BHARTI VISHWAVIDYALAYA

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SCHEME OF EXAMINATION

&

SYLLABUS

OF

Bachelor of Science (Honors) Zoology

UNDER

FACULTY OF SCIENCE

Session: 2021-2022

(Approved by Board of Studies)

EXAMINATIONSCHEME

B. Sc. (Hon's) Zoology

B. Sc. (Hon's) examination will be conducted in six SEMESTERS.

SEMESTER– I

THEORY

PAPER CODE	SUBJECT	CREDITS	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-101	Animal Diversity – I (Non-Chordates)	4	70	30	100
BSHZO-102	Principles of Ecology	4	70	30	100
GE-I	A. Chemistry B. Botany C. Microbiology D. Biotechnology	4	35	15	50
AECC	English Communication / MIL	2	35	15	50
ECA	Pisciculture and Economic importance of Fishes	2	35	15	50

PRACTICAL

PAPER CODE	SUBJECT	CREDITS	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-L101	Animal Diversity – I (Non-Chordates)	2	35	15	50
BSHZO-L102	Principles of Ecology	2	35	15	50
GEL-I	Generic Elective - Practical-I	2	35	15	50

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SEMESTER–II

THEORY

PAPER CODE	SUBJECT	CREDITS	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-201	Animal Diversity – II (Chordates)	4	70	30	100
BSHZO-202	Cell Biology	4	70	30	100
GE-II	A. Chemistry B. Botany C. Microbiology D. Biotechnology	4	35	15	50
AECC	Environmental Studies	2	35	15	50
ECA	ECA-Extracurricular activity/ Tour, Industrial training/ Field visit, NSS/ Swachhta/ vocational Training/ Sports/ others	2	35	15	50

PRACTICAL

PAPER CODE	SUBJECT	CREDITS	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-L201	Animal Diversity – II (Chordates)	2	35	15	50
BSHZO-L202	Cell Biology	2	35	15	50
GEL-II	Generic Elective – Practical II	2	35	15	50

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SEMESTER–III

THEORY

PAPER	COURSE	CREDITS	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-301	Genetics and evolution	4	70	30	100
BSHZO-302	Parasitology and economic zoology	4	70	30	100
BSHZO-303	Fundamentals of biochemistry	4	70	30	100
GE-III	A. *Chemistry B. Botany C. Microbiology D. Biotechnology	4	35	15	50
SEC - 1	Select one from the pool of sec courses offered by different department	2	35	15	50

PRACTICAL

PAPER	COURSE	CREDITS	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZOL-301	Genetics and evolution	2	35	15	50
BSHZOL-302	Parasitology and economic zoology	2	35	15	50
BSHZOL-303	Fundamentals of biochemistry	2	35	15	50
GEL-III	Generic Elective – Lab	2	35	15	50

***Students may Opt any one GE-III Chemistry as mention in syllabus**

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SEMESTER–IV

THEORY

PAPER	COURSE	CREDITS	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-401	Comparative anatomy of vertebrates	4	70	30	100
BSHZO-402	Physiology: life sustaining system	4	70	30	100
BSHZO-403	Microbiology and immunology	4	70	30	100
GE-IV	A. *Chemistry B. Botany C. Microbiology D. Biotechnology	4	35	15	50
SEC –II	Select one from the pool of sec courses offered by different department	2	35	15	50

PRACTICAL

PAPER	COURSE	CREDITS	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZOL-401	Comparative anatomy of vertebrates	2	35	15	50
BSHZOL-402	Physiology: life sustaining system	2	35	15	50
BSHZOL-403	Microbiology and immunology	2	35	15	50
GEL-IV	Generic Elective - Practical-IV	2	35	15	50

***Students may Opt any one GE-IV Chemistry as mention in syllabus**

B. Sc. (Hon's) Zoology

SEMESTER–V

THEORY

PAPER	COURSE	CREDITS	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-501	Animal Behaviour and Molecular Biology	4	70	30	100
BSHZO-502	Fish biology and endocrinology	4	70	30	100
DSE-1	DSE 1-Theory	4	70	30	100
DSE-2	DSE 2-Theory	4	70	30	100

PRACTICAL

PAPER	COURSE	CREDITS	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZOL-501	Animal Behaviour and Molecular Biology	2	35	15	50
BSHZOL-502	Fish biology and endocrinology	2	35	15	50
DSEL-1	DSE 1-Lab	2	35	15	50
DSEL-2	DSE 2-Lab	2	35	15	50

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SEMESTER–VI

THEORY

PAPER	COURSE	CREDITS	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZO-601	Biostatistics, Bioinformatics &Computer Application	4	70	30	100
BSHZO-602	Wild life conservation and management	4	70	30	100
DSE-3	DSE-3 Theory	4	70	30	100
DSE-4	DSE-4 Theory	4	70	30	100

PRACTICAL

PAPER	COURSE	CREDITS	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHZOL-601	Biostatistics, Bioinformatics and Computer Application	2	35	15	50
BSHZOL-602	Animal Behaviour and Molecular Biology	2	35	15	50
DSEL-3	DSE 3-Lab	2	35	15	50
DSEL-4 Project	Dissertation /Project workfollowed by seminar	2	35	15	50

* As per UGC CBCS guidelines, University / departments have liberty to offer GE and SEC courses offered by one department to students of other departments. The No. of GE course is four. One GE course is compulsory in first 4 semesters each.

Minimum One Skill Enhancement course shall be proposed by each department (4 CREDITSs) [4 L **or 2 L+ 2 P or l L+3 P or 3L+ l T] 1P = 2 hours.**

***CREDITS= L+T+P/2**

Where, L-Lecture, T-Tutorial and P- Practical

Total CREDITSs=144

SCHEMEFORPRACTICALEXAMINATION

EXPERIMENT	MARKS
Experiment	25
Viva-voce	10
Teacher Assessment	15
TOTALMARKS	50

ZOOLOGY -DSE I-IV (ELECTIVES)

DSE-I: REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

DSE-II: BIOTECHNIQUES

DSE-III: INSECT VECTORS AND DISEASES

DSE-IV: ANIMAL PHYSIOLOGY

SKILL ENHANCEMENT COURSE (ANY TWO)

SEC-I: SERICULTURE

SEC-2: VERMICULTURE AND VERMICOMPOSTING

SEC.3: AQUACULTURE AND SERICULTURE

SEC-4: APICULTURE AND VERMICULTURE

NAME OF THE GENERIC ELECTIVE SUBJECTS OFFERED BY YOUR DEPARTMENT

1. SEMESTER I: ANIMAL DIVERSITY-I (NON-CHORDATES)
2. SEMESTER II: ANIMAL DIVERSITY-II (CHORDATES)
3. SEMESTER III: GENETICS AND EVOLUTION
4. SEMESTER IV: COMPARATIVE ANATOMY OF VERTEBRATE

CORE SUBJECTS (HONOURS IN ZOOLOGY)

Semester I

ANIMAL DIVERSITY– I (NON-CHORDATES) (BSHZO-101)

CREDITS-4

UNIT-I

Taxonomy: definition, taxonomic procedure, classification, systemic, taxonomic levels, taxa, hierarchy, species concepts, Zoological nomenclature: kinds of taxonomic characters (morphological, embryological, cytogenetic, and numerical characters).

UNIT-II

Classification of multicellular animals: symmetry and early development (spiral and radial cleavage). Protostomes and Deuterostomes; body cavities: acoelomates, pseudocoelomates, coelomates.

UNIT-III

General characters and classification up to classes with examples showing distinctive and adaptive features:

1. Protozoans (locomotion)
2. Poriferans (canal system and skeleton),
3. Platyhelminthes and Nematodes (parasitic adaptations),
4. Annelids (metamerism),
5. Arthropods (mouthparts),
6. Molluscs (modification of foot),
7. Echinodermata (water vascular system and larval forms).

UNIT-IV

Overview of different patterns:

1. Digestion- intracellular, extracellular, feeding mechanisms (suspension, deposit, cropping, sucking, herbivorous and raptorial carnivorous)
2. Gas exchange and internal transport (structure and function of gills, trachea, book lungs)

UNIT-V

Overview of different patterns:

1. Excretory organs - open tubular (metanephridia) and closed saccular (protonephridia and Malpighian tubules)
2. Pattern of nervous system in non-chordates.
3. Types of asexual reproduction: fission, regeneration and parthenogenesis; sexual reproduction: primary and accessory sex organs in non- chordates.

Books Recommended:

- Kotpal Series on Non-chordates (Rastogi Publications)
- Nigam: Biology of Non-Chordates (1997, S. Chand)
- Barnes: The invertebrate (3rd ed. 2001, Wiley-Blackwell)
- Moore: An introduction to the invertebrates (2006, Cambridge)
- Kotpal, Agarwal and Khetrapal: Modern Text Book of Zoology; Invertebrates. Edition, 6. Publisher, Rastogi Publications, 1990

PRINCIPLES OF ECOLOGY(BSHZO-102)

CREDITS-4

UNIT-I

Historyofecology,autecologyandsynecology,levelsoforganization., Lawsoflimitingfactors,studyofphysicalfactors.

UNIT-II

Unique and group attribute of population:density,natality,mortality,lifetables,fecunditytables,survivorshipcurves,age ratio,sexratio,dispersalanddispersionexponentialandlogisticgrowth,equationandpatterns.

- Populationregulation- density-dependentandindependentfactors
- Population interactions, gause's principle with laboratory andfieldexample,lotka-volterraequationforcompetition andpredation,functionalandnumericalresponses

UNIT-III

Characteristics of Community: species richness, dominance, diversity,abundance, vertical stratification, ecotone and edge effect; ecologicalsuccession with oneexample,Theories pertainingtoclimaxcommunity.

UNIT-IV

Typesofecosystemswithoneexampleindetail,Foodchain:detritusandgrazing foodchains,linearandyshapedfoodchains.Foodweb,energyflowthroughtheecosystem,ecological pyramidsandecologicalefficiencies, Nutrientandbiogeochemicalcyclewithoneexampleof nitrogencycle.

UNIT-V

Ecologyinwildlifeconservationandmanagement

Books Recommended:

1 Population Ecology by Anupam Pandey2009 Pandey,2006.

2 Introduction to Population ecology, Larry L, Rock wood,2006

CHEMISTRY-INORGANIC CHEMISTRY-I
CODE- (BSHCY-101)

CREDITS-4

UNIT –I : Atomic Structure

Bohr,s theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Shapes of *s, p, d* and *f* orbitals.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

UNIT –II: Periodicity of Elements

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s &p-block'

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

(b) Atomic radii (van der Waals)

(c) Ionic and crystal radii.

(d) Covalent radii (octahedral and tetrahedral)

(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(f) Electron gain enthalpy, trends of electron gain enthalpy.

(g) Electronegativity, Pauling's/ Mullikan's/ Allred Rachow's/ and Mulliken-JafIe's electronegativity scales. Variation of electronegativity with bond order, pa(ial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

UNIT –III: Chemical Bonding

Ionicbond- General characteristics, types of *ions*, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Bonn-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Bonn-Haber cycle and its application, Solvation energy.

Covalent bond- Lewis's structure, Valence Bond theory (HeitIer-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCI,

BeF_2, CO_2, (idea of *s-p* mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons.

UNIT –IV: Chemical Bonding-II

Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electro-negativity difference.

Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

Weak Chemical Forces. van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

UNIT- V: Oxidation-Reduction

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.

GE-I: BOTANY-I (BSHB-101)

PLANT DIVERSITY-I (VIRUS,BACTERIA, ALGAE &FUNGI)

CREDITS 4

UNIT-I include – between unit and digit

Discovery, general characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction).

UNIT-II

Viruses:Generalcharacteristics,generalaccountofRetrovirus,TMV;Generalcharacteristics,general structure with special reference to viroids and prions; replication (general account),

UNIT-III

Cyanobacteria:Generalcharacteristics;heterocystandkinetes;Generalaccountof*Nostoc,Oscillatoria*and*Scytonema*;Economicimportanceofcyanobacteria.Generalaccountof actinomycetes.

UNIT-IV

Algae:Generalcharacteristics;Chlorophyceae:*Volvox,*Xanthophyceae,, *Vaucheria*Phaeophyceae: *Sargassum;*Rhodophyceae:*Polysiphonia;*Singlecell protein, Economicimportanceof algae.

UNIT-V

Fungi: General characteristics; Mastigomycotina: *Phytophthora*; Zygomycotina: *Rhizopus*;Ascomycotina:*Peziza; Basidiomycotina: Puccinia;*Deuteromycotina:*Alternaria.*

SuggestedReadings:

1. AlexopoulusandMims, 1996.Anintroductiontofungi. Wiley,NewYork
2. AnanthanarayanandPaniker: 7thEdison.AtextbookofMicrobiology, OrientBlackswanPublisher,Delhi
3. KumarHD, 1990.IntroductoryPhycology. East-westPress,India
4. LeeR E.2008.IntroductiontoAlgae. CambridgeUniversityPress,UK.
5. PelczarMiJ., Chan, E.C.S., Krieg,NR,1972.Microbiology, McGraw-Hillpublisher,
6. Columbus, OHPrescottML,2000: Microbiology.McGraw-HillPublisher,

GE-I: MICROBIOLOGY

INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY (BSHMB-101)

CREDITS 4

UNIT-I: History of Development of Microbiology

Development of microbiology as a discipline, Spontaneous generation *vs*. biogenesis. Contributions ofAntonvon Leeuwenhoek, Louis Pasteur,RobertKoch, JosephLister, AlexanderFleming. Role of microorganisms in fermentation, Germ theory of disease Development of various microbiological techniques and golden era of microbiology,Development of the field of soil microbiology: Contributions of Martinus W. Beijerinck, Sergei N. Winogradsky, Selman A.Waksman Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich,Elie Metchnik off, Edward Jenner.

UNIT-II: DiversityofMicrobialWorld

Systemsofclassification

Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms.

General characteristics of different groups: **A cellular** microorganisms (Viruses,Viroids, Prions)and **Cellular** microorganisms (Bacteria, Algae, Fungi andProtozoa) with emphasis on distribution andoccurrence,morphology,modeofreproduction and economicimportance.

Unit-III: Algae

General characteristics of algae including occurrence, thallus organization, algae cell ultra-structure,pigments, flagella, eyespot food reserves and vegetative, asexual and sexual reproduction. Different types of life cycles in algae with suitable examples: Haplobiontic, Haplontic,Diplontic, Diplobiontic and Diplohaplontic life cycles. Type studies: *Chlamydomonas, Volvox* and *Spirogyra*. Applications ofalgae in agriculture, industry, environment and food.

UNIT-IV: Fungi

General characteristics of fungi includinghabitat, distribution, nutritional requirements, fungal cellultra-structure, thallus organization and aggregation,fungal wall structure and synthesis,asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and para

sexual mechanism.Type studies: *Rhizopus*, *Aspergillus*, *Saccharomyces* and *Agaricus*. Economic Importance of Fungi with examples in agriculture, environment, Industry,medicine, food ,biodeterioration, mycotoxins.

UNIT-V: Protozoa

General characteristics with special reference to *Amoeba, Paramecium and Plasmodium.*

SUGGESTEDREADING:

1. TortoraGJ,FunkeBRandCaseCL.(2008).Microbiology: AnIntroduction.9th edition.PearsonEducation.
2. MadiganMT,MartinkoJM,DunlapPVandClarkDP.(2014).BrockBiologyofMicroorganisms.14thedition. Pearson InternationalEdition.
3. CappucinoJandShermanN.(2010).Microbiology:ALaboratoryManual.9thedition.PearsonEducationLimited.
4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGrawHill International.
5. AtlasRM.(1997).PrinciplesofMicrobiology.2ndedition.WM.T.BrownPublishers.
6. PelczarMJ,ChanECSandKriegNR.(1993).Microbiology.5thedition.McGrawHillBook Company.
7. StanierRY,IngrahamJL,WheelisML,andPainterPR.(2005).GeneralMicrobiology.5thedition.McMillan.

GE-I BIOTECHNOLOGY

GENERAL BIOCHEMISTRY (BSHBT-101)

CREDITS-4

UNIT –I

Carbohydrates: General Properties, Types (Monosaccharide, Oligosaccharide and Polysaccharide) and Biological Importance.

Monosaccharide: Structure, Occurrence, Reactions and Biological importance of Monosaccharide.

Isomerism: Stereoisomerism and Optical isomerism, Ring Structure and Anomeric forms, Mutarotation.

Derivatives: Derivatives of Monosaccharide, Di and Tri-saccharide.

Important Polysaccharide: Glycogen, Starch and Cellulose.

UNIT –II

Lipids: General Properties and Classification.

Fatty acids: Nomenclature, Classification, Structure and Properties of Saturated and Unsaturated fatty acids. Essential Fatty Acids.

Triacylglycerols: Properties and Characterization of Fats, Hydrolysis, Saponification value, Acid value, Rancidity of fats and Functions. Biological Significance of Glycerophospholipids, Sphingomyelins and Glycolipids.

UNIT –III

Amino acids: Definition, Classification and Properties of Amino acids.

Peptide bond: Definition, Structure, Solid phase Protein Synthesis in brief, C – terminal and N – terminal Amino acid determination.

Protein: Structure, Types (Primary, Secondary, Tertiary and Quaternary) and Functions.

UNIT –IV: Chemical Bonding-II

Nucleic Acids: Definition, Structure, Phosphodiester bond and Properties.

Purine and Pyrimidine Bases: Structure and Types, Composition of DNA and RNA, Nucleosides and Nucleotides.

DNA double helix: Watson - Crick Model, Complementary base- pairings, Base staking, Chargaff's rule. Different forms of DNA structure (A, B & Z DNA), Major and Minor groove, Denaturation and Annealing of DNA

RNA: Types of RNA, Secondary and Tertiary structure of t-RNA.

UNIT- V: Oxidation-Reduction

Porphyrin: General Properties, Structure of Nucleus and Classification.

Metalloporphyrins: Structure of Haemoglobin, Myoglobin, Chlorophyll, Cyanocobalamin and their Biological Importance.

Reference Books:

1. Biochemistry: J M Berg, J L Tymoczko and L Stryer.
2. Lehninger Principles of Biochemistry: David L Nelson and Michael M Cox.
3. Biochemistry: D Voet, J Voet and C W Pratt.
4. Biochemistry: U Satyanarayana and U Chakrapani.
5. Textbook of Biochemistry: Edward S West.
6. Fundamentals of Biochemistry: J L Jain, Sunjay Jain and Nitin Jain
7. Harpers Illustrated Biochemistry: Robert K Murray, Daryl K Garner and Peter A Mayes

AECC- ENGLISH LANGUAGE

CREDITS-4

UNIT-I: COMMUNICATION

THEORY AND TYPES

Theory of Communication, Types and modes of Communication Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal,Inter-personal and Group communication

UNIT-II: SPEAKING SKILLS

Monologue Dialogue Group Discussion Effective Communication/ Mis-Communication,Interview Public Speech.

UNIT-III: READING AND UNDERSTANDING

Close Reading Comprehension Summary Paraphrasing Analysis and Interpretation Translation (from Indian language to English and vice-versa) Literary/Knowledge Texts.

UNIT-IV WRITING SKILLS

Documenting Report Writing Making notes Letter writing .

UNIT-V FUNCTIOANL GRAMMAR

Parts of Speech, Word order / Types of Sentences, Questions (Affirmative and Negative), Present Perfect – Simple & Continuous, Present Perfect and Past Simple, Future Tense, Articles, Prepositions, Modals, Conjunctions, Quantifiers and Voice.

REFERENCE BOOKS:

English Language and Indian Culture - Published by M.P. Hindi Grant Academy Bhopal.

ZOOLOGY I-ANIMAL DIVERSITY – I (NON-CHORDATES)PRACTICAL

(BSHZOL-101)

CREDITS-2

- Study of transverse sections/chart of the following: Sycon, Hydra, Fasciola, Ascaris, Hirudinaria.
- Study of salient features and classification up to classes of the following non-chordates: Amoeba, Euglena, Plasmodium, Paramecium, Euplectella, Physalia, Taenia, Ascaris (male and female), Nereis, Chiton, Mytilus, Octopus, Limulus, Sacculina, Asterias, Echinus, Holothuria.
- External features of Earthworm.
- Dissection of Earthworm showing alimentary canal, nervous system, reproductive system.
- Dissection of snail showing radula, nervous system, Osphradium.
- Culture of amoeba and paramecium.

Reference text:

- Kotpal Series on Non-chordates (Rastogi Publications)
- Nigam: Biology of Non-Chordates (1997, S. Chand)

ZOOLOGY II- PRINCIPLES OF ECOLOGY PRACTICAL

(BSHZOL-102)

CREDITS-2

- Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
- Determination of population density in a natural/hypothetical community by quadrate method and calculation of shannon-Weiner diversity index for the same community
- Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of ph,and dissolved oxygen content (Winkler'smethod),chemical oxygen demand and free co_2.
- Report on a visit on national park/biodiversity park/Wild life sanctuary

Reference text:

1. Population Ecology by Anupam Pandey 2009 Pandey,2006.
2. Introduction to the Population ecology,Larry L,Rock wood,2006

INORGANIC CHEMISTRY-1 PRACTICAL(BSHCY-L101)

CREDITS-2

1. **Titrimetric Analysis**
   - (i) Calibration and use of apparatus
   - (ii) Preparation of solutions of different Polarity/Normality of titrants
2. **Acid-Base Titrations**
   - (iii) Estimation of carbonate and hydroxide present together in a mixture.
   - (iv) Estimation of carbonate and bicarbonate present together in a mixture.
   - (v) Estimation of free alkali present in different soaps/detergents
3. **Oxidation-Reduction Titrimetry**
   - (vi) Estimation of Fe (II) and oxalic acid using standardized $KMnO_4$ solution.
   - (vii) Estimation of oxalic acid and sodium oxalate in a given mixture.
   - (viii) Estimation of Fe (II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Reference text:

l. Vogegl, A.l. A Textbook of Quantitatlve I norgganic Analysis, ELBS.

GEL-I: PLANTDIVERSITYI(VIRUS,BACTERIA, ALGAE &FUNGI)

PRACTICAL (BSHB-L101)

CREDITS-2

1. Micropreparationobservationsofbacteriaandviruses.
2. Gram stainingofbacteria
3. Identificationofcyanobacterialspecimens
4. Identificationofalgalspecimens
5. Identificationoffungalspecimens

Fieldtrips:forhabitatstudy&collectionof samples

References

1. Ananthanarayan and Paniker: 7th Edison. A text book of Microbiology, Orient Blackswan Publisher, Delhi
2. KumarHD,1990.IntroductoryPhycology.East-westPress,India
3. LeeR E.2008.IntroductiontoAlgae.CambridgeUniversityPress,UK

GEL-I:INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY PRACTICAL(BSHMB-L101)

CREDITS-2

1. MicrobiologyGoodLaboratoryPracticesandBiosafety.
2. To study the principle and applications of important instruments (biological safety cabinets,autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in themicrobiologylaboratory.
3. SterilizationofmediumusingAutoclaveandassessment forsterility.
4. SterilizationofglasswareusingHotAirOvenandassessmentforsterility.
5. Sterilizationofheatsensitivematerialbymembranefiltrationandassessmentforsterility.
6. Demonstrationofthepresenceofmicrofloraintheenvironmentbyexposingnutrientagarplatest o air.
7. Studyof *Rhizopus*,*Penicillium*,*Aspergillus*,*Saccharomyces*usingtemporarymounts.
8. Studyof *Spirogyra*and*Chlamydomonas*,*Volvox*usingtemporarymounts.
9. Studyofthefollowingprotozoansusingpermanentmounts/photographs:*Amoeba*,*Entamoeba*, *Parameciu*mand *Plasmodium*.

Reference:

1.Tortora GJ,Funke B R and Case CL . (2008) . Microbiology: An Introduction . 9th edition. PearsonEducation.

GEL-I: GENERAL BIOCHEMISTRY PRACTICAL (BSHBT-L101)

CREDITS-2

1. Molisch's test for Carbohydrate.
2. Benedict's test- distinguishes between reducing and non-reducing sugars.
3. Barfoed's test- distinguishes between monosaccharides and disaccharides.
4. Iodine test for starch.
5. Ninhydrin test for amino acids.
6. Thiol group test using sodium nitroprusside.
7. Test for indole group using Ehlrich's reagent.
8. Test for hydroxyphenylaniline using Million's test.
9. Iodine value of oil and wax.
10. Acid value of oil and wax.
11. Saponification value of oil and wax.

Reference text:

l. Vogegl, A.l. A Textbook of Quantitatlve I norgganic Analysis, ELBS.

(ECA)PISCI CULTURE AND ECONOMIC IMPORTANCE OF FISHES

CREDITS-2

UNIT-I

Collection of fish seed from natural resources and transportation of fish seed.

Breeding in fish, Bundh breeding and Induced breeding.

Types of ponds required for fresh water fish culture farms.

Management of fish farm.

UNIT-II

Composite fish culture

Fisheries resources of C.G.

Riverine fisheries.

UNIT-III

Role of fisheries in rural development

Sewage fed fisheries

UNIT-IV

Methods of fish preservation

Marketing of fish in India.

UNIT-V

Economic importance and by product of fishes

Fish disease.

Books Recommended

1. Khanna and Singh: A textbook of Fish Biology and Fisheries (2003, Narendra Pub House)

2. Gupta and Gupta: General and applied Ichthyology (Fish and Fisheries) (2006, S. Chand)

3. Singh: Advances in Fish Research, Vol. I, II and III (Fisheries and Fish Biology: Ed Datta Munshi)

Semester II

ANIMAL DIVERSITY– II (CHORADATES-BSHZO-201)

CREDITS-4

UNIT-I

Hemichordates: General characters and classification up to the order, Protochordates: Urochordates,Cephalochordates, Cyclostomes: General characters, Comparative account of Petromyzon and myxine.

UNIT-II

General characters and classification of Pisces and Amphibians up to orders, Fishes: migration, Parental care, Amphibian: Parental care, Neoteny.

UNIT-III

General characters and classification of Reptiles up to orders, Difference between poisonous and non-poisonous snakes with examples, Poison apparatus and biting mechanism of poisonous snakes. Snake venom, its uses and antivenin.

UNIT-IV

General characters and classification of Aves up to orders, Migration and flight adaptation, Beaks and claws in birds, Ratitae, Archaeopteryx.

UNIT-V

General characters and classification of Mammals up to orders,Receptors and Sense organs: Phonoreception and Photoreception, Oviparity, Ovoviviparity, Viviparity, Aquatic and Flying mammals.

Books Recommended

1. Cambell and Reece: Biology (7th ed. 2005, Pearson)
2. Nigam: Biology of Chordates (1997, Chand)
3. Kotpal Series of Chordates (Rastogi Publications)

CELL BIOLOGY(BSHZO-202)

CREDITS-4

UNIT-I

Introduction to cell theory; pro- and eukaryotic cell, Methods in Cell Biology: An Elementary idea of Microscopy.

UNIT-II

Elementary knowledge of structure and function of plasma membrane, Introduction to endomembrane system (endoplasmic reticulum, Golgi complex, lysosome) and peroxisome, Structure and functions of mitochondria.

UNIT-III

Nucleus: Nuclear envelope, nucleolus and biogenesis of ribosome; Interphase chromatin and its compaction into metaphase chromosome, Introduction to specialized chromosomes: polytene and lamp brush chromosomes.

UNIT-IV

Cell reproduction: Basic features of cell cycle; Mitosis, mitotic spindle and chromosome movement, Process and phases of meiosis and its significance.

UNIT-V

Cell adhesion, Cell junctions and Extracellular matrix, Organizations of cells in tissues, Elementary knowledge of cell transformation and cancer, Cell death.

Books Recommended

1. P K Gupta Cell Biology

3. Cooper Jeffery M, The Cell - A Molecular Approach, 4th ed, Sinauer Asso. Inc. (June 2007)

5. Lodish et al: Molecular Cell Biology (2008, Freeman)

GE II: ORGANIC CHEMISTRY-I (BSHCY-201)

CREDITS-4

UNIT- I: Structure and Bonding

Classification, *nomenclature* and general structure *of* organic compounds. Hybridization. orbital representation of methane, ethane, ethylene, acetylene and benzene. Bond energy, bond length and bond angels. Polarity of covalent bonds-Inductive, resonance, hyper-conjugation and steric inhibition in resonance and its influence on acidity and basicity of organic compounds.

UNIT- II: Mechanism of Organic reactions

Curved arrow notation, drawing electron movements with arrows, half-headed and double headed arrows. Homoljsis and heterolysis of carbon-carbon bonds; Reactive species e.g. Carbocations, carbanions, free radicals and their stability. Nucleophiles and electrophiles.

UNIT- III: Alkanes and cycloalkanes

Preparation and general reactions of alkanes and cycloalkanes, Bayer Strain theory of strain less ring; Conformation of ethane, *n*-butane and cyclohexane, chlorination of methane and side chain chlorination of toluene.

UNIT-IV: Alkenes

General methods for preparation of alkenes, Reactions of alkenes: Addition reactions (Electrophilic and free radical), Halogenation, Hydrohalogenation, Hydration, Hydroxylation, Hydroboration-oxidation, Mercuration-demercuration, Epoxidation and Ozonoloysis.

Dienes: Conjugated and isolated Dienes; 1,2- versus 1,4-addition. Diels-Alder reaction of dienes: Mechanism.

UNIT-V: Alkynes

Preparation of alkynes, acidity and metal acetylides, Electrophilic addition reactions viz.,Halogenation, Hydrohalogenation, Hydration. Hydroboration-oxidation, Mercuration-demercuration and Ozonoloysis.

Reference Books:

- *"Organic Chemistry*", R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P)Ltd., New Delhi.
- *"Organic Chemistry",* S. M. Mukherjee, S. P. Singh, and R. P. Kapoor, I st Edition (1985), New Age International (P) Ltd. Publishers, New Delhi.
- *"Organic Chemistry", I.* L. Finar, [Vol. 1, 6th Edition (1973), Reprinted in 1980 & Vol. II, 5th Edition (1975), Reprinted in 1996], ELBS and Longman Ltd., New Delhi.

- *'Organic Chemistry - Structure and Reactivity", Seyhan N' Ege, 3rd Edition (1998), AITBS Publishers and Distributtors, Delhi'*
- *-Organic Chemistry", Paula Y. Bruice, 2nd Edition, Prentice-Hall, lntemational Edition* (1998).
- "Organic Chemistry", *",* G. Solomon, W illey India, Paper Back, 9" Edition.
- *"Modern Organic Chemistry",* M. K. Jain and S. C. Sharma, V ishal Publishing CO. Jalandhar, India. 4^{h} Edition (2012).

GE-II: BOTANY –II

TAXONOMYANDEMBRYOLOGYOFANGIOSPERMS

CREDITS-4

UNIT-I

Structure and Development of Plant Body Internal organization of plant body: The three tissue systems, types of cells and tissues. Development of plant body: Polarity, Cytodifferentiation and organogenesis during embryogenic development.Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspec :

UNIT-II

GeneralfeatureandclassificationofAngiosperms,meritsanddemerits(benthamandhooker,Takhtajan);Moderntrends inplants taxonomy.

UNIT-III

General features of the following families: Ranunculaceae, Malvaceae,Brassicaceae,Asclepiadaceae,Solanaceae, Asteraceae,Euphorbiaceae,Poaceae.

UNIT-IV

Embryology:structureofangiospermsflower,Androecium(stamens),pollenmorphologyonly,Gynoecium (Ovary, style and Stigma). Types of ovary, ovules and placentation, structure and main types.

UNIT-V

Pollination types, Double fertilization and triple fusion, Monocot and dicotembryo. Types of embryo sacs, organization and ultrastructure of mature embryo sac. Embryo endosperm relationship

Suggestedreadings:

1. BhojwaniSSandBhatnagarSP,2009.EmbryologyofAngiosperm,VikasPublication House,NewDelhi.
2. Eames,A.J,1961: MorphologyofAngiosperms,McGrawHillPublication, NewDelhi.
3. PandeyB P, 2001: Plant Anatomy, SChandandCompany,NewDelhi.
4. SharmaOP,2005. PlantTaxonomy,Tata Mc GrawHill,NewDelhi.

GE-II MICROBIOLOGY

BIOCHEMISTRY (BSHMB-201)

CREDITS-4

UNIT-I:Bioenergetics

FirstandsecondlawsofThermodynamics.DefinitionsofGibb'sFreeEnergy,Enthalpy, andEntropyand mathematical relationship among them, Standard free energy change and equilibrium constantCoupledreactionsandadditivenatureofstandardfreeenergychange,Energyrichcompounds:Phosphoenolpyruvate,1,3-Bisphosphoglycerate,Thioesters, ATP.

UNIT-II: Carbohydrates

Familiesofmonosaccharides:aldosesandketoses,trioses,tetroses,pentoses,andhexoses. Stereo-isomerism of monosaccharides, epimers, Mutarotation and anomers of glucose. Furanose andpyranose forms of glucose and fructose, Haworth projection formulae for glucose; chair and boatforms of glucose, Sugar derivatives, glucosamine, galactosamine, muramic acid, N-acetyl neuraminicacid,Disaccharides;conceptofreducingandnon-reducingsugars,occurrenceandHaworthprojections of maltose, lactose, and sucrose, Polysaccharides, storage polysaccharides, starch andglycogen.StructuralPolysaccharides,cellulose,peptidoglycan andchitin.

UNIT-III: Lipids

Definitionandmajorclassesofstorageandstructurallipids.Storagelipids.Fattyacidsstructureandfunctions. Essential fatty acids. Triacyl glycerols structure, functions and properties. SaponificationStructurallipids.Phosphoglycerides:Buildingblocks,Generalstructure,functions andproperties.Structureofphosphatidylethanolamineandphosphatidylcholine,Sphingolipids:buildingblocks,structure of sphingosine, ceramide. Special mention of sphingomyelins, cerebrosides and gangliosidesLipidfunctions:cellsignals,cofactors,prostaglandins,Introductionoflipidmicelles, monolayersandbilayers.

UNIT-IV: Proteins

Functionsofproteins,Primarystructuresofproteins:Aminoacids,thebuildingblocksofproteins.General formula of amino acid and concept of zwitterion. Titration curve of amino acid and itssignificance,classification,biochemical structureandnotationofstandardproteinamino acids. Ninhydrinreaction.Naturalmodificationsofaminoacidsinproteinshydrolysine,cystineandhydro

xyproline, Non protein amino acids: Gramicidin, beta-alanine, D-alanine and D- glutamic acidOligopeptides:Structureandfunctionsofnaturallyoccurringglutathioneandinsulinandsynthe ticaspartame,Secondarystructureofproteins:PeptideUNITanditssalientfeatures.Thealphahelix,t hebetapleatedsheetandtheiroccurrenceinproteins,TertiaryandQuaternarystructuresofproteins.F orcesholdingthe polypeptide together. Humanhaemoglobin structure.

UNIT-V: Enzymes

Structureofenzyme:Apoenzymeandcofactors,prostheticgroup-TPP,coenzyme NAD,metalcofactors,Classificationofenzymes,Mechanismofactionofenzymes:activesite,transi tion state complex and activation energy. Lock and key hypothesisand Induced Fit hypothesis.Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and allosteric mechanismDefinitions of terms – enzyme UNIT, specific activity and turnover number, Multienzyme complex:pyruvate dehydrogenase; isozyme: lactate dehydrogenase, Effect of pH and temperature on enzymeactivity.Enzymeinhibition:competitive-sulfa drugs;non-competitive-heavymetal salts.

SUGGESTEDREADING

1. Campbell,MK(2012) Biochemistry,7thed.,PublishedbyCengageLearning.
2. Campbell,PNandSmithAD(2011)BiochemistryIllustrated,4thed.,PublishedbyChurchillLivin gstone.
3. TymoczkoJL,BergJMandStryer L (2012)Biochemistry: Ashort course,2nded.,W.H.Freem

GE-II BIOTECHNOLOGY

INDUSTRIAL FERMENTATIONS (BSHBT-201)

CREDITS-4

UNIT-I

Production of industrial chemicals, biochemicals and chemotherapeutic products. Propionic acid,butyric acid, 2-3 butanediol, gluconic acid, itaconic acid, Biofuels: Biogas, Ethanol, butanol,hydrogen, iodiesel, microbial electricity, starch conversion processes; Microbialpolysaccharides; Microbial insecticides; microbial flavours and fragrances, newer antibiotics,anti cancer agents, amino acids.

UNIT-II

Microbial products of pharmacological interest, steriod fermentations and transformations. Overproduction of microbial metabolite, Secondary metabolism – its significance and products.Metabolic engineering of secondary metabolism for highest productivity.

UNIT-III

Enzyme and cell immobilization techniques in industrial processing, enzymes in organicsynthesis, proteolytic enzymes, hydrolytic enzymes, glucose isomerase, enzymes in foodtechnology/organic synthesis.

UNIT-IV

Purification & characterization of proteins, Upstream and downstream processing, solids andliquid handling. Distribution of microbial cells, centrifugation, filtration of fermentation broth,ultracentrifugation, liquid extraction, ion-exchange recovery of biological products.Experimental model for design of fermentation systems, Anaerobic fermentations.

UNIT-V

Rate equations for enzyme kinetics, simple and complex reactions. Inhibition kinetics; effect ofpH and temperature on rate of enzyme reactions. Mathematical derivation of growth kinetics,mathematical derivations of batch and continuous culture operations; single stage CSTR; masstransfer in aerobic fermentation; resistances encountered; overall mass transfer co-efficient (Ka)determination, factors depending on scale up principle and different methods of scaling up.Metabolic engineering of antibiotic biosynthetic pathways.

SUGGESTED READING:

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology.

2nd edition. Panima Publishing Co. New Delhi.
3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd
edition, Elsevier Science Ltd.
5. Salisbury, Whitaker and Hall. Principles of fermentation Technology,

AECC- ENVIRONMENTAL SCIENCE

CREDITS-2

UNIT – I

General: Environmental segments, environmental degradation, environmental impact assessment. Concept of Ecosystem: Fundamental of Ecology and Ecosystem, components of ecosystem, food-chain, foodweb, trophic levels, energy flow, cycling of nutrients, major ecosystem types (forest, grass land and aquatic ecosystem).

UNIT – II

Air Pollution: Atmospheric composition, energy balance, classification of air pollutants, source and effect of pollutants – Primary (CO, SOx, NOx, particulates, hydrocarbons), Secondary [photochemical smog, acid rain, ozone, PAN (Peroxy Acetyl Nitrate)], green house effect, ozone depletion, atmospheric stability and temperature inversion, Techniques used to control gaseous and particulate pollution, ambient air quality standards.

UNIT – III

Water Pollution: Hydrosphere, natural water, classification of water pollutants, trace element contamination of water, sources and effect of water pollution, types of pollutants, determination and significance of D.O., B.O.D., C.O.D. in waste water, Eutrophication, methods and equipment used in waste water treatment preliminary, secondary and tertiary.

UNIT – IV

Land Pollution & Noise Pollution: Lithosphere, pollutants (agricultural, industrial, urban waste, hazardous waste), their origin and effect, collection of solid waste, solid waste management, recycling and reuse of solid waste and their disposal techniques (open dumping, sanitary land filling, thermal, composting). Noise Pollution: Sources, effect, standards and control.

UNIT – V

Environmental Biotechnology: Definition, current status of biotechnology in environmental protection, bio-fuels, bio-fertilize. Pollution Prevention through Biotechnology: Tannery industry, paper and pulp industry, pesticide industry, food and allied industry.

TEXT BOOKS:

1. Environment and Ecology by Piyush Kant Pandey and Dipti Gupta (Sum India Publication)

2. A Textbook of Environmental Chemistry and Pollution Control by S.S. Dara (S. Chand and Company)

REFERENCE BOOKS:

1. Masters, G.M. Introduction to Environment Engineering and Science (Prentice Hall of India).

2. Environmental Chemistry by A.K. Dey (Eastern Ltd.).

3. Environmental Chemistry by B.K. Sharma (Krishna Prakashan).

4. Nebel B.J. Environmental Science (Prentice Hall of India-1987).

5. Environmental Biotechnology by S.N. Jogdand (Himalaya Publishing House).

6. Introduction to Environmental Biotechnology by A.K. Chatterji (Prentice Hall of India).

ZOOLOGY I-ANIMAL DIVERSITY– II (CHORADATESPRACTICAL

(BSHZO-L201)

CREDITS-2

Animal Diversity

- Study of museum specimens relevant to theory paper.
- Study of models relevant to theory paper.
- Dissection of fish showing digestive system.
- Mounting of scales.
- Fish dissection showing afferent and efferent cranial nerves.
- Fish internal ear.

Reference Books

- Nigam: Biology of Chordates (1997, Chand)
- Kotpal Series of Chordates (Rastogi Publications)

ZOOLOGY II-CELL BIOLOGY PRACTICAL

(BSHZO-L202)

CREDITS-2

1. Diagram showing ultrastructure of cell and different organelles.
2. Familiarization with the student's Light and dissecting Microscope
4. Permeability of Plasma membrane- effect of isotonic, hypertonic solution
5. Mitosis in onion root tips and permanent slide
6. Meiosis in grasshopper testis and permanent slide
7. Preparation of temporary slide of bar body and mitochondria (Janus green) by own cheek epithelium or hair root.

Reference Books

- P K Gupta Cell Biology
- Lodish et al: Molecular Cell Biology (2008, Freeman)

GEL II-ORGANIC CHEMISTRY-I PRACTICAL

CREDITS-2

1. Calibration of the thermometer
2. Purification *of organic* compounds by crystallization using the following solvents: a. Water b. Alcohol, c. Alcohol-Water
3. Determination of the melting points of unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point-mixed melting point of two unknown organic compounds.
5. Detection of special elements (N, S, C1. Br, I).

Reference Books

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemisstry*, Pearson Education (2009)
- Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry*, 5th Ed. Pearson (2012)

GEL- II: TAXONOMYANDEMBRYOLOGYOFANGIOSPERMS

PRACTICAL (BSHB- L201)

CREDITS-2

1. StudyofFloralcharactersandFloraldiagramofrepresentativememberofsomefamilies:Malvaceae, Brassicaceae,Asclepiadaceae,Solanaceae, Euphorbiaceae,Poaceae
2. Studyoftypeofovary,ovules,placentationtypes,typesofpollengrainsandstagesofdicotembryo.

Fieldtrips: forhabitatstudy&collection of samples.

Reference:

1. Lawrence, G. H. M 1951. Taxonomy of Vascular Plants. N. Y.
2. Pande B. P 1997. Taxonomy of Angiosperms. S. Chand Publication.
3. Takhtajan A. 1969. Flowering Plants; Origin and Dispersion.

GEL-II BIOCHEMISTRY PRACTICAL

(BSHMB-L201)

CREDITS 2

Propertiesofwater,ConceptofpHandbuffers,preparationofbuffersandNumericalproblems toexplaintheconcepts.

1. Handlingofmicropipettesandcheckingtheiraccuracy.
2. StandardFreeEnergyChangeof coupled reactions.
3. Qualitativetestsforcarbohydrates, reducingsugars, nonreducingsugars.
4. Qualitativetestsforlipidsandproteins.
5. Studyof protein secondaryandtertiarystructureswith thehelp ofmodels.
6. Studyofenzymekinetics–calculationofV_{max},Km, Kcat values.

References:

1. Campbell,MK(2012) Biochemistry,7thed.,PublishedbyCengageLearning.
2. Campbell,MNanSmithAD(2011)BiochemistryIllustrated,5thed.,PublishedbyChurchill Livingstone.
3. TymoczkoJL,BergJMandStryer L (2012)Biochemistry: Ashort course,2nded.,W.H.Freeman.
4. BergJM,TymoczkoJLandStryerL(2011)Biochemistry,W.H.Freeman andCompany.
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition. W.H. FreemanandCompany.
6. WilleyMJ,Sherwood,LM&WoolvertonCJ(2013)Prescott,HarleyandKlein'sMicrobiology.9th Ed., McGraw Hill.
7. Voet D.andVoetJ.G(2004)Biochemistry3rd edition,JohnWileyand Sons.

INDUSTRIAL FERMENTATIONS (BSHBT-L201)

CREDITS-2

1. Comparative analysis of design of a batch and continuous fermenter.
2. Calculation of Mathematical derivation of growth kinetics.
3. Solvent extraction & analysis of a metabolite from a bacterial culture.
4. Perform an enzyme assay demonstrating its hydrolytic activity (protease/peptidase/glucosidase etc.)

Reference Book:

Principles and Practice of Animal Tissue Culture - By Sudha Gangal (Universities Press

SEMESTER – III
GENETICS AND EVOLUTION(BSHZO-301)

CREDITS-4

UNIT-I

Elements of heredity and variation: Mendel's laws of inheritance; Chromosomal basis of inheritance. Extension of Mentalism: dominance relationships,Multiple allelism, Leathalalleles', Pleiotropy, Epistasis, Complementary, Supplementary inheritance; Cytoplasmic inheritance.

UNIT-II

Linkage and crossing-over, Sex-linkage; Sex chromosome systems,Sex determination; Structural and numerical alterations of chromosomes, Pedigree analysis: symbols of pedigree, Pedigrees of sex linked and autosomal inheritance.

UNIT-III

Human genetics: Karyotype, banding, nomenclature of chromosome subdivisions and genetic map. Genetic disorders: Chromosomal aneuploidy (Down, Turner and Klinefelter syndromes),Chromosome translocation (chronic myeloid leukemia) and deletion ("cry of cat" syndrome), Gene mutation (cystic fibrosis);Genetic counselling.

UNIT-IV

Concept of organic evolution, Evidences of organic evolution from comparative anatomy, embryology, palaeontology, Theories of organic evolution: Lamarckism, Darwinism, Modern synthetic theory, natural selection in action.

UNIT-V

Gene frequency in Mendelian population, Hardy-Weinberg equilibrium; major evolutionary forces; isolating mechanisms, modes of speciation (allopatric and sympatric).

Books Recommended

Genetics

1. Gardner et al: Principles of Genetics (2006, John Wiley)

2. Griffith et al: An Introduction to Genetic Analysis (2008, Freeman)

3. Hartl& Jones: Essential Genetics - A Genomic Perspective (2009, Jones &Bartlet)

4. Pierce: Genetics – A Conceptual Approach (W. H. Freeman, 12-Apr-2011)

5. Russell: iGenetics (2009, Benjamin Cummings)

6. Snustad& Simmons: Principles of Genetics (2012, John Wiley)

Evolution

1. P.A. Moody: Introduction to Evolution

2. Rastogi: Organic Evolution (2007, Kedarnath& Ramnath)

3. Strickberger: Evolution

PARASITOLOGY AND ECONOMIC ZOOLOGY(BSHZO-302)

CREDITS-4

UNIT-I

General concept of parasites and parasitism, Host – parasite interaction; life cycle of Protozoans parasites, Entamoeba histolytica, Leishmania donovani, Trypanosoma gambiense, Plasmodium-pathogenesis, treatment and prevention.

UNIT-II

Life cycle of Parasitic Helminths: Fasciola hepatica, Schistosoma haematobium and Wuchereriabancrofti - pathogenesis, treatment and prevention.

UNIT-III

Introduction to Economic Zoology: Beneficial and harmful organisms, Aquaculture: Fish culture, Fish by-products, Prawn culture, Pearl culture, Sericulture: Types of silk, Silkworms and their host plants, Mulberry silk worm culture, Natural enemies and their control.

UNIT-IV

Apiculture: Species of honey bees in India, Life history of honey bees, Bee products and their uses, Natural enemies and their control, Lac culture: Lac insect and its life cycle, Cultivation of lac insect host plants, processing and uses of lac.

UNIT-V

Animal husbandry: Introduction to common dairy animals, Techniques of dairy management Poultry: Types of breeds, Rearing methods, Diseases and control measures.

Books Recommended

Parasitology

• K D Cheterjje- Parasitology. CBS Publishers and Distributors, New Delhi

• P Schmid- Hemple- Evolutionary Parasitology 1996. Oxford University Press.

• Chandler and Reid. Introduction to Parasitology 1970, Wiley.

Economic Zoology

1. Shukla and Upadhyaya: Economic Zoology (Rastogi Publishers, 1999-2000)

2. Shrivastava: Test book of Applied Entomology, Vol. I &II (Kalyani Publishers, 1991)

3 .Jabde: Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture, Agricultural Pests

and their Control , 2005 Discovery Publishing House.

5. Jadhav U. Aquaculture Technology and Environment. PHI Learning. 2011.

FUNDAMENTALS OF BIOCHEMISTRY(BSHZO-303)

CREDITS-4

UNIT-I

Chemistry of Living system: scope and importance; biomolecules: organizational principle, configuration and confirmation, Water as biological solvent.

UNIT-II

Proteins: Amino acids ,An Elementary idea of structure of protein, Enzyme: Properties, regulation of enzyme activity, Ribozyme and abymes.

UNIT-III

Carbohydrate: Types, Carbohydrate as a source of energy, Glycolysis, Krebs Cycle, Electron Transport chain.

UNIT-IV

Lipids: Elementary idea of Structural and functional significant of triglycerides, phospholipids, cholesterol and prostaglandin.

UNIT-V

Nucleic acids: Types, Structure and functions of nucleic acids, mechanism of DNA replication, Transcription; Central Dogma, Genetic code and Translation.

Books Recommended:

1. Boyer, R. Concepts in Biochemistry (3rd ed. 2005, Wiley)

3. Stryer: Biochemistry (6th Ed. 2006, Freeman)

5. Jain JL, Fundamentals of Biochemistry (6th ed.) S Chand, 20

***GE III-Choose from scheme**

CREDITS-4

BHARTI VISHWAVIDYALAY

GE-III: BOTANY-III (BSHB 301)

PLANTPHYSIOLOGY

CREDITS-4

UNIT-I

Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, guttation. Ascent of sap– cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement.

UNIT-II

Nutrient Uptake: Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, Electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport.

UNIT-III

Photosynthesis: role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO_2 reduction photophosphorylation, C3, C4 and CAM pathways of carbon fixation, photorespiration.

UNIT-IV

Respiration: Glycolysis, tcacycle, electrontransport, oxidativephosphorylation, alphaandbetaoxidationof fattyacid.

UNIT-V

Plantgrowthhormones: Physiologicalroleofauxins, gibberellins, cytokinins, abscisicacidandethylene, Phytochrome: Structureandfunction; Photoperiodism; Vernalization; Seeddormancy

SuggestedBooks:

1. DevlinRobertM.1983.PlantPhysiology,PrindleWeberandSchmidtPublisher;4thedition.UK
2. Hopkins,W.G.1995.Introduction to Plant Physiology,JohnWiley&Sons.Inc., NewYork,USA.
3. Moore,T.C.1989.BiochemistryandPhysiologyofPlantHormones.SpringerVerlag,NewYork,US

A.

4. PandeyS Nand SinhaBK.2009.Plantphysiology:VikasPublishing,NewDelhi
5. SinghGS.RengerG,Sopory,SK,IrrganagKD,Govindjee;1999. ConceptsinPhotobiology,PhotosynthesisandPhytomorphognesis,Narosa Pub.House, NewDelhi.
6. TaizLandZeigerE.2010.Plantphysiology.SinauerAssociates,UK.

GE III-MICROBIOLOGY

MICROBIALPHYSIOLOGYANDMETABOLISMPRACTICAL (BSHMB-L301)

CREDITS-4

UNIT-I:Microbial GrowthandEffect ofEnvironmentonMicrobial Growth

Definitions of growth, Batch culture, Continuous culture, generation time and specific growth rateEffectoftemperatureand pH on microbialgrowth. Effect of solute and water activity on growth.Effectofoxygenconcentrationongrowth. Nutritionalcategoriesofmicroorganisms.

UNIT-II:NutrientuptakeandTransport

Passiveand facilitate diffusion. Primary and secondary active transport, concept of uniport, symport and antiportGrouptranslocation. Ironuptake.

UNIT-III ChemoheterotrophicMetabolism-AerobicRespiration

Concept of aerobic respiration, anaerobic respiration and fermentation.Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathwayTCAcycle.
ElectrontransportchainComponentsofrespiratorychain,comparisonofmitochondrialandbacterialETC,electron transportphosphorylation,uncouplers and inhibitors.

UNIT-IV:ChemoheterotrophicMetabolism-Anaerobicrespirationandfermentation

Anaerobicrespirationwithspecialreferencetodissimilatorynitratereduction(Denitrification;nitrate /nitriteandnitrate/ammoniarespiration; fermentativenitratereduction).Fermentation-AlcoholfermentationandPasteureffect;Lactatefermentation(homofermentativeandheterofermentativepathways),concept toflinearandbranched fermentationpathways.

UNIT-V:ChemolithotrophicandPhototrophicMetabolism

Introductiontoaerobicandanaerobicchemolithotrophywithanexampleeach.Hydrogenoxidation(definitionand reaction) andmethanogenesis (definition andreaction).

Introduction to phototrophic metabolism - groups of phototrophic microorganisms,anoxygenic*vs.* oxygenic photosynthesis with reference to photosynthesis in green bacteriaandcyanobacteria.

SUGGESTEDREADINGS

1. MadiganMT,andMartinkoJM(2014).BrockBiologyofMicroorganisms.14thedition.PrenticeHall InternationalInc.
2. Moat AGandFosterJW.(2002).MicrobialPhysiology.4th edition.JohnWiley&Sons.
3. ReddySRandReddySM.(2005).Microbial Physiology. ScientificPublishersIndia.
4. GottschalkG.(1986). BacterialMetabolism.2ndedition.SpringerVerlag.
5. StanierRY,IngrahmJI,WheelisMLandPainterPR.(1987).GeneralMicrobiology.5thedition,McMillanPress.

GE III-BIOTECHNOLOGY

CELL AND MOLECULAR BIOLOGY (BSHBT-301)

CREDITS-4

UNIT-I: CELL

Discovery of cell, The Cell theory. Prokaryotic and Eukaryotic cell – Plant and Animal cell. Cell Membrane, Cellular Reproduction. Techniques in Cell Biology.

UNIT-II: CELL ORGANELLES

Cell Organelles: Structure and Functions of Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus and Chromosomes.

UNIT-III: CELL DIVISION

Cell Division - Cell cycle, Amitosis, Mitosis and Meiosis. Regulation of cell cycle. Central Dogma: Brief introduction of Structure and Functions of DNA, RNA and proteins.

UNIT-IV: MECHANISM OF REPLICATION

DNA Replication: Prokaryotic and Eukaryotic – Mechanism, Enzymes and accessory proteins involved. DNA Repair.

UNIT-V: INHERITENCE

Prokaryotic and Eukaryotic Transcription and Translation, Genetic code, Recombination in prokaryotes.

Suggested Readings:

5. Cell & Molecular Biology : Gerald Karp
6. Cell Biology : C.B. Powar
7. Essential Cell Biology : An introduction: Bruce, Alberts, Dennis
8. The Cell: A Molecular Approach: Geoffrey M. Cooper
9. Cell & Molecular Biology: SC Rastogi
10. Cell & Molecular Biology: Robertis&Robertis
11. Cell Biology & Genetics: Starr & Taggart
12. Molecular Cell Biology: Lodish

ZOOLOGY I-GENETICS AND EVOLUTION PRACTICAL

(BSHZO-L301)

CREDITS-2

1. Application of probability in the law of segregation with the coin tossing

2. Frequency of following genetic trait in human attached ear lobe, widow's peak, dimple in chin mid-digital Hair, Thumb, hypertrichosis, color blindness, PTC (phenyl thiocarbamide)

3. Study of mode of inheritance of the following traits by pedigree charts – attached ear lobe,

widow's peak

4. Familiarization with techniques of handling Drosophila, identifying males and females; observing wild type and mutant (white eye, wing less) flies, and setting up cultures.

5 Study of structural chromosome aberrations (dicentric, ring chromosomes and inversions in polytene chromosomes) from prepared slides/photographs.

6. Study of human karyotypes and numerical alterations (Down, Klinefelter and Turner syndrome).

7. Preparation of temporary slide of Barr body by own cheek epithelium or hair root.

Reference Books:

- Gardner et al: Principles of Genetics (2006, John Wiley)
- Griffith et al: An Introduction to Genetic Analysis (2008, Freeman)

ZOOLOGY II- PARASITOLOGY AND ECONOMIC ZOOLOGY PRACTICAL(BSHZO-L302)

CREDITS-2

- Identification protozoan parasites from permanent slides.
- Identification and characterization of helminth parasites from permanent slides
- Study of permanent slides of different larvae of insects and Helminthes.
- Study of life cycle of insects through chart/specimens
- Study of external morphology of honey bee and dissection of sting apparatus of honey bee
- Study of social organization of honey bee.

Reference Books:

- Shrivastava: Test book of Applied Entomology, Vol. I &II (Kalyani Publishers, 1991)

ZOOLOGY III- FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL

(BSHZO-L303)

CREDITS-2

- Preparation of models of amino acids and dipeptides
- Ninhydrin test for α-amino acids
- Qualitative estimation of carbohydrate: Benedict's test for reducing sugars, Iodine test for starch
- Qualitative estimation of lipid, determination of acid value of oil
- Preparation of models of nitrogenous bases, nucleosides and nucleotides
- Structural study of DNA and RNA through Models.

Reference Books:

Boyer, R. Concepts in Biochemistry (3rd ed. 2005, Wiley).
Stryer: Biochemistry (5th Ed. 2006, Freeman)

***GEL III-Choose from scheme**

CREDITS-2

BHARTI VISHWAVIDYALAY

GEL-III: PLANTPHYSIOLOGY

PRACTICALS (BSHB- L301)

CREDITS-2

1. Determinationofdiffusionpressuredeficit(DPD)
2. Studyoftranspirationrate
3. TranspirationratebyGanong'spotomter
4. Studyof effectof differentlightonphotosyntheticrate
5. Separation of plantpigmentsbypaperchromatography
6. Demonstrationofosmosisphenomenon
7. Roleofplantgrowthhormones

Reference Books:

1. Salisbury F. B and Ross C.W 1992. Plant physiology (Fourth Edition) Wadsworth Publishing Company, California, USA
2. Singhal G. S., Renger G., Sopory, S. K. Irrgang K. D and Govindjee1999.Concept in Photobiology; Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
3. Taiz L. and Zeiger E. 1998. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts, USA.

GE III-

MICROBIALPHYSIOLOGYANDMETABOLISMPRACTICALLAB(BSHMB-L301)

CREDITS-2

1. Studyandplot thegrowthcurveof*E.coli* bytubidometric method.
2. Calculationsofgenerationtimeandspecificgrowthrateofbacteriafromthegraphplottedwith thegivendata.
3. Effectoftemperatureongrowth of*E.coli*.
4. EffectofpHongrowthof*E. coli*.
5. Demonstrationofalcoholicfermentation.
6. Demonstrationofthethermaldeathtimeanddecimalreductiontimeof *E.coli.*

References

1. MadiganMT,andMartinkoJM(2014).BrockBiologyofMicroorganisms.14thedition.PrenticeHall InternationalInc.
2. Moat AGand FosterJW.(2002).MicrobialPhysiology.4th edition.John Wiley&Sons.
3. ReddySRandReddySM.(2005).Microbial Physiology. ScientificPublishersIndia.
4. GottschalkG.(1986). BacterialMetabolism.2ndedition.SpringerVerlag.
5. StanierRY,IngrahmJI,WheelisMLandPainterPR.(1987).GeneralMicrobiology.5thedition,Mc MillanPress.
6. WilleyJM,SherwoodLM,andWoolvertonCJ.(2013).Prescott'sMicrobiology.9thedition.McGra wHillHigherEducation.

GEL-III -CELL AND MOLECULAR BIOLOGYLAB (BSHBT-L301)

CREDITS-2

1. Study of Parts of Microscope
2. To measure the length and breadth of the given cell sample by using micrometer.
3. To prepare permanent slides using the given sections like Stem, Root and Leaf.
4. Study of Mitosis.
5. Study of Meiosis.
6. Preparation of Blood Smear and study of blood cells.
7. Differential counting of white blood cells using Micrometer.
8. Identification of Barr Body in Buccal smear.
9. Identify the different types cells present in the leaf cross section.
10. Extraction of DNA from plants.
11. Extraction of DNA from animal tissues.
12. Extraction of DNA from fungus.
13. Estimation of DNA using Diphenyl amine.

Reference Book:

1. Principles and Practice of Animal Tissue Culture - By Sudha Gangal (Universities Press).
2. Essentials of Biotechnology for Students - By Satya N. Das.

SEMESTER – IV

COMPARATIVE ANATOMY OF VERTEBRATES (BSHZO-401)

CREDITS-4

UNIT-I

Origin of vertebrates, Integument and its derivatives, Structure of integument, scales, feathers, hair, beak, claw, nail, hoof, horn, antler, gland, Endoskeleton: Pectoral, Pelvic, Hindlimb, Forelimb.

UNIT-II

Digestive system: Modifications in relation to feeding habits, digestive glands, Oesophagus, Stomach; Dentition, dental formula in mammals.

UNIT-III

Respiratory System: Aquatic respiration, Aerial respiration, Circulatory system: Heart, Aortic arches.

UNIT-IV

Nervous system: Brain, Chemoreceptors, Photoreceptors, Photoreceptors of vertebrates, Cranial and spinal nerve.

UNIT-V

Urinogenital system: Excretory system- Types and evolution of kidney tubules, Urinary duct and bladder.

Reproductive system- General plan of gonads, Accessory reproductive organs.

Books Recommended

• Hildebrand: Analysis of Vertebrate Structure (1995, John Wiley)

• Kotpal: Modern Text Book of Zoology Vertebrates (2003, Rastogi)

• Nigam: Biology of Chordates (1983, S Chand)

PHYSIOLOGY: LIFE SUSTAINING SYSTEM(BSHZO-402)

CREDITS-4

UNIT-I

Nutrition and Digestion: Balanced diet; Role of salivary glands, Gastric glands (Pancreas, Intestinal Glands and liver) in digestion, Digestion and absorption of carbohydrates, proteins and fats; Control of secretion of digestive fluids.

UNIT-II

Blood: Buffer system in blood, Composition of blood, Blood groups, coagulation of blood, Homeostasis.

Circulation: double circulation, origin and conduction heartbeat, Cardiac cycle and its regulation, Elementary knowledge of ECG.

UNIT-III

Respiration: Mechanism and regulation of breathing, Structure and types of haemoglobin, Exchange of gases, Transport of oxygen and carbon dioxide, Respiratory quotient, Chloride shift.

UNIT-IV

Excretion: Nephron, Urine formation, Hormonal control of renal function, Elementary knowledge of Dialysis, Elementary knowledge of muscle twitch, tetanus and fatigue.

UNIT-V

Nervous System: Myelinated and non-myelinated nerve fibres, Resting and action potential, Initiation and conduction of nerve impulse, Types of synapses and chemical transmission.

Books Recommended

• Ganong: Review of Medical Physiology (22nd ed. 2005, Lange Medical)

• Guyton and Hall: A text book of Medical Physiology (11th ed. 2006, Saunders).

• Keele& Neil: Samson Wright's Applied Physiology (13th ed. 1989, Oxford)

• Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2005, Cambridge)

• Hoar: General and Comparative Physiology (3rd ed., 1987, Prentice Hall)

MICROBIOLOGY AND IMMUNOLOGY (BSHZO-403)

CREDITS-4

UNIT-I

Microbiology: Introduction to microbes: Viruses, Bacteria and Eukaryotic microorganisms, Classification of bacteria based on shape and size, nutrition and staining methods, beneficial and harmful interactions of microbes with human.

UNIT-II

Viruses – General structure, properties, classification and replication, lytic cycle, lysogeny. Virions, Prions, Virulence factor and toxins.

UNIT-III

Techniques in microbiology: media preparation, culture and growth of microorganisms, Applied microbiology: production of antibiotics, biopesticides, biopolymers; Dairy Microbiology; fermentation and fermentable microbes.

UNIT-IV

Introduction to immunity; Innate and acquired immunity; Cells and organs of immune system,Types of immune cells, Primary and secondary lymphoid organs and lymphatic system.

UNIT-V

Humoral immunity: Antigen, Immunoglobulins (types, diversity), antigen antibody interaction,Cell mediated immunity: Structural organization of MHC complex, Antigen processing and presentation, Functions of T-cells.

Book Recommended

Microbiology

1. Madigan and Martinko: Brock Biology of Microorganisms 12 ed. (PEARSON PUB. 2009).

2. Prescott, Harley and Klein: Microbiology (7th Ed, McGraw Hill)

3. Upadhyaya & Upadhyaya Vol – II (Himalaya Pub.)

Immunology

1. Immunology by Kuby

2. Albert et all Molecular Biology of Cell

***GE IV-Choose from scheme**

CREDITS-4

BHARTI VISHWAVIDYALAY

BHARTI VISHWAVIDYALAY

GEIV (BSHB 401)

PLANTPATHOLOGY

CREDITS-4

UNITI

Historyofplantpathology, classificationofplantdiseases,generalsymptomsofplantdiseases.

UNITII

Mode of infection and role of enzymes and toxins in plant disease, defense mechanisms of plantsagainst infection: Pre-existing structural and chemical defense, Host pathogen interactions, PRproteins.

UNIT-III

Control of plant diseases: biological, chemical, physical; bio-pesticides, plant quarantine, integratedpestmanagement.

UNIT-IV

General account of some plant diseases: Late blight of Potato, Tikka disease of groundnut, Black rust of wheat, Redrotof sugarcane, leaf spotoffice,Citruscanker; Yellowinmosaicorbhindi.

UNIT-V

Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine.

Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers.

SuggestedReadings:

1. AgriosGN,200.PlantPathology,Academicpress,London
2. BilgramiK.H.&DubeH.C..1976.AtextbookofModernPlantPathology.InternationalBookDistributingCo.Lucknow.
3. DubeyH.C.2009.Anintroductionto Fungi, VikasPublisherNewDelhi

4. R.S.MehrotraandA.Agrawal,2005.PlantPathology,TataMcGrawNewDelhi
5. SharmaP.D.2004.PlantPathology,RastogiPublishers,Meerut

GE IV-MICROBIOLOGY

MICROBIAL GENETICS AND GENOMICS (BSHMB-401)

CREDITS-4

UNIT-I:GenomeOrganizationandMutations

Genome organization: *E. coli, Saccharomyces, Tetrahymena*.Organellegenome: Chroloroplast and Mitochondria. Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens;Molecularbasisofmutations;Functionalmutants(lossandgainoffunctionmutants);Use sofmutations. Reversion and suppression: True revertants; Intra- and inter-genic suppression;Ames test; Mutatorgenes.

UNIT-II:Plasmids

Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids,yeast-2 μ plasmid, Plasmid replication and partitioning, Host range, plasmid-incompatibility, plasmidamplification,Regulation of copynumber,curingofplasmids.

UNIT-III:MechanismsofGenetic Exchange

Transformation-Discovery, mechanismof natural competence. Conjugation-Discovery,mechanism,HfrandF'strains,Interruptedmatingtechniqueandtimeofentrymapping. Transduction-Generalizedtransduction,specializedtransduction,LFT&HFTlysates,Mappingbyrecombination andco-transduction of markers.

UNIT-IV:Phage Genetics

FeaturesofT4 genetics,Geneticbasisoflytic*versus*lysogenicswitchofphagelambda.

UNIT-V:Transposableelements

Prokaryotictransposableelements–InsertionSequences,compositeandnon-compositetransposons,Replicativeand Nonreplicativetransposition,Mutransposon. Eukaryotictransposableelements-Yeast(Tyretrotransposon),Drosophila(Pelements),Maize(Ac/Ds). Usesoftransposonsandtransposition.

SUGGESTEDREADING

1. KlugWS,CummingsMR,Spencer,C,Palladino,M(2011).ConceptsofGenetics,10thEd.,BenjaminCummings.

2. KrebsJ,GoldsteinE,KilpatrickS(2013).Lewin'sEssentialGenes,3rdEd.,JonesandBartlettLearning.

3. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher EducationLearning.

4. WatsonJD,BakerTA,BellSPetal.(2008)MolecularBiologyoftheGene,6thEd.,BenjaminCummings.

5. GardnerEJ,SimmonsMJ,SnustadDP(2008).PrinciplesofGenetics.8thEd.Wiley-India.

6. RussellPJ.(2009).*i*Genetics-AMolecularApproach.3rdEd,BenjaminCummings.

7. SambrookJandRussellDW.(2001).MolecularCloning:ALaboratoryManual.4th Edition,Cold SpringHarbour Laboratorypress.

8. Maloy SR, Cronan JE and FriefelderD(2004) Microbial Genetics 2nd Edition., Jones and BarlettPublishers.

GE-IV BIOTECHNOLOGY

ANIMAL BIOTECHNOLOGY ND GENETIC ENGINEERING-

(BSHBT-401)

CREDITS-4

UNIT-I

Animal Biotechnology: Animal Biotechnology- Introduction, History, Scope, Advantages & Disadvantages. Tissue Culture Media, Applications of Animal Biotechnology

UNIT-II

Cell Culture & Cell Lines, Culture Procedure, Large Scale Cell Culture in Biotechnology, Cell Banking & Scaling up of Cell Culture, Organ Culture- Types & Techniques, Applications in the field of Biotechnology

UNIT-III

Genetic Engineering- Concepts, Tools, Enzymes responsible for Genetic Engineering, Cloning Vectors and their Applications

UNIT-IV

Gene Libraries- Creating & Screening Methods & Its different Techniques Methods of DNA Technology, Molecular Research Procedures of DNA

UNIT-V

DNA & its Sequencing, Applications of Genetic Engineering in the Field of Agriculture, Industry, Medicine & Diagnostics.

Suggested Readings:

1. Elements of Biotechnology (2nd Edition): P K Gupta

2. Animal Cell Culture: A Practical Approach: R. I. Freshney

3. Methods in Cell Biology(Vol-57): Animal Cell Culture Methods Mather & David Barnes

4. Principles of Genetic Manipulation: Old & Primrose

5. Animal Cell Culture Techniques- Martin Clynes

6. Recombination DNA Technology: Glick

7. Applied Molecular Genetics: Roger L Meisfeld

8. DNA Cloning:- A Practical Approach; A.M. Glover and B.D. Hames, IRL Press, Oxford

ZOOLOGY I-COMPARATIVE ANATOMY OF VERTEBRATES PRACTICAL

(BSHZO-L401)

CREDITS-2

- Study of histological slides of Pisces.
- Study of histological slides of Amphibians.
- Study of histological slides of Reptiles.
- Study of histological slides of Aves.
- Study of histological slides of Mammals.
- Dissection of Afferent and efferent arteries of available fish/ amphibia
- Dissection of Cranial nerve of fish

Reference Book:

- Kotpal: Modern Text Book of Zoology Vertebrates (2003, Rastogi).
- Nigam: Biology of Chordates (1983, S Chand)

ZOOLOGY II-ANIMAL PHYSIOLOGY

PRACTICAL

(BSHZO-L402)

CREDITS-2

- Counting of red blood corpuscles
- Counting of white blood corpuscles
- Determination of haemoglobin content
- Measurement of blood pressure using sphygmomanometer
- Study of activity of salivary amylase in relation to substrates, pH and temperature
- Determination of Unit Metabolism in fish

Reference Book:

- Ganong: Review of Medical Physiology (22nd ed. 2005, Large Medical)
- Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2005, Cambridge)

ZOOLOGY III- MICROBIOLOGY AND IMMUNOLOGY

PRACTICAL

(BSHZO-L403)

CREDITS-2

• Gram staining.

• Study of bacterial growth curve.

• Study of microflora of milk.

• Study of leguminous bacteria.

• Differential counting of RBCs and WBCs

• Identification of Blood Group

Reference Book:

- Immunology by Kuby.
- Albert et all Molecular Biology of Cell

***GE IV- Choose from scheme**

CREDITS-2

HARTI VISHWAVIDYALAY

GEL-IV: PLANTPATHOLOGY

LAB(BSHB-L401)

CREDITS-2

1. Todemonstratecontrolofplantdiseases.
2. Symptomologyofsomeviraldiseasespecimens: Yellowveinmosaic of hindi
3. Symptomologyof somebacterialdiseasespecimens:Bacterialblightof rice,Citruscanker
4. Symptomology of some fungal disease specimens: Late blight of Potato, Tikka disease of groundnut, Black rust of wheat, Red rot of sugarcane.

References:

1. Agrios G N, 2000. Plant Pathology, Academic press, London
2. Bilgrami K .H. & Dube H. C... 1976. A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
3. Dubey H. C. 2009. An introduction to Fungi, Vikas Publisher New Delhi

GEL IV-MICROBIAL GENETICS AND GENOMICS LAB (BSHMB-L401)

CREDITS-2

1. PreparationofMasterandReplicaPlates.
2. Studytheeffect ofchemical(HNO2)andphysical (UV)mutagensonbacterial cells
3. Studysurvival curveofbacteriaafterexposuretoultraviolet(UV)light.
4. IsolationofPlasmidDNAfrom*E.coli.*
5. StudydifferentconformationsofplasmidDNAthroughAgaraosegelelectrophoresis.
6. DemonstrationofBacterialConjugation.
7. DemonstrationofAmes test.

References

1. KlugWS,CummingsMR,Spencer,C,Palladino,M(2011).ConceptsofGenetics,10thEd., BenjaminCummings.
2. KrebsJ,GoldsteinE,KilpatrickS(2013).Lewin'sEssentialGenes,3rdEd.,JonesandBartlett Learning.
3. Pierce BA (2011). Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher EducationLearning.
4. WatsonJD,BakerTA,BellSPetal.(2008)MolecularBiologyoftheGene,6thEd.,Benjamin Cummings.
5. GardnerEJ,SimmonsMJ,SnustadDP(2008).PrinciplesofGenetics.8thEd.Wiley-India.
6. RussellPJ.(2009).*i* Genetics-AMolecularApproach.3rdEd,BenjaminCummings.
7. SambrookJandRussellDW.(2001).MolecularCloning:ALaboratoryManual.4th Edition, ColdSpringHarbour Laboratorypress.
8. Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd Edition., Jones and BarlettPublishers.

GE IV-ANIMAL BIOTECHNOLOGY AND GENETIC ENGINEERINGLAB- (BSHBT-L401)

CREDITS-2

1. To Isolate the Genomic DNA from spleen
2. To Estimate the DNA by DPA method.
3. To Estimate the RNA by Orcinol method.
4. To Isolate and Elute the DNA from Given sample by Agarose Gel Electrophoresis
5. To Isolate the Genomic DNA from Rice Plant by GFP Cloning mehtods
6. To Determine the Tm Value (GC) content in Denatured DNA.
7. To Determine the Competent Cell from the given sample.
8. To Transform the foreign DNA from given sample.
9. To Study the Bacterial conjugation by Genetic Engineering process.
10. To Isolate the Plasmid DNA from given sample.

Reference Books:

1. Essentials of Biotechnology for Students - By Satya N. Das.
2. Bioprocess Engineering - By Shuler (Pearson Education).

SEMESTER – V

(ANIMAL BEHAVIOUR AND MOLECULAR BIOLOGY (BSHZO-501)

CREDITS-4

UNIT-I

Concepts and patterns of behaviour: instinct and learning, innate behaviour, learning behaviour and its types, Genetic basis of behaviour, control of behaviour (Neural control and Hormonal control).

UNIT-II

Social organization, biological rhythms, migration, orientation and navigation (migration of birds, parental care in amphibian's and schooling in fishes).

UNIT-III

Structure of atom, molecules, ionic bonds, covalent bonds, hydrogen bond, Vander Vaal's forces, electrolytes, pH and buffer capacity in the cell environment.

UNIT-IV

DNA & RNA as genetic material, Molecular architecture of DNA, regulation of gene expression, Operon model (Inducible and Repressible Operon),Mutation: Types, Induced mutation.

UNIT-V

Elementary concept of genetic engineering: Restriction enzymes, vectors,Construction of recombinant DNA; Concept of gene cloning; Production of recombinant protein.

Books Recommended

1. Boyer: Concepts in Biochemistry (3rd ed. 2006, Brooks/Cole)

2. Lehninger, Nelson & Cox: Principles of Biochemistry (5th ed, 2008, Worth),

3. Murray et al: Harper's Biochemistry (25th ed. 2000, Appleton & Lange)

4. Stryer: Biochemistry (5th ed. 2001, Freeman)

5. Conn, Stumpf, Bruening& Doi: Principles of Biochemistry (5th ed. 1987, Wiley)

6. B.D. Singh: Biotechnology

7. W. J. Thieman, M. A. Palladino: Introduction to Biotechnology (2012)

8. H.K. Das: Text Book of Biotechnology (4th ed, Wiley)

HARTI VISHWAVIDYALAY

FISH BIOLOGY AND ENDOCRINOLOGY (BSHZO-502)

CREDITS-4

UNIT-I

Characteristics and classification of major groups of living fishes up to order; Fins: Origin, type and function, Respiratory organs: air breathing and water breathing. Distinctive features in fishes: Swim bladder, Electric organs, Poisonous and Venomous fishes. Exotic fishes and their role in fish farming; Fish preservation, Fish by-products.

UNIT-II

Cultivable Fish (name): Fish culture in ponds, Fish culture in paddy fields, Sewage-fed fisheries, Larvivores fishes, weed fishes, hill stream and deep-sea adaptations in fishes; breeding patterns, breeding seasons, factors influencing reproduction

UNIT-III

Introduction to Endocrinology, History of endocrinology, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormones, Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction, Structure of hypothalamus, Structure of pituitary gland, Hormones and their functions.

UNIT-IV

Structure and functions of following peptide hormone secreting endocrine gland and the hypo and hypersecretion of their hormones: Pituitary, Thyroid, Parathyroid,

UNIT-V

Structure and functions of following peptide hormone secreting endocrine gland and the hypo and hypersecretion of their hormones Adrenal, Pancreas, Testis, Ovary.

Books Recommended

Fish Biology

1. Hoar and Randall: Fish Physiology, Volumes I-XV (Academic Press)

2. Khanna and Singh: A textbook of Fish Biology and Fisheries (2003, Narendra Pub House)

3. Gupta and Gupta: General and applied Ichthyology (Fish and Fisheries) (2006, S. Chand)

4. Singh: Advances in Fish Research, Vol. I, II and III (Fisheries and Fish Biology: Ed Datta Munshi)

(1993, 1997and 2004, Narendra Publishing House Delhi)

Endocrinology

1. Hadley: Endocrinology 5th edition 2000, Prentice Hall

2. Norris: Vertebrate Endocrinology, 4th Edition 2007, Elsevier

3. Turner and Bugnara : General Endocrinology, 6th Edition 1984 Saunders

4. S Nagy: Introduction to Endocrinology

DSE-I: REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

CREDITS-4

UNIT-I

Reproductive cycles in vertebrates, Spermatogenesis: Events in spermatogenesis, structure of spermatozoa, Oogenesis: Events in Oogenesis, role of follicles and nurse cells, Hormonal regulation in gametogenesis in male and female.

UNIT-II

Mechanism of fertilization: Sperm egg interaction, biochemical events, post fertilization events.

Monospermy and Polyspermy; Fertilization in vivo and in vitro, Embryo transfer technology.

UNIT-III

Types of eggs and pattern of cleavage; Gastrulation and fate map, Comparison of cleavage and gastrulation in sea urchin, frog and chick embryos.

UNIT-IV

Determination and differentiation: Morphogenetic gradients in sea urchin egg; Organizer concept, Mechanism of axis determination in amphibians and functions of the organizers; Induction and determination during vertebrate eye formation.

UNIT-V

Mechanism of metamorphosis in frog; extra-embryonic membranes in mammals; Parthenogenesis; Regeneration; types and functions of placenta in mammals; Concept of Potency and application of embryonic stem cells.

Books Recommended

• Nalbandov: Reproductive Physiology

• Alberts et al.: Molecular Biology of the Cell, (4th ed. 2002, Garland)

• Gilbert: Developmental Biology (8th ed. 2006, Sinauer)

• Wolpert: Principles of Development (3rd ed. 2007, Oxford)

HARTI VISHWAVIDYALAY

DSE II-BIOTECHNIQUES

CREDITS-4

UNIT-I

Quantification techniques: Measuring of pH using paper strips, pH meter; Centrifugation (sedimentation,density gradient)

UNIT-II

Principle of colorimeter and spectrophotometer; Cell counting by using haemocytometer cells sorting by flow cytometer.

UNIT-III

Basic principles of microscopy: Type of microscopes: Bright field, dark-field, Phase Contrast, fluorescence, confocal; Microscopic measurements: micrometry using the ocular and stage micrometres,Tissue fixation, sectioning / microtomy.

U NIT IV

Cell and tissue culture technique: Culture media; Sterilization: room, culture media and glass wares,Types of animal cell culture. Cell viability, cryopreservation.

UNIT-V

Electrophoresis: Nucleic acid and Protein electrophoresis. Chromatography: Principle and applications of i) Thin layer, ii) Gel filtration, iii) Ion change iv) HPLC and v) Gas Chromatography.

Books Recommended

1. Boyer: Modern Experimental Biochemistry. Benjamin – Cummings

2. Pearse: Theoretical and Applied Histochemistry, Volume I-III, Churchill – Livingston

3. Wilson and Walker: Experimental Biochemistry, Cambridge

4. Ghatak, K.L. Techniques and Methods in Biology, PHI Learning. 201

ZOOLOGY I-ANIMAL BEHAVIOR MOLECULAR BIOLOGY PRACTICAL(BSHZO-L501)

CREDITS-2

1. Models Based on different aspects of animal behavior.

2. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna through photographs/models

3. Study of Birds Nest showing Nesting Behaviour

4. Experiments related to learning bhaviour/conditional learning.

5.Study of Watson & Crick Model of DNA through model/photographs

6.Isolation of chromosomal DNA from bacterial cells.

Reference Book:

- Boyer: Concepts in Biochemistry (3rd ed. 2006, Brooks/Cole).
- Lehninger, Nelson & Cox: Principles of Biochemistry (5th ed, 2008, Worth),
- . B.D. Singh: Biotechnology

ZOOLOGY II-FISH BIOLOGY AND ENDOCRINOLOGY PRACTICAL(BSHZO-L502)

CREDITS-2

• Classification of the following locally available fishes using key: Carps: Catlacatla; Labeo Rohitha, Cirrhinusmrigala. Catfishes: Heteropneustesfossilis, Clariasbatrachus.

• Dissection and display of accessory respiratory organs of Clariasbatrachus, Channa sp., Heteropneustes fossils

• Study of museum specimens of fishes: Larvivores fishes, Fishes having electric organs, Venomous organs, Air breathing fishes

• Mounting of respiratory epithelium of accessory respiratory organs of Heteropneustesfossilisand air bladder epithelium of carp

• Study of T.S. of gills, accessory respiratory organs and swim bladder from prepared slides

- Dissect and display of Endocrine glands in laboratory bred rat*
- Study of the permanent slides of all the endocrine glands

Reference Book:

- Hadley: Endocrinology 5th edition 2000, Prentice Hall.
- Norris: Vertebrate Endocrinology, 4th Edition 2007, Elsevier

DSE-I LAB: REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

CREDITS-2

• Study of different types of egg

• Study of eggs and tadpoles of frog from collected/preserved material

• Study of frog development through models

• Window preparation on hen's egg and blastoderm mounting.

• Demonstration of chick embryonic development making window preparation of fertilized egg

• Study of whole mount preparations of chick embryos of 16-18, 24-28, 33-36 and 42-48 hrs. of development

Reference Book:

- Alberts et al.: Molecular Biology of the Cell, (4th ed. 2002, Garland).
- Gilbert: Developmental Biology (8th ed. 2006, Sinauer)

DSE-II LAB: BIOTECHNIQUES

CREDITS-2

• Principle and working of Centrifuges.

• Principle and working of Chromatography (Paper chromatography)

• Principle and working of colorimeter and spectrophotometer

• Cell counting using haemocytometer (by using suitable stain)

• Measuring of pH using a pH meter

• Gel electrophoresis: Nucleic acid and Protein electrophoresis

Reference Book:

- Wilson and Walker: Experimental Biochemistry, Cambridge.
- Ghatak, K.L. Techniques and Methods in Biology, PHI Learning. 2011

SEMESTER – VI

BIOSTATISTICS, BIOINFORMATICS AND COMPUTER APPLICATION

(BSHZO-601)

CREDITS-4

UNIT-I

Collection of Data, Sampling Design, Classification and Tabulation, Presentation of data; Measures of central tendency: Definition, Characteristics of satisfactory averages, types of averages, their merits and demerits.

UNIT-II

Measures of dispersion: Range, Mean deviation, Standard deviation, Standard error of mean, Variance, Coefficient of variation and Calculation based on them; Correlation and Regression and their coefficients.

UNIT-III

Elementary idea of probability: Null hypothesis, Test of significance and calculations: Z-Test, Student test, Chi-squire test and its significance, Frequency distribution: Binomial distribution, Poison distribution and Normal distribution, Program used in biostatistics: SPSS, Minitab.

UNIT-IV

Elementary knowledge of Bioinfonnatics, E- learning, phylogenetic study, modelling etc, Basic features and management systems of nucleic acid sequences databases, Genome databases, Protein sequence, structures and interacting proteins databases, Literature databases, Biodiversity and ecosystem-based databases,Applications of bioinformatics-Clinical informatics, Cheminformatic resources and pharmacoinformatic.

UNIT-V

Basics of computers (CPU, I/O units), operating systems (Windows, UNIX), networks (LAN, WAN) and Networking, information technology, Concept of hypertext and internet protocol (HTTP, TCP/IP),Basics of home-pages, web-pages and uniform resource locators (URL), Computer application in biological sciences.

Books Recommended

Biostatistics:

1. James L. Bruning, B.L. Kintz, Computational Handbook of Statistics (4th Edition)

2. Helmut Fritz Van Emden, Statistics for Terrified Biologists. Wiley Blackwell (2008)

3. Rebecca W-Bremer, Martina. Statistics at the Bench-A Step-by-Step Handbook for Biologists by Doerge (2009)

Bioinformatics:

1. Campbel: Discovering Genomics, Proteomics and Bioinformatics (2006, LPE)

2. Pevzner, P.A. Computational Molecular Biology: An Algorithmic Approach. (2010, PHI Learning)

3. Rastogi, Mendiratta& Rastogi. Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery (3rd Ed. 2011, PHI, Learning)

WILD LIFE CONSERVATION AND MANAGEMENT (BSHZO-602)

CREDITS-4

UNIT-I

Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

UNIT-II

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

UNIT-III

Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats

UNIT-IV

National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation, Tiger reserves in India; Management challenges in Tiger reserves.

UNIT-V

Wildlife management and conservation; factors influencing wildlife management: habitats, population, behaviour and food-habits. Role of local communities in wildlife management. Habitat degradation and fragmentation, overexploitation, Poaching of wildlife. Vision and mission of IUCN; Red list categories, threatened species of India.

Books Recommended

- Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management.Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Co-existence? Cambridge University.
- Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society, Allen Press.

- Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

DSE III: INSECT VECTORS AND DISEASES

CREDITS-4

UNIT-I

General Features of Insects, Morphological features Head,Eyes, Types ofantennae, Mouth parts,feeding habits.

UNIT-II

Brief introduction of Carrier and Vectors (mechanical and biological vector).Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity.

UNIT-III

Classification of insects up to orders, detailed features of orders with insects as vectorsDiptera, Siphonaptera, Siphunculata, Hemiptera

UNIT-IV

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies, Study of mosquito-borne Diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes, Study of sand fly-borne diseases – Visceral Leishmaniasis, CutaneousLeishmaniasis, Phlebotomus fever, Control of Sand fly,Study of house fly as important mechanical vector, Myiasis, Control of house fly.

UNIT-V

Human louse (Head, Body and Pubic louse) as important insect vectors.
Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

1. **Books Recommended**

2. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
3. Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, CambridgeUniversity Press, UK.
4. Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
5. Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell

HARTI VISHWAVIDYALAY

DSE IV-ANIMAL PHYSIOLOGY

CREDITS-4

UNIT-I

Nutrition and Digestion: Balanced diet; Role of salivary glands, Gastric glands (Pancreas, Intestinal Glands and liver) in digestion. Digestion and absorption of carbohydrates, proteins and fats; Control of secretion of digestive fluids.

UNIT-II

Blood: Buffer system in blood, Composition of blood, Blood groups, coagulation of blood, Homeostasis. Circulation: double circulation, origin and conduction heartbeat, Cardiac cycle and its regulation. Elementary knowledge of ECG.

UNIT-III

Respiration: Mechanism and regulation of breathing, Structure and types of haemoglobin. Exchange of gases, Transport of oxygen and carbon dioxide, Respiratory quotient, Chloride shift.

UNIT-IV

Excretion: Nephron, Urine formation, Hormonal control of renal function, Elementary knowledge of Dialysis; Muscles: Ultrastructure of skeletal muscle, Muscle proteins, Elementary knowledge of muscle twitch, tetanus and fatigue.

UNIT-V

Nervous System: Myelinated and non-myelinated nerve fibres, Resting and action potential, Initiation and conduction of nerve impulse, Types of synapses and chemical transmission.

Books Recommended

• Ganong: Review of Medical Physiology (22nd ed. 2005, Lange Medical)

• Guyton and Hall: A text book of Medical Physiology (11th ed. 2006, Saunders).

• Keele& Neil: Samson Wright's Applied Physiology (13th ed. 1989, Oxford)

• Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2005, Cambridge)

• Hoar: General and Comparative Physiology (3rd ed., 1987, Prentice Hall)

6. Tortora: Animal Physiology

HARTI VISHWAVIDYALAY

ZOOLOGY I- BIOMOLECULES, BIOSTATISTICS

PRACTICAL

(BSHZO-L601)

CREDITS-2

Biomolecules

1. Identification of amino acids in the mixture using paper chromatography

2. Estimation of protein by Biuret method

3. Qualitative tests for identification of sugars

Biostatistics

• Mean

• Median

• Mode

• Standard deviation

• Standard error of mean

• Diagrammatic representation of results

Reference Book:

- Bevzner, P.A. Computational Molecular Biology: An Algorithmic Approach. (2010, PHI Learning).
- Rastogi, Mendiratta& Rastogi. Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery (3rd Ed. 2011, PHI, Learning)

ZOOLOGY II-WILD LIFE CONSERVATION AND MANAGEMENT PRACTICAL

(BSHZO-L602)

CREDITS-2

1.Identification of flora, mammalian fauna, avian fauna, herpeto-fauna

2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)

3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.

4. Demonstration of different field techniques for flora and fauna

5. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (Direct and indirect evidences)

Reference Book:

- Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management.Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Co-existence? Cambridge University.

DSE-III LAB: INSECT VECTORS AND DISEASES

CREDITS-2

1. Study of different kinds of mouth parts of insects

2. Study of following insect vectors through permanent slides/ photographs: Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phithiruspubis, Xenopsyllacheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica, through permanent slides/ photographs

3. Study of different diseases transmitted by above insect vectors.

4. Submission of a project report on any one of the insect vectors and disease transmitted

Reference Book:

- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK.
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication

DSE-IV LAB: ANIMAL PHYSIOLOGY

CREDITS-2

• Counting of red blood corpuscles.

• Counting of white blood corpuscles.

• Determination of hemoglobin content.

• Determination of Erythrocyte sedimentation rate (ESR) and Packed Cell Volume PCV.

• Measurement of blood pressure using sphygmomanometer.

• Study of activity of salivary amylase in relation to substrates, pH and temperature.

• Determination of Unit Metabolism in fish.

Reference Book:

- Keele& Neil: Samson Wright's Applied Physiology (13th ed. 1989, Oxford) .
- Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2005, Cambridge)

SKIILL ENHANCEMENT COURSE (ANY 2)

SEC1 TO SEC4

SEC I: SERICULTURE

CREDITS-4

UNIT: I

History and economic importance of sericulture – types of silkworms – Mulberry and no Mulberry (Tassar, Eri and Muga), Systematic position of Bombyx and Life Cycle - Morphology of silk gland, Horticulture – mulberry cultivation – Environmental conditions for mulberry cultivation – soil, climatic factors, preparation of land.Intercoalition – pruning methods – harvesting, Diseases and pests of mulberry and control methods.

UNIT: II

Silkworm rearing – general principles of silkworm rearing – primary requisite forsuccessfulrearing, feeding of silkworm, bed cleaning, sparing, moulting, late age silkworms – Moulting andharvesting economics of silkworm, Diseases and pests of silkworm, Reeling –reeling appliances and process of reeling cocoons, Sericulture as cottage industry.

REFERENCES:

1. Handbook of sericulture – S.R. Ullal and M. N. Varasimhanna
2. An introduction to sericulture – G. Ganga, J. Sulochana Chetty
3. Manual of Sericulture – FA O Volumes.

SEC II-VERMICULTURE AND VERMICOMPOSTING

CREDITS-4

UNIT: I

Scope of vermi technology- Vermiculture and vermi composting – difference between vermicultureandvermi composting –Earthworm diversity – Ecological groups of earthworms, biology of composting earthworms –Eoisenafoeitida, Eudriluslugeniae.Soil – Physical, chemical and biological features, Organic waste sources – problems in traditional composting, vermicompositing,Types small and large scale pit method, heap method.

UNIT: II

Vermiculture techniques – vermi culture process – site selection - Selection and collection ofspecies mono and poly culture,Essential parameters for vermi culture – bedding. Methods of harvesting worms general manualmethods, self-harvesting method, mechanical method ,Nutritive value of vermi compost, storing and packing of compost,Applications of vermi composting in agricultural and horticultural practices,Economic of vermi culture, nationalized bank, NABARD support for vermi culture.

REFERENCES:

1. Earthworm ecology by LEE

2. Biology of earthworm by Steven son

3. Vermi composting tech – soil health to human health by Ranganathan L.S.

SEC III- AQUACULTURE AND SERICULTURE

CREDITS-4

UNIT-I

Types of Fisheries; Fresh Water Fish and Prawn culture, Fresh water fishing gears and crafts; Induced Breeding, Hatchery design and Management of fish and prawn; Transportation of fish and prawn seed, Preservation, Processing and By-products of fishes, Fish Diseases and control measures

UNIT-II

Life cycle of Bombyx mori, Structure of silk gland and secretion of silk, Silkworm rearing technology, Spinning, harvesting and storage of cocoons, Silk worm Pests and Diseases: Uzi fly; Protozoan, Viral, Fungal and Bacterial; Control andprevention, Prospects of Sericulture in India

REFERENCES

1.Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Bisht, D.S., Apiculture, ICAR Publication.
3. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.
4. Ullal S.R. and Narasimhanna, M.N. Handbook of Practical Sericulture: CSB,Bangalore
5. Jolly. M. S. Appropriate Sericultural Techniques; Ed., Director, CSR & TI, Mysore.
6. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co.
7. Narasimhanna, M. N. Manual of Silkworm Egg Production;, CSB, Bangalore 1988.
8. Wupang—Chun and Chen Da-Chung, Silkworm Rearing;, Pub. By FAO, Rome 1988.
9. Sengupta, K. A Guide for Bivoltine Sericulture; Director, CSR & TI, Mysore 1989.
10. Krishnaswamy, S. Improved Method of Rearing Young age silkworm;CSB,Bangalore,1986

SEC-IV: APICULTURE AND VERMICULTURE

CREDITS-4

UNIT-I

Selection of Bee Species for Apiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern),Bee Diseases and Enemies, Products of Apiculture Industry and its Uses (Honey, Bees Wax).

UNIT-II

Introduction of Vermiculture and Vermicomposting Vermiculturetechniques, Bedding, Essential parameters for Vermiculture and ManagementMethods of Harvesting (Manual & Mechanical), Economic Importance of Vermiculture.

REFERENCES:

1.Jhingran. V.G. Fish and fisheries in India.,
2. Khanna. S.S, An introduction to fishes
3. Santanam, B. et al, A manual of freshwater aquaculture,
4. Boyd. C.E. &Tucker.C.S, Pond aquaculture water quality management,
5. Biswas K.P, Fish and prawn diseases
6. Hafez, E. S. E. (1960). Reproduction in Farm Animals. Lea & Fabiger, Publisher
7. Lunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI
8. Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.
9. Lee, Earthworm Ecology
10. Stevenson, Biology of Earthworms
11. Ranganathan L.S, Vermicomposting technology- soil health to human health