
8. Biochemical Methods.1st(1995), S.Sadashivam, A.Manickam, New Age International Publishers, India

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First Year of B.Sc. Biotechnology
(2019 Course)

Course Code: 19ScBioU207
Course Name: Microbiologyll

Teaching Scheme: TH: 3Hours/Week   **Credits: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**
Prerequisite:
- Basic concepts of microbiology

Course Objectives:
- To study in detail the structure and characteristics of microorganisms
- To learn the different techniques used in microbiology

Course Outcomes:

On completion of the course, student will be able to–

- Isolate and preserve the unknown microorganism
- Understand the role of microorganisms in Nature

Semester II

Course Contents

Chapter 1	Techniques in Microbiology	9 lectures
	- Cell Enumeration and quantification of Growth - Total Count- Breeds count, Direct microscopic count, haemocytometer, turbidity. - Viable Count- Spread plate, pour plate method - Microscopy: Wet mount and dry mount. - Staining Techniques - Definitions: Classification of stains, Stain(Basic and Acidic), Fixative, Mordant, Decoloriser, Accentuator - Staining techniques for following (Monochrome, - Negative, Differential (Gram, Acid fast, Blood staining), - Structural features and Special staining of Spore, Flagella, Cell wall, Nucleic acid, Capsule)	
Chapter 2	Microbial Growth	9 lectures
	- Growth curve, Introduction to kinetics of growth, Generation time, Growth rate. - Reproduction in microorganisms : Binary Fission, - Asexual, Sexual, Lytic, Lysogenic Cycle	
Chapter 3	Design of media and growth requirements	9 lectures

	• Types of media and Composition Temperature and Oxygen. • Basic Considerations – Nutritional, Hydrogen ion concentration, • Nutritional classification of bacteria • Cultivation – *In vitro* (Streak plate method) - Concept of Pure culture, co-culture and Mixed culture, Colony characteristics and Biofilm formation. • Preservation and Maintenance methods for microbial cultures	
Chapter 4	Microbial interaction and applications	9 lectures
	• Microbe-Plant, Microbe-Animal, Microbe-Microbe interaction, • Application of microbes in industry	

References:

1. Microbiology–6thEdition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY

2. General Microbiology - Stanier R.Y., 5th Edition, (1987) Macmillan Publication, UK.

3. Presscott's Microbiology, 8th Edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHil Science Engineering, USA.

4. Brock Biology of Microorganisms 9thed. (2000), John M. Martinko, Jack Parker. Prentice Hall, Upper Saddle River, New Jersey.

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(2019 Course)

Course Code: 19ScBioU208
Course Name: Computer and Applications

Teaching Scheme: TH: 3Hours/Week   **Credits:02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**
Prerequisite:
  • Basic handling of Computers
Course Objectives:
  • To Study Computer languages for Biology
  • To learn the basics of Bioinformatics required in Biology.
Course Outcomes:
On completion of the course, student will be able to–
  • Use XL & PPT
  • To understand basics of Bioinformatics
<div align="center">**Semester II**</div>

Course Contents

Chapter 1	Introduction to Computers	9 lectures
	History: • Generations of computers (I, II, III, IV, V) • Modern computers: The workstation, The Minicomputer, Mainframe Computers, Parallel processing Computer & The Super Computer. Introduction to computers: • Overview and functions of a computer system • Input and output devices • Storage devices: Hard disk, Diskette, Magnetic tape, RAID, ZIP devices, Digital tape, CD-ROM, DVD (capacity and access time) • Introduction to operating system: Operating system concept-Windows and unix/Linux	
Chapter 2	Data Processing	9 lectures
	Data processing & presentation: Introduction • MS office (Word, Excel & Power Point) Computer viruses: An overview of Computer viruses What is a virus? Virus symptoms, How do they get transmitted? • General Precautions Internet searches: Concepts in text-based searching • Searching Medline. Pub Med, bibliographic database	
Chapter 3	Databases	9 lectures
	Databases Introduction & Need of Databases	

	Types of Databases
	Basic concepts in:
	    • Data Abstraction
	    • Data Models
	    • Instances & Schemes
	    • E-R Model (Entity and entity sets; Relations and relationship sets; E-R diagrams;
	Reducing E-R Diagrams to tables)
	Network Data Model: Basic concepts
	Hierarchical Data Model: Basic concepts
	Multimedia Database: Basic concepts and Applications
	Indexing and Hashing
	    • B + Tree indexed files
	    • B Tree indexed files
	    • Static Hash functions
	    • Dynamic Hash functions
	        Text Databases
	        Introduction & Overview of Biological database,
	    • Types of Biological Database	

Chapter 4	Bioinformatics	9 lectures
	• Bioinformatics • Introduction to bioinformatics, History, Goals, Relation to other fields, Introduction to DNA sequence.	

References:
1) Bioinformatics –Principles and Applications by Zhumur Ghosh, BibekanandMallick-Oxford university press
2) Introduction to Bioinformatics by Teresa Attwood and David.J. Parry Smith-Pearson Education
3) Computer Fundamentals , 4th Edition (2004) P.K. Sinha, BPB publication, India
4) Computer Networks. 4th Edition (2008). Tanenbaum. Pearson Education, India
5) Introduction To Database Management Systems, 1st Edition, (2004), AtulKahate, Pearson Education, India

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5
First Year of B.Sc. Biotechnology
(2019 Course)

Course Code: 19ScBioU209
Course Name:Practicals in Chemistry and Biochemistry II

Teaching Scheme: TH: 3 Hours/Week   **Credits:02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic chemistry and biology from XI & XII Science.
Course Objectives:
- To study basics of Chemistry and important reactions which will help various processes in Biological system
- To study Estimation methods of important biomolecules.

Course Outcomes:
> On completion of the course, student will be able to–
- Study all basic fundamentals of chemistry and extend their analytical thinking in the research field.

Semester II

Course Contents

Practicals in Chemistry		
Practical	Title	No. of Practical 6P
Practical-1	Viscometer	1 Practical
	• To determine viscosity of a given liquid by Ostwald's viscometer	
Practical-2	Titration	1 Practical
	• To determine content of acetic acid in vinegar using NaOH	
Practical-3	Titration	1 Practical
	• To determine normality/molarity usingacid base volumetric titration	
Practical-4	Stereochemistry	1 Practical
	• To study different conformations of biomolecules using models	
Practical-5	Separation techniques	2 Practical
	• To study Separation Techniques like Recrystallization, distillation, sublimation, • To separate plant pigments by TLC	
Practicals in Biochemistry		
Practical	Title	Practical
Practical-1	Estimations	2 Practical
	• Estimation of concentration of protein by Biuret method	

	• Estimation of concentration of protein by Lowery's method	
Practical-2	Melting temperature of Nucleic Acid	1 Practical
	• To determine T_m of DNA	
Practical-3	Thin Layer Chromatography	2 Practical
	• To separate amino acids by thin layer chromatography (TLC)	
Practical-4	Enzyme Activity	1 Practical
	• To find out enzyme activity (amylase)	

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5
First Year of B.Sc. Biotechnology
(2019 Course)

Course Code: 19ScBioU210
Course Name: Practical in Microbiology and Bioinstrumentation II

Teaching Scheme: TH: 3 Hours/Week   **Credits:02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite: Basic concepts of Microbiology,Physics and Biology
Course Objectives:
- To study basics of instrumentations: Spectroscopy, Centrifugation, pH meter.
- To study in detail the structure and characteristics of microorganisms
- To learn the different techniques used in microbiology

Course Outcomes:

On completion of the course, student will be able to–

- Understand basics of instrumentations: Spectroscopy, Centrifugation, pH meter.
- Isolate and preserve the unknown microorganism
- Understand the role of microorganisms in nature

Semester II

Course Contents

Practicals in Bioinstrumentation		
Practical	Title	No of Practical 6P
Practical 1	To study Principle, Components and working of-	2practicals
	- Beer and Lambert's Law - Colorimeter - Spectrophotomete	
Practical2	To study Absorption Spectrum of:	2 practicals
	- Protein - DNA	
Practical 3	pH meter:	1 practical
	Working and Standardization of pH meter	
Practical 4	Centrifugation	1 practical
	- Types - Types of rotors - Types of centrifugations - Components and Working	

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5
First Year of B.Sc. Biotechnology
(2019 Course)

Course Code: 19ScBioU211
Course Name: Practical in Bioscience II

Teaching Scheme: TH: 3 Hours/ Week   **Credits: 02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Prerequisite:
- Basic Zoology from XI & XII Science

Course Objectives:
- To Study the physiological aspects of plants
- To learn metabolism of certain pathways
- To study morphology and reproduction in Hydra,
- To study morphology, lifecycle and mutants of *Drosophila*
- To study parasitology of *Plasmodium sp.* and *Fasciola sp.*

Course Outcomes:

On completion of the course, student will be able to–

- Practicality they will understand physiology of plants
- Understand morphology and reproduction in Hydra
- Understand Morphology, lifecycle and identify different mutants of *Drosophila.*
- Understand parasitology of *Plasmodium sp.* and *Fasciola sp.*

Semester II

Course Contents

Animal Sciences II		
Practical-1	Study of Hydra:	2Practicals
	- Morphology - Reproduction	
Practical-2	Study of *Drosophila:*	2Practicals
	- Morphology - Sexual dimorphism - Lifecycle (temporary mounts of developmental stages: larva, pupa and adult) - Eye and wing mutants	
Practical-3	Parasitology	2Practicals
	Plasmodium sp. *Fasciola sp.*	

Plant Sciences ll		
Practical-1	Study of Structure of stomata	1 Practical

	• Study the Structure of stomata (dicot and monocot)	
Practical-2	Study of Diffusion Pressure Deficit	1 Practical
	• Determination of Diffusion Pressure Deficit using potato tubers. (D.P.D.)	
Practical-3	Study of Rate of respiration	1 Practical
	• Determination of Rate of Respiration	
Practical-4	Study of Osmosis and Turgor Pressure	1 Practical
	• Study the process of Osmosis and Turgor pressure	
Practical- 5	Study of mineral deficiency	1 Practical
	• Study of Mineral Deficiency Symptoms using Plant material/photographs	
Practical -6	Study of transpiration	1 Practical
	• Demonstration of transpiration by Ganongs' photometer • Demonstration of ascent of Sap/Transpiration pull.	

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune - 5
First Year of B.Sc. Biotechnology
(2019 Course)

Course Code:19ScBioU212
Course Name: Practicals in Computer applications and statistics II

Teaching Scheme: TH: 3 Hours/Week   **Credits:02**
Examination Scheme: CIA: 40 Marks   **End-Sem: 60 Marks**

Course Objectives: To understand the basics of computer required for various Life Science courses under Biotechnology and to gain basics as well as applied knowledge of Bioinformatics

Course Outcomes:

On completion of the course, student will be able to–

- Understand basic concepts of Bioinformatics and biotechnology which will help the student industry as well as research.

Semester II

Course Contents

Practicals in Computer Applications		
Practical -1	Study of Operating Systems	1 Practical
	- Tutorials operating systems: DOS - File handling: copy, rename, delete, type - Directory structure: make, rename, move directory	
Practical -2	Study of Word Processing	1 Practical
	Word Processing (Microsoft Word): Creating, Saving & Operating a document, Editing, Inserting, Deleting, Formatting, Moving & Copying Text, Find & Replace, Spell Checker & Grammar Check, Document Enhancement (Borders, Shading, Header, Footer), Printing Document (Page Layout, Margins), Introduction to the use of Wizards & Templates, Working with Graphics (Word Art), Working with Tables & Charts, Inserting Pictures	
Practical -3	Study of Spreadsheet	2 Practical
	Spreadsheet Applications (Microsoft Excel): Worksheet Basics: Entering information in a Worksheet, Saving & Opening a Worksheet, Editing, Copying & Moving Data, Inserting, Deleting & Moving Columns & Rows, Clearing.	
Practical- 4	Study of Database applications	2 Practical
	Database Applications (Microsoft Access): Fields, Records, Files, Organization of Files. Access Modes: Updating Records, Querying, Reports, Forms & sub forms.	
Practicals in Statistics		
Practical -1	Introduction to MS Excel	1 Practical

	• Introduction to MS Excel and use of Spreadsheets for Data organization and basic Mathematics calculations	
Practical -2	Study of Data Analysis Tools	2 Practical
	Hypothesis testing using 'Data analysis tools': t-test, Chi square test.	
Practical -3	Study of Analysis of Variance	1 Practical
	Analysis of variance	
Practical -4	Study of Correlation and Regression Analysis	2 Practical
	Correlation and regression analysis of data and graphical representation	