

Deccan Education Society's
FERGUSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY
FIRST YEAR B.Sc. BIOTECHNOLOGY
SEMESTER – I

Academic Year 2016-2017

**Deccan Education Society's
Fergusson College (Autonomous), Pune
Faculty of Science
Under-graduate Syllabus First Year B.Sc. (Biotechnology)**

Particulars	Code	Title of Paper	Credits
F.Y. B.Sc. Semester I	BTH1101	Concepts and applications in Biotechnology	2
	BTH1102	Biological Chemistry - I	2
	BTH1103	Biophysics	2
	BTH1104	Animal Sciences - I	2
	BTH1105	Plant Sciences - I	2
	BTH1106	Introduction to Microbial World	2
	BTH1107	Quantitative methods in Biology - I	2
	BTH1108	Ecology	2
	BTH1109	Practicals in Chemistry and Biophysics	2
	BTH1110	Practicals in Plant & Animal Sciences - I	2
	BTH1111	Practicals in Microbiology and Ecology	2
	BTH1112	Practicals in Biostatistics and Computers - I	2
		Total	24

Particulars	Code	Course Title	Credits
F.Y. B.Sc. Semester II	BTH1201	Evolutionary Biology and Biodiversity	2
	BTH1202	Biological Chemistry - II	2
	BTH1203	Bioinstrumentation	2
	BTH1204	Animal Sciences - II	2
	BTH1205	Plant Sciences - II	2
	BTH1206	Microbial Growth, Control and Applications	2
	BTH1207	Quantitative methods in Biology - II	2
	BTH1208	Disease Biology	2
	BTH1209	Practicals in Biochemistry and Bioinstrumentation	2
	BTH1210	Practicals in Microbiology and Disease Biology	2
	BTH1211	Practicals in Plant & Animal Sciences - II	2
	BTH1212	Practicals in Biostatistics and Computers - II	2
		Total	24

PAPER CODE: BTH1101**PAPER – I: Concepts and applications in Biotechnology****[Credit - 2: No. of Lectures 36]**

UNIT. No.	Title and Contents	No. of Lectures
I	What is Biotechnology - Introduction - Milestones in the History of Biotechnology - Biotechnology in day to day life	5
II	Agricultural Biotechnology - Need of genetically modified crops - GMOs in Agriculture - Role of Biotechnologist and recent developments in this field	5
III	Medical Biotechnology - Disease diagnosis - Genome editing and gene silencing techniques - Concept of Stem Cell Technology	6
IV	Applied Biotechnology - Production of recombinant proteins - Introduction to Pharmacogenomics - Molecular markers	6
V	Environmental Biotechnology - Biosensors - Waste water treatments -Bioremediation - Biosafety of GMOs and Bioethics	6
VI	Introduction to National Research funding institutes (UGC, DBT, CSIR, ICMR etc.), National and International Research Institutes (NCL, NIV, IISER, NCCS, DST, DRDO,DAE)	5
VII	Industrial Visit and report writing, one guest lecture	3

Learning Outcome:

- Students should also have an idea about ongoing research all over the world

References:

1. Milestones in Biotechnology : Classic papers in Genetic Engineering: J. A. Davis, W. S. Resnikoff
2. Plant biotechnology - J Hammond & P. Mc Gravey, V.Yushibov, Springer-Verlag
3. Principles of Gene Manipulation & Genomics – Primrose and Twyman (2006, 7th Edition)
4. Amann, R.I. Stromley, J. Stahl : Applied & Environmental Microbiology
5. Official websites for NCL, NIV, IISER, NCCS, DST, DRDO, DAE can be used as references.

PAPER CODE: BTH1102**PAPER – II: Biological Chemistry - I****[Credit - 2: No. of Lectures 36]**

Unit No.	Title and Contents	No. of lectures
I	Introduction to biomolecules: Carbohydrates: Introduction, biological importance. Definition, Classification (glyceraldehydes, Simple Aldose, Simple Ketoses, D-glucose, Conformation of D-glucose), disaccharides, polysaccharides (starch, glycogen) Proteins:- Amino acids; Structure and properties, Primary, Secondary, Tertiary and Quaternary structure Lipids: - Introduction, classes, fatty acids; physical and chemical properties, simple lipids Nucleic acids: Nucleosides, nucleotides, Polynucleotide, DNA and RNA	9
II	Thermodynamics and chemical equilibrium: Thermodynamics: Introduction, scope and limitations, terms and basic concepts, types of systems, intensive and extensive properties, equilibrium and non-equilibrium states, reversible and irreversible processes, laws of thermodynamics, internal energy, enthalpy, endo and exothermic reactions, free energy and work, Gibb's Helmholtz equations, ATP and its role in bioenergetics. Chemical Equilibrium: Equilibrium constant, Le Chatelier's principle, Acid and bases, strength of acid & bases, pH of aqueous solutions, Acid-base titrations, indicators in titrations, Titration curves Solubility product & applications, ionic product, Condition for precipitation, Buffers, buffer action, Henderson equation & related problems, Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure, Properties of water, water as a reactant, interaction of biomolecules with water	13
III	Electrochemistry: Redox reactions; basic concepts, free energy changes in redox reactions, EMF of a cell and its measurements, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (ΔG , ΔH and K), standard electrode potential, sign conventions, electrochemical series	7
IV	Chemical bonding: Types of bonds and factors affecting the bond formation, various theories, bond parameters, types of bonds in biomolecule [Covalent (glycoside, peptide, phosphodiester), ionic, hydrogen, Van der Waals, hydrophobic, coordinate)], Hydrophilic and hydrophobic interactions	7

Learning outcome:

- Student is expected to understand basics of chemical science that find relevance in biological systems.

References:

1. The elements of Physical Chemistry, 5th edition (2009), Atkins P, de Paula J. W. H. Freeman Publication, USA
2. An Introduction to Electrochemistry, edition reprint, 2011, Samuel Glasstone, BiblioBazaar, USA
3. Physical Chemistry for biological sciences, 1st edition, (2005), Chang R., University Science Books, USA

4. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl, S. Chand Limited, India.
5. Concise Inorganic Chemistry, 5th edition (2008), Author: J. D. Lee, John Wiley and Sons, USA.
6. Organic Chemistry, 6th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)

PAPER CODE: BTH1103
PAPER –III: Biophysics (2C)
[Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of lectures
I	Atomic structure: Historical background upto Bohr model. Significance of second and third postulate of Bohr's model. Derivation of radius and energy value. Quantization of energy levels. Using Rydberg's constant, Atomic spectra is signature of the element. Bohr – Sommerfeld model. Vector atom model. Quantum numbers. Selection rules. Pauli's exclusion principle. Emission spectra with respect to Na atoms to understand selection rules.	8
II	Radioactivity: Nucleus. Properties. Nuclear forces. Nuclear models (liquid drop and shell model). Radioactive nucleus. Revision of nuclear radiations and their properties - alpha, beta and gamma. Half life, physical and biological handling and standardization of alpha and beta emitting isotopes. Radioimmunoassay. Radiopharmaceuticals and their uptake. Production of radionuclides. Measurement of radiation - Dosimetry and detectors. Principle, construction and working of – GM counter. Scintillation Counter (Solid and liquid).	9
III	Energy production, movement and force: Energetics of human performance , ATP, ADP and Phosphocreatine , Glycolysis , Mitochondria, molecular motors, muscle shortening, lengthening and power, Cardiac and smooth muscle length–tension relations, The Hill formalism of the crossbridge cycle	9
IV	Homeostasis: Gaseous exchange , heat regulation, energy transfer, osmoregulation	5
V	Biophysics of light: Photobiological processes and properties of light, photosynthesis, photomorphogenesis, visual processing, circadian rhythms, bioluminescence, and UV radiation effects.	5

Learning outcome:

- Student should be able to understand basic concepts of biophysics
- Should be able to relate it to day today life.

References:

1. Biophysics, an introduction. 1st edition. (2002) Cotteril R. John Willey and Sons Ltd., USA
2. Physical Biochemistry: Applications to Biochemistry and Molecular Biology David Freifelder
3. Biophysics. 1st edition (2002), Pattabhi V and Gautham N. Kluwer Academic Publisher, USA.
4. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson and Michael Cox, W.H. Freeman and company, NY.
5. Textbook of optics and atomic physics, 8th edition (1989) P.P. Khandelwal, Himlaya Publishing House, India.

PAPER CODE: BTH1104

PAPER –IV: Animal Sciences - I
[Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of lectures
I	Introduction to Kingdom Animalia: Outline of classification and Characterization of non-chordates and chordates with examples.	6
II	Animal Tissues: Classification and characterization of various types of tissues with examples.	5
III	Type Study : Non-chordate : Honeybee: Morphology, Structure of Head , Mouthparts , Legs, wings, Sting Apparatus and Pollen Basket., Apiculture, Social Organization of Honey Bee and Bee Products.	8
IV	Type Study : Chordate : Frog / Toad (Anatomy and Physiology : Circulatory System (Heart, Arterial and Venous Systems), Nervous System (CNS and PNS), Sense Organs (Auditory and Vision) , Urinogenital System and Reproductive system	9
V	Model System: i) Drosophila as a model system ii) Zebra fish as a Model system ii) Chick embryo as a model system	8

Learning Outcome:

- Student should be able to understand basic and applied biological sciences.
- Student should gain an insight in the fascinating subjects like Animal physiology, Parasitology and Economic zoology.
- Student should understand various vertebrate and invertebrate model systems which are analogous to the human system, required for research purposes.

Reference books:

1. Jordan, E.L. and Verma P.S. 1978, (i) Chordate Zoology S. Chand & CompanyLtd. Ram Nagar. New Delhi.
2. Jordan, E.L. and Verma P.S. 1978 (ii) Invertebrate Zoology. S. Chand &Company Ltd. Ram Nagar. New Delhi.
3. Modern Text Book of Zoology: Invertebrates., R.L.Kotpal. Publisher, Rastogi Publications, 2012

PAPER CODE: BTH1105

PAPER -V: Plant Sciences - I [Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of lectures
I	Conquest of land- <ul style="list-style-type: none">• Unique features of plants• Cryptogams- general characters and Economic Importance of Algae, Fungi, Bryophytes and Pteridophytes• Phanerogams - general characters and Economic Importance of Gymnosperms and Angiosperms	13
II	Major Aspects of plant sciences Structural <ul style="list-style-type: none">• Morphology- Vegetative and reproductive plant parts• Anatomy- Vegetative and reproductive plant parts• Taxonomy-Binomial nomenclature, Systems of Classification, ICBN, Study of some families	23

Learning Outcome:

After completing the syllabus students should understand-

- The gradual progression of Sporophytic and gradual regression of gametophytic generations
- The terminology used in Morphology and Anatomy.
- Diversity in plant kingdom and need of classification.

Reference Books:

1. Botany for Degree students-Algae by B. R. Vashishta
2. Botany for Degree students- Fungi by B. R. Vashishta
3. Botany for Degree students- Bryophyta by B. R. Vashishta
4. Botany for Degree students- Pteridophyta by B. R. Vashishta
5. Botany for Degree students- Gymnosperms by B. R. Vashishta
6. Botany for Degree students- Angiosperms by B. R. Vashishta
7. Class book of Botany- by A.C.Dutta
8. College Botany Vol.I, II, III by Ganguli, Das dutta.
9. Taxonomy of Vascular Plants by G H. Lawrence
10. Plant Physiology- by Taiz,L. and Zeiger E.

PAPER CODE: BTH1106**PAPER -VI: Introduction to Microbial World****Credit -2: No. of Lectures 36]**

Unit. No.	Title and Contents	No. of lectures
I	HISTORY OF MICROBIOLOGY Important developments leading to major discoveries: (pre golden, golden and post golden era) a. Discovery of microscope (Anton von Leeuwenhoek and Robert Hooke) b. Abiogenesis v/s biogenesis Contributions of various Scientists (Aristotle, Francesco Redi, Louis Pasteur, Tyndall and others) c. Germ theory of Diseases, Discovery of microbes as pathogens, Koch's postulates & River's postulates, concept of antiseptic surgery d. Role of microorganisms in transformation of organic matter, anaerobes, germ theory of fermentation. e. Vaccination and Chemotherapy f. Contributions of Nobel Laureates in Immunology, Molecular Biology & Biotechnology	5
II	CLASSIFICATION AND MORPHOLOGY Classification: Principles in classification of Bacteria (Introduction to Bergey's Manual of Determinative and Systemic Bacteriology) and viruses (ICTV) Morphological and differentiating characters of microorganisms: <ul style="list-style-type: none">• Bacteria• Rickettsia• Protozoa• Algae• Fungi (Molds and Yeasts)• Viruses, viroids and prions	4
III	PROCARYOTIC CELL STRUCTURE AND FUNCTION: Studies on structure, chemical composition and functions of the following components in bacterial cell: a. Size, shape and arrangement of bacterial cells b. Structures External to Cell Wall <ul style="list-style-type: none">• Cell wall (Gram Positive, Gram Negative, Archaea)• Glycocalyx• Capsule• Flagella• Fimbriae and Pili• Axial Filaments c. Structures Internal to Cell Wall Cell membrane (Gram Positive, Gram Negative, Archaea) Chromosomal & extra-chromosomal material Ribosomes Cell inclusions (Gas vesicles, carboxysomes, PHB granules, metachromatic granules and glycogen bodies)	10

	d. Endospores Formation and Germination	
IV	EUKARYOTIC CELL STRUCTURE AND FUNCTION : a. Overview of eukaryotic cell structure: General structure and types of cells b. Structure and Function: Cell wall, glycocalyx, cytoplasmic membrane, flagella and cilia, Cell organells c. Comparison of Prokaryotic and Eukaryotic cells - Structure & Function	7
V	MICROSCOPY AND STAINING TECHNIQUES: I. Units of measurement: Modern SI units (Length, volume, Weight) II. Microscopy: • Bright field microscopy: Structure, working of and ray diagram of a compound light microscope; Concepts of magnification, numerical aperture and resolving power Focal Length, Working distance, Depth of Focus. • Types, ray diagram and functions of – condensers, eye-pieces and objectives • Aberrations in lenses - spherical, chromatic, comma and astigmatism • Principles, construction, working and applications of: i. Dark field microscopy ii. Fluorescence microscopy iii. Confocal microscopy III. Staining Techniques : • Definitions of Stain; Types of stains (Basic and Acidic), Leuco compounds. • Properties and role of Fixatives, Mordants, Decolorisers and Accentuators • Principles of staining techniques for following: i. Monochrome staining and Negative (Relief) staining ii. Differential staining - Gram staining ,Acid fast staining iii. Special staining- Spore, flagella, cell wall, nucleic acid, capsule	10

Learning Outcomes:

After completing the credits students should gain knowledge about:

- Landmarks in Microbiology.
- Fundamental aspects of Prokaryotic and Eukaryotic Cell structure and function, and the differences between these cells
- Principles of working of the light microscope and other modified microscopes and to know the differences between them. To be able to apply this knowledge in the laboratory.
- Develop analytical skills, critical & creative thinking

References:

1. Brock Biology of Microorganisms, Michael.T.Madigan, John.M.Martinko, Paul V. Dunlap, David P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition.Thomson Brooks / Cole.
3. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11th Edition.Pearson Education Inc.
4. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata MacGraw Hill Press.
5. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. MacGraw

- HillCompanies Inc.
6. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006) Microbiology, 6th Edition, McGraw Hill Higher Education
 7. Willey J. M., Sherwood L. M. and Woolverton C. J. (2013) Prescott's Microbiology, 8thEdition, McGraw-Hill Higher Education
 8. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw HillPublishing Co.
 9. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5th Edition.Macmillan Press Ltd.
 10. Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition.Pearson Education Inc

PAPER CODE: BTH1107

PAPER -VII: Quantitative Methods in Biology - I

Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of lectures
I	Introduction to statistics with scope in biosciences (examples) Statistics as statistical data : various types of data (Raw data, grouped data) Representation of data using frequency distribution diagram (Simple/Multiple/Subdivided bar diagram, Pie diagram), Graphs (Histogram, polygon, curve) Stem and leaf diagram Population, sample, sampling methods (SRS, Stratified sampling)	6
II	Descriptive statistics a)Measure of central tendency Mean (Definition & simple problems) Median, Quartiles (Definition, Graphical calculation) Box PlotMode (Definition, graphical calculation)Situations where one is preferred over others b)Measures of dispersion: Variance (Definition, simple problems) Standard deviation Coefficient of variance c)Skewness (Definition, types of skewness and graphical representation, no formula, and real life example) d)Kurtosis (Definition, types of Kurtosis, graphical representation, no formula, and real life example) Testing of hypothesis (two tailed only) a)For mean (one population) Mean (2 populations- dependent and independent) b)For variance (one population) Variance (2 populations)	10
III	Probability a)Classical definition and its limitations, axiomatic approach (laws of probability only statement and no proof) b)Independence and conditional probability (real life examples in biology)	2
IV	Complex numbers : Addition, subtraction, multiplication, division, De-Moivre's theorem, finding roots of polynomial equation	5
V	Sequences and series: Definition of convergent, divergent and oscillatory sequence. Following results without proof. (i) A monotonic increasing sequence bounded above is	6

	<p>Convergent. (ii) Geometric sequence $\{a_n\}$ is convergent if $-1 < r < 1$</p> <p>Definition of convergent, divergent, oscillatory series</p> <p>Convergence of i) geometric series, ii) P-series (without proof) Tests of convergence i) comparison test, ii) D'Alembert's ratio test (limit form), iii) Cauchy's root test (limit form)</p>	
VI	<p>Partial Differentiation</p> <p>Maxima and minima (up to 2 variables)</p> <p>Rules of partial differentiation</p> <p>Higher order partial derivatives</p>	2
VII	<p>Matrices and system of linear equations, row echelon form, rank of a matrix, homogeneous and non-homogeneous systems $AX = B$, consistency, gaussian elimination method.</p>	5
VIII	<p>History: Evolution, Generations of computers (I, II, III, IV, V) Classification of computers (mainframes, mini computers, microcomputers, special purpose) Comparison with respect to memory, power, cost and size, Real-Time, Online, Offline</p>	1
IX	<p>Overview and functions of a computer system: Input and output devices</p> <p>Storage devices: Hard disk, Diskette, Magnetic tape, RAID, ZIP</p> <p>Devices, Digital tape, CD-ROM, DVD (capacity and access time)</p> <p>Main Circuit Board of a PC: Chips, Ports, Expansion</p>	1
X	<p>Modern computers: The workstation, The Minicomputer, Mainframe Computers, Parallel processing Computer & The Super Computer</p>	1
XI	<p>Introduction to operating systems: Operating System concept, Windows 98/XP and later versions, Windows server NT/2000, Unix/Linux & servers</p>	1
XII	<p>Data processing & presentation: Introduction MS office (Word, Excel & Power Point)</p>	2
XIII	<p>Computer viruses: An overview of Computer viruses. What is a virus? Virus symptoms, How do they get transmitted? What are the dangers? General Precautions</p>	1

Learning Outcomes:

After completing the Credits students should gain knowledge about:

- Understanding the basic fundamentals of the statistics.
- Students should be able to do the data analysis statistically
- Representation of the data in tabular format and graphical representation of the data.
- They should be able to draw the statistical inference based on the statistical tools and techniques.

Reference Books:

1. R.G. Bartle and D.R. Sherbert 2nd edition, (1992), Introduction to real analysis, John Wiley, USA
2. Introductory biostatistics. 1st edition. (2003), Chap T. Le. John Wiley, USA
3. High YieldTMBiostatistics. (2001) Antony N Glaser. Lippincott Williams and Wilkins, USA
4. Introduction to Mathematics for Life Scientists. 3rd edition (1979). Edward Batschalet,
5. Mathematics for the Biological Sciences. Illustrated edition(1979) J.C. Acharya and
6. Lardner, Prentice Hall, USA

PAPER CODE: BTH1108

PAPER –VIII: Ecology

[Credit -2: No. of Lectures 36]

UNIT. No	Title and Contents	No. of Lectures
I	Ecology: Introduction, Concept and Scope	1
II	Ecological Factors: Climatic, Edaphic, Topographic	2
III	Ecosystems: Concept of Ecosystem Biotic & Abiotic components and their interactions Types of Ecosystem, Dynamics (Food Chain, Food Web, Ecological pyramids), Biogeochemical cycles (C, N, P, Water)	12
IV	Habitat Ecology: Aquatic, Terrestrial and Desert Animal adaptations to water, temperature, salinity, predation Plant adaptations to water, temperature, salinity, predation Association between plants & animals for adaptation	12
V	Concept of Population and Community Ecology	2
VI	Animal Behavior: Sensory inputs, Habituation, Imprinting, Cognition and Problem Solving, Spatial Learning, Associative Learning, Altruism, Inclusive Fitness.	7

Learning outcome:

After completing the course the students should acquire the knowledge about:

- Concepts of Ecosystems ,interdependence of ecosystems, Adaptations to different habitats

Reference Books:

1. An Introduction To Geographic Information Technology (2009) Suchandra Choudhury I K International Pvt Ltd., New Delhi
2. Concepts and Techniques of Geographic Information Systems C.P.Lo.Albert K.W.Yeung 2nd edition, Prentice Hall, Inc., New Jersey
3. Ecology and environment (2005) Sharma PD Rastogi Publication, New Delhi
4. Ecology and environmental biology (2011) Saha T K Books & Allied (p) Ltd, Kolkata
5. Ecology science and practice (2001) Faurie et al Oxford & IBH Publ. Co. Pvg. Ltd, New Delhi
6. Ecology: Principles and Applications (1998) J. L. Chapman, M. J. Reiss Cambridge
7. The biology of biodiversity : M.Kato

PAPER CODE: BTH1109**PAPER -IX: - Practicals in Chemistry and Biophysics****Credit -2: No. of Practicals 15]**

	Title of Experiment/ Practical	Practical
I	Calibration and use of micropipettes	1
II	Working of a G.M. counter	2
III	To study osmosis	2
IV	To study photosynthesis	2
V	Titration a) Determination of acetic acid in commercial vinegar using NaOH b) Determination of alkali content-antacid tablet using HCl	2
VI	Qualitative tests for Carbohydrates, Lipids, Proteins and Nucleic acids	2
VII	Absorption spectra of proteins and estimation by different methods (Lowry, Biuret, Bradford)	3
VIII	Acid-base titration based on conductivity measurement	1

Learning outcome:

- At the end of this module, student is expected to know simple applied chemistry techniques for detection of common yet important analytes, also to understand the importance of processes like osmosis and photosynthesis, use of radiation and its measurement. Models should bring clarity in concepts of conformations of biomolecules.

PAPER CODE: BTH1110**PAPER -X: - Practicals in Plant and Animal Sciences - I****Credit -2: No. of Practicals 15]**

	Title of Experiment/ Practical	Practicals
	Plant sciences	
I	Study of one example each of the following- Algae, Fungi, Bryophytes, Pteridophytes Gymnosperms and Angiosperms	3
II	Study of anatomical features of root, stem and leaves of Dicotyledons and Monocotyledons.	2
III	Study of Morphological features of plants and plant families.	3
	Animal Sciences-	
IV	Study of Paramecium : a) Morphology, b) Reproduction	1
V	Study of Hydra : Morphology Reproduction Regeneration	1
VI	Dissection of Honey Bee, Mounting of Mouth parts, pollen basket, Sting Apparatus, legs and wings.	2
VII	Study of Fasciola : a) Morphology b) Life cycle	1
VIII	Study of Zebrafish a) Morphology b) Life cycle	2

Learning Outcome-

Students should be acquainted with –

- Mounting, Sectioning, Staining of plant material
- Use of morphological terminology to describe the plant and study of the plant families.
- The students will develop the skill in dissection and microscopy which is highly needed for any type of research work in animal sciences.

PAPER CODE: BTH1111**PAPER -XI:-Practicals in Microbiology and Ecology****Credit -2: No. of Practicals 15]**

	Title of Experiment/ Practical	Practical
I	Biosafety in the Microbiology Laboratory- practices and rules involved Introduction to Microbiology Laboratory and common microbiology laboratory instruments e.g. Incubator, Hot Air Oven, Autoclave, Colorimeter, pH Meter, Distillation Unit, Chemical Balance, Laminar air flow hood, Clinical Centrifuge	1
II	Use and care of bright field microscope Observation of microorganisms using bright field microscope - Bacteria, Protozoa, Molds and Yeasts, Algae – from natural habitat	2
III	Observation of microorganisms using staining techniques: a. Monochrome staining and b. Negative /Relief staining (Capsule staining) c. Gram staining of bacteria d. Endospore staining e. Staining of yeast and fungi	5
IV	Observation of motility in bacteria using: a. Hanging drop method and Cragie's tube method b. Swarming growth methods	2
V	Activity for students : SOP's of the instruments, Preparation of Charts depicting size, shape and arrangements of bacteria, Motility types, Quiz etc. Activity related to study of animal Behavior	2
VI	Isolation of nitrogen fixing /phosphate solublizing bacteria from soil (Demonstration)	2
VII	Study of ecological adaptations in Plants (Hydrophytes/mesophytes/Xerophytes)	1

Learning Outcome:

After completing the Practicals students should gain knowledge:

- To learn, understand and practice Safety rules when in the Microbiology Laboratory and become proficient in Aseptic techniques
- To gain proficiency in the use of Micropipettes and glass pipettes
- To learn principles of Microscopy, to gain proficiency in the use and care of the Compound Microscope and to successfully focus and observe stained bacteria
- To become proficient in observing motility of bacteria.

PAPER CODE: BTH1112**PAPER - XII: - Practicals in Biostatistics and Computers - I Credit -2: No. of Practicals 15]****Learning outcome:**

	Title of Experiment/ Practical	Practical
I	Data Presentation By Preparing Frequency Table	1
II	Data Presentation <ul style="list-style-type: none">• Bar Diagrams• Histograms• Frequency Curves• Pie Chart• Scatter Plot	1
III	Measures of central tendency <ul style="list-style-type: none">• Mean• Mode• Median To measure Variance, Standard Deviation & Correlation	5
IV	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, Statistical analysis of the data using Excel.	3
V	Word Processing (Microsoft Word): Creating, Saving & Operating a document, Editing, Inserting, Deleting, Formatting, Moving & Copying Text, Find & Replace, Spell Checker & Grammar Checker, 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 Files (Pictures, Databases, Spreadsheets)	3
VI	Usage of multimedia – Creation of Computer Presentations with graphics (Microsoft Power Point): Creation of slides, Rapid Presentation design using wizards	2

- By the end of this course students should be able to do the statistical analysis independently.
- Also able to use the computational tools and techniques for the data analysis

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SYLLABUS UNDER AUTONOMY
FIRST YEAR B.Sc. BIOTECHNOLOGY
SEMESTER –II

Academic Year 2016-2017

PAPER CODE: BTH1201**PAPER -I: Evolutionary Biology and Biodiversity****Credit -2: No. of Lectures 36**

Unit No.	Title and Contents	No. of Lectures
I	Evolution: Concept, time line of evolution Origin of Life: Earliest life on Earth, Unicellular to Multi cellular, Diversification of life Origin of Species: Speciation: Allopatric, Sympatric. Evidence of Evolution: Index fossils, common descent, chemical and anatomical similarities	10
II	Theories of Evolution: Darwin's theory of Natural Selection, Lamarck's theory of acquired characters De Vries theory of Mutation and Neo-darwinism Speciation and Evolution of Sexual Reproduction Outcomes of Evolution. Extinction	10
III	Conservation of Biodiversity Biodiversity Hot Spots Conservation of plant and animal species Seed Banks & Artificial seeds in conservation Significance of gene banks and germ plasm conservation Wildlife conservation	10
IV	Effects on Ecosystems: Human and Natural Changes Green house effect Global warming Climate change	6

Learning outcome:**After completing the course the students should acquire the knowledge about:**

- Concepts of evolution, origin of life, theories of evolution, biodiversity basics and effects on ecosystem.

Reference Books:

1. Strickberger's Evolution by Brian K. Hall and Benedikt Hallgrímsson 5th Ed 2013
2. Handbook of Evolutionary Biology by Richard Arber 2015
3. The Origin of Species by Charles Darwin.
4. An Introduction To Geographic Information Technology (2009) Suchandra Choudhury I K International Pvt Ltd., New Delhi
5. Concepts and Techniques of Geographic Information Systems C.P.Lo.Albert K.W.Yeung 2nd edition, Prentice Hall, Inc., New Jersey
6. Ecology science and practice (2001) Faurie et al Oxford & IBH Publ. Co. Pvg. Ltd, New Delhi
7. Ecology: Principles and Applications (1998) J. L. Chapman, M. J. Reiss Cambridge
8. The biology of biodiversity : M.Kato

PAPER CODE: BTH1202**PAPER -II: Biological Chemistry - II****Credit -2: No. of Lectures 36]**

Unit No.	Title and Contents	No. of Lectures
I	Chemical Kinetics and Catalysis: Definition, Reaction rate, Rate laws, Molecularity of reaction, Zero order, Pseudo-order, first order, second order reactions, Half-life of a reaction, Methods to determine order of reaction, Collision theory, effect of temperature on reaction rate, Activation energy and catalysis, Catalysis; types, characteristics of catalysed reactions, classification of catalysis, enzyme catalysis; classification of enzymes, modes of enhancement of bond cleavage rate by enzymes, rate enhancement and activation energy, role of non-protein organic and inorganic molecules, coenzymes, prosthetic groups, role of vitamins as coenzyme precursors	14
II	Organic chemistry: Nomenclature, hydrocarbons, alcohols, amines. Conformations of alkanes, cycloalkane, alkyl halides, alcohol, ether, amines. Oxidation, reduction, elimination, addition and substitution reactions	11
III	Stereochemistry: Representation of molecules; projection formulae, Newman and Fisher formula. Isomerism; conformational, optical and geometrical isomerism	10

Learning outcome:

- At the end of this course, student should understand the basics of different types of reaction, bonds and thermodynamics as applied to biological system, importance of acids, bases and measuring concentrations of solutions with relevance to biological systems. Student is expected to realize the importance of biochemistry and various biomolecules, with a brief overview of their chemistry, functions and their relevance to physiology.

Reference books:

1. The elements of Physical Chemistry, 5th edition (2009), Atkins P, de Paula J. W. H. Freeman Publication, USA
2. An Introduction to Electrochemistry, edition reprint, 2011, Samuel Glasstone, BiblioBazaar, USA
3. Physical Chemistry for biological sciences, 1st edition, (2005), Chang R., University Science Books, USA
4. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl, S. Chand Limited, India.
5. Concise Inorganic Chemistry, 5th edition (2008), Author: J. D. Lee, John Wiley and Sons, USA.
6. Organic Chemistry, 6th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)
7. Guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th edition, (1996), Prentice Hall, India.
8. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf ; John Wiley and Sons, USA
9. Fundamentals of Biochemistry. 4th Edition, (2008), Donald Voet & Judith Voet, John Wiley and Sons, Inc. USA

10. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson and Michael Cox, W.H. Freeman and company, NY.
11. An Introduction to Practical Biochemistry. 3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India
12. Biochemical Methods. 1st, (1995), S. Sadashivam, A. Manickam, New Age International Publishers, India

PAPER CODE: BTH1203

PAPER -III: Bioinstrumentation

Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of Lectures
I	pH meter & conductivity meter : Principle, construction, working, calibration, maintenance and application	6
II	Spectroscopy : Definition. Electromagnetic wave. Electromagnetic spectrum. Applications of each region of electromagnetic spectrum for spectroscopy. Introduction to molecular energy levels. Excitation. Absorption. Emission. Rotational spectra. Energy levels of rigid diatomic molecules. Electrospectroscopy. UV-visible spectroscopy, NMR, CT, Mass spectroscopy, AAS. Principle, construction and working of colorimeter, Spectrophotometer, Fluorometer. Application to biomolecules (proteins, DNA, Hb, chlorophyll)	12
III	Centrifuge : RCF and sedimentation concepts, principle construction, working, rotor types and application of preparative & analytical centrifuges, gradient centrifuge	6
IV	Microscopes : Construction and Biophysical working principles of the following Microscopes: <ul style="list-style-type: none"> - Stereozoom (Dissecting) - Compound - Bright and Dark field - Inverted - Phase contrast - Electron microscopes: TEM and SEM, Specimen preparation - Confocal 	12

Learning outcome:

- Student should be able to should get acquainted with various instruments.

References:

1. Instrumentation measurements and analysis – 2nd edition (2003). Nakra and Choudhari, Tata Mc Graw Hill, India.
2. Nuclear Physics: An Introduction. 2nd edition (2011). S. B. Patel. Anshan Publication, India

PAPER CODE: BTH1204
PAPER -IV: Animal Sciences - II
Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of Lectures
I	Animal Physiology Blood Pigments: Role in oxygen transport, Oxygen dissociation curves and their physiological significances.	4
II	Chemical communication: with emphasis on endocrine hormones and their action (Pituitary and adrenal gland) Neuroanatomy and Neurophysiology. Regulation of body temperature. Physiology of Lactation in Mammals.	15
III	Parasitology: Study of <i>Plasmodium sp.</i> Study of <i>Entamoeba histolytica</i> Study of <i>Fasciola hepatica</i> Study of <i>Taenia sp.</i>	10
IV	Economic Zoology: Vermiculture Aquaculture Sericulture	7

Learning Outcome:

- Animal Science is a multidisciplinary course in learning Economic zoology, Parasitology Animal physiology etc. along with fundamental principles of animal life.
- Professional education in Animal Science prepares the students for career opportunities in the field of diagnostic parasitology as well as in sericulture, apiculture, vermiculture, mariculture, pisciculture etc, which are highly demandable today commercially.

Reference books:

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
4. Parasitology (Protozoology and Helminthology) 13th Edition by K D Chatterjee
5. Sericulture: www.csb.gov.in/publications/books by Central Silk Board, Ministry of Textiles - Govt of India
Animal Physiology, Ashok Kumar (2003) , Discovery Publishing House.
Animal Physiology & Biochemistry by Shrivastava, Agarwal and Kumar. 2000. Chand Publisher.
Animal Physiology for BSc and MSc, Mohan Aurora 2001, Himalaya Pub. House.
Animal Physiology by Verma, Agarwal and Tyagi. 2008. Chand Publisher.

PAPER CODE: BTH1205

PAPER -V: Plant Sciences - II
Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of Lectures
I	Physiology- Photosynthesis, Respiration, Mineral Nutrition, Plant water relation	12
II	Plant Breeding-Introduction, need and methods	3
III	Plant Resources and their Utilization- <ul style="list-style-type: none">• Plants as natural resources• Forest as potential resource• Plant resources used in Cosmetics and Pharmaceutics• Economic Botany• Bioprospecting- Introduction, Concept and scope, Untapped potential resources like sea weeds, Lichens	14
IV	Phytoremediation	2
V	Plant Pathology- Introduction, Concept, Pathogens, Diseases (2-3 examples)	5

Learning Outcome:

After completing the syllabus students should understand-

- Basic Plant physiology and plant pathology

Reference Books:

1. Plant Physiology- by Taiz,L. and Zeiger E.
2. College Botany Vol.I, II, III by Ganguli Das Dutta.

PAPER CODE: BTH1206**PAPER -VI: Microbial Growth, Control and Applications****Credit -2: No. of Lectures 36]**

Unit No.	Title and Contents	No. of Lectures
I	Cultivation and isolation Nutritional requirements and classification of bacteria Design of media: Common ingredients, Types of media and Composition with examples Concept of Pure culture, axenic culture, co-culture and Mixed culture Isolation of microorganisms and pure culture techniques: Streak , Spread, Serial Dilution, Pour plate, Enrichment, Single cell isolation Colony characteristics Preservation and maintenance of microorganisms Culture collection centers and their role.	8
II	Sterilization and Disinfection Definition: Sterilization, disinfectant, antiseptic, different cidal and static agents Chemical agents and their mode of action - Aldehydes, Halogens, Quaternary ammonium compounds, Phenol and phenolic compounds, Heavy metals, Alcohol, Dyes, Detergents and Ethylene oxide. Physical Agents - Heat, Radiation, Filtration Characteristics of an ideal disinfectant Checking of Efficiency of Sterilization – Biological and Chemical Indicators Checking of Efficiency of Disinfection - Phenol Coefficient	10
III	Microbial Growth Growth curve; definitions of Generation time, Growth rate and specific growth rate Reproduction in microorganisms: Binary Fission, Asexual, Sexual, Lytic, Lysogenic Cycle. Methods of enumeration: i. Microscopic methods (Direct Microscopic Count, Counting cells using Neubauer, Petroff and Hauser's chambers) ii. Plate counts (Total Viable Count) iii. Estimation of Biomass (Dry mass, Cell volume) iv. Chemical methods (Cell Carbon and Nitrogen estimation) v. Turbidometric methods Factors affecting bacterial growth (pH, Temperature, Solute Concentration (Salt and Sugar) and Heavy metals Diauxic and Synchronous growth	10
IV	Microbial Interactions (Any 2 examples each) Microbe-Plant, Microbe-Animal Microbe-Microbe interaction	4
V	Applications of Microbiology i. Bioremediation ii. Significance of normal flora and probiotics in human health iii. Microbes as Biofertilizers and Biocontrol Agents (e.g. Nitrogen fixers, Phosphate Solubilizers and <i>Bacillus thuringensis</i>) iv. Microbes in Biotechnology	4

Learning Outcome:

After completing the credits students should gain knowledge about:

- Basic concepts of microbial nutrition, growth and control
- Principles and basic methods involved in the study and control of microbes
- Basic techniques of pure culture isolation and preservation of microbes.
- Critical & analytical thinking

References:

1. Brock Biology of Microorganisms, Michael.T.Madigan, John.M.Martinko, Paul V. Dunlap, David P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
2. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition.Thomson Brooks / Cole.
3. Madigan M.T., Martinko J.M. (2006). Brock's Biology of Microorganisms. 11th Edition.Pearson Education Inc.
4. Michael J Pelczar, JR. E.C.S. Chan, Noel R. Krieg. (1993) Microbiology, 5th Edition, Tata MacGraw Hill Press.
5. Prescott L.M., Harley J.P., and Klein D.A. (2005). Microbiology, 6th Edition. MacGraw HillCompanies Inc.
6. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006) Microbiology, 6th Edition, McGraw Hill Higher Education
7. Willey J. M., Sherwood L. M. and Woolverton C. J. (2013) Prescott's Microbiology, 8thEdition, McGraw-Hill Higher Education
8. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw HillPublishing Co.
9. Stanier R.Y., Adelberg E.A. and Ingraham J.L. (1987) General Microbiology, 5th Edition.Macmillan Press Ltd.
10. Tortora G.J., Funke B.R., Case C.L. (2006). Microbiology: An Introduction. 8th Edition.Pearson Education Inc

PAPER CODE: BTH1207

PAPER -VII: Quantitative Methods in Biology - II

Credit -2: No. of Lectures 36]

Unit No.	Title and Contents	No. of Lectures
I	Standard probability distribution a) Binomial (Definition, biological example, additive property (only statement), simple examples b) Poisson (Definition, biological example, additive property (only statement), simple examples c) Normal (Definition, biological example, linear property (only statement), simple examples (using statistical tables), central limit theorem Concept of random variable p.m.f of discrete r.v. probability distribution	5
II	Inferential statistics a) Hypothesis- definition, types (One tailed, two tailed) b) Sampling distribution and errors c) Types of errors (Type I, II)	10
III	Chi-square test for 1) fitting of distribution 2) Independence of attributes ANOVA 1) one way, 2) two way followed by t test (pairwise)	5
IV	Differential equations: Homogeneous and non-homogeneous differential equations, exact d.e. (including integrating factor). Linear differential equation. Applications to growth and decay, law of cooling	6
V	Vector spaces : \mathbb{R}^n and $M_{m \times n}$, subspace of a vector space, linear dependence of vectors, eigenvalues and eigenvectors, diagonalization	10
VI	Computer Networking: Introduction to networking: various terminologies, Associated hardware devices, gadgets (Router, Switch) tools, services, and resources Network Topologies and Protocols, LAN, WAN and MAN World Wide Web (WWW) Network security: fire walls	2
VII	Internet searches: Search engines: Google, Yahoo . Concepts in text-based searching Searching Medline, PubMed, bibliographic databases	2
VIII	Databases: Introduction & need of databases Types of databases	4

	<p>Basic concepts in:</p> <ul style="list-style-type: none"> □ □ Data Abstraction □ □ Data Models o Instances & Schemes o 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 Databases: Basic concepts and Applications Indexing and Hashing o B+ Tree indexed files o B Tree indexed files o Static Hash functions o Dynamic Hash functions Text Databases Introduction & Overview of Biological databases 	
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Learning Outcome:

After completing the credits students should gain knowledge about:

- Understanding the basic fundamentals of the statistics.
- Students should be able to do the data analysis statistically
- Representation of the data in tabular format and graphical representation of the data.
- They should must be able to draw the statistical inference based on the statistical tools and techniques.

Reference Books:

1. R.G. Bartle and D.R. Sherbert 2nd edition, (1992), Introduction to real analysis, John Wiley, USA
2. Introductory biostatistics. 1st edition. (2003), Chap T. Le. John Wiley, USA
3. High Yield™ Biostatistics. (2001) Antony N Glaser. Lippincott Williams and Wilkins, USA
4. Introduction to Mathematics for Life Scientists. 3rd edition (1979). Edward Batschalet,
5. Mathematics for the Biological Sciences. Illustrated edition(1979) J.C. Acharya and R.
6. Lardner, Prentice Hall, USA

PAPER CODE: BTH1208
PAPER –VIII: Disease Biology
[Credit -2: No. of Lectures 36]

UNIT. No	Title and Contents	No. of Lectures
I	Concept of Disease: Concepts of health and disease. Pathogenesis- Historical and modern perspectives. Overview of transmissible and non transmissible diseases.	3
II	Diseases of the Heart and Blood: Cardiovascular diseases, Hypertension, Anaemia, Haemophilia.	4
III	Diseases of the Gastrointestinal tract: Ulcers, Hepatitis, Alcoholic cirrhosis, Appendicitis	4
IV	Diseases of the Urino-genital System : STDs, infertility in males and females, renal failure.	4
V	Diseases of the Nervous system : ischemic diseases – Paralysis, Depression, Neurodegenerative diseases.	5
VI	Endocrine Disorders: Diabetes mellitus, Hypo and Hyper thyroidism, Growth hormone disorders	4
VII	Diseases of the immune system: Innate and acquired defenses, autoimmune diseases (Lupus, multiple sclerosis and RA)	5
VIII	Types of Cancer: Staging a Cancer, Breast Cancer, Leukaemia.	4
IX	Disease management and Medical Ethics: Types of disease management: personal hygiene, preventive, curative, life style changes, palliative care.	3

Learning outcome:

After completing the course the students should acquire the knowledge about:

- Causes, pathogenesis, prophylaxis and treatment of diseases

Reference Books:

1. Human Diseases by Marianne Neighbors and Ruth Tannehill-Jones 4th Ed. 2015
2. Metabolism of Human Diseases-Organ Physiology and Pathophysiology by Lammert, Eckhard, Zeeb and Martin 2014.
3. Pathological physiology of internal diseases by Albion Walter Hewlett 3rd Ed 2015
4. Campbell's Pathophysiology Notes by John Campbell 2nd Ed 2010
5. Principles of Anatomy and Physiology by Gerard Tortora and Bryan Derrickson 14th Ed. 2014

PAPER CODE: BTH1209

PAPER-IX: Practicals in Biochemistry and Bioinstrumentation

[Credit -2: No. of Practicals 15]

Unit No.	Title of Experiment/ Practical	Practicals
I	Standardization and calibration of pH meter	1
II	Working and components of various types of Centrifuges	2
III	Beer and Lambert's Law – Components and working of Colorimeter, Spectrophotometer	2
IV	Microscopy – Components and working of Bright field compound microscope	2
V	To study acidic and basic properties of amino acids through its titration curve using pH metry	2
VI	To find the order of given reaction	2
VII	Titration a) Estimation of calcium content in chalk as calcium oxalate by permanganometry b) Estimation of hardness of water by EDTA	2
VIII	To study conformations of biomolecules using models	2

Learning outcome:

After completion of the practicals students should be able to understand

- Standardization and calibration of pH meter and conductivity meter
- Qualitative analysis of various biomolecules

PAPER CODE: BTH1210**PAPER - X: Practicals in Microbiology and Disease Biology****[Credit -2: No. of Practicals 15]**

Unit. No.	Title of Experiment/ Practical	Practicals
I	Cultivation of microorganisms: a. Preparation of simple laboratory nutrient media (solid and liquid) and using them to cultivate bacteria. b. Aseptic transfer techniques (slant to slant, broth to broth, broth to agar and Agar to agar using glass and micro pipettes)	3
II	i. Isolation of bacteria by streak plate technique ii. Enumeration of bacteria from fermented food / soil / water by: a. Spread plate method b. Pour plate method iii. Observation of the growth of cultures and reporting of colony and cultural characteristics (Nutrient and MacConkey's agar)	2
III	Enumeration of yeast cells using a counting chamber	1
IV	a. To study the effect of different parameters on growth of <i>E. coli</i> : pH, temperature, sodium chloride concentration b. Study of Oligodynamic action of heavy metal	2
V	Activity for students: Evaluation of disinfectants, Study colonies of bacteria on differential and Specific media, Petri dish art, Quiz,	2
VI	Peripheral blood smear for total and differential count	1
VII	Glucose tolerance test	1
VIII	Hemoglobin and Blood pressure detection	2
IX	Visit to pathology lab	1

Learning Objectives:**After completing the practicals students should be able:**

- To gain proficiency in the techniques of cultivation, isolation and preservation of bacteria
- To use physical and chemical methods to control the growth of micro-organisms.
- To learn the techniques of enumeration of micro-organisms.
- To learn to critically observe and record the observation of all experimentation.

PAPER CODE: BTH1211

PAPER -XI: Practicals in Plant and Animal Sciences - II
[Credit -2: No. of Practicals 15]

Unit No.	Title of Experiment/ Practical	Practicals
	Plant Sciences-	
I	Study the process of Osmosis	1
II	To determination of Transpiration under different conditions of shade, wind and light.	1
III	Determination of Diffusion Pressure Deficit by using potato tubers	1
IV	Plant resources and their utilization- <ul style="list-style-type: none">• Food crops - Botanical and common names, description and Phytochemical tests for stored food material• Medicinal and aromatic plants - Botanical and common names, plant parts used, and diseases/disorders for which they prescribed.• Vegetable oils-• Gums, Resins, Tannins-	3
V	Study of some plant diseases.	1
	Animal Sciences-	
VI	Study of Plasmodium a) Morphology, b) Life cycle	1
VII	Establishment and maintenance of Drosophila culture	2
VIII	Preparation of temporary mounts of developmental stages of Drosophila (egg, larva and pupa)	3
IX	Study of Drosophila (Morphology, sexual dimorphism, Mutation in eye and wing)	2

Learning Outcome:

Students should be acquainted with:

- Various qualitative and quantitative techniques.
- Basics of developmental biology and Parasitology.

PAPER CODE: BTH1212

PAPER - XII: Practicals in Biostatistics and Computers - II

[Credit -2: No. of Practicals 15]

Unit. No.	Title of Experiment/ Practical	Practicals
I	Regression and correlation of Biological Data	2
II	Evaluation of probabilities using addition and multiplication theorem	2
III	Fitting of the following standard distributions: binomial, Poisson, normal	2
IV	Chi square test, T-test, ANOVA	2
V	Null Hypothesis	2
VI	Database Applications (Microsoft Access): Fields, Records, Files, Organization of Files, Access Modes; Updating Records, Querying, Reports, Forms & subforms	2
VII	Searching and Information Retrieval of Biological Databases :Through Entrez and SRS Search Engines: 1.Nucleic acid sequence databases, Genome Browser 2.Protein Sequence Databases 3.Bibliographic databases (PubMed PubMed Central, PLOS,BMC,MEDLINE)	1
VIII	File handling: copy, rename, delete, type Directory structure: make, rename, move directory	2

Learning outcome:

- By the end of this course students should be able to do the statistical analysis independently.
- Also able to use the computational tools and techniques for the data analysis