U.G. 4th SEMESTER SYLLABUS
DEPARTMENT OF ZOOLOGY
COTTON UNIVERSITY

PAPER: ZOO401C

FUNDAMENTALS OF BIOCHEMISTRY
(Credits: 3+0+2=5)

UNIT 1-Introduction to Biochemistry (8L)

1.1. **Chemistry of living system: 4L**
1. Chemistry of living system-Scope and importance; 2. Chemical bonds and energy; 3.Properties of water as biological solvent.

1.2. Biomolecules– 4L
1. Definition of biomolecules and its Configuration, Conformation, Organization of biomolecules.

UNIT 2–Carbohydrates and proteins: their metabolism (14L)

2.1. Carbohydrate metabolism 7L
1. Structure, functional and classification of carbohydrates; 2. carbohydrate metabolism: gluconeogenesis, citric acid cycle, fermentation, pentose phosphate pathway, shuttle systems (malate aspartate shuttle, glycerol -3- phosphate shuttle, and Cori cycle); 3. Glycogen metabolism (glycolysis, glycogenolysis, glycogenesis)

2.2. Protein metabolism 7L
1. General properties of amino acids; essential and non-essential amino acids; 2. Classification and general properties of proteins; 3. Structural organization and functional significance of proteins; 4. Protein metabolism (catabolism of amino acids: transamination, deamination and ornithine cycle, fate of glucogenic and ketogenic-amino acids with examples of serine and leucine)

UNIT3–Lipids and metabolism, intermediarymetabolism and oxidative phosphorylation (12L)

3.1. **Lipid metabolism 6L**
1. Classification, properties and functional significance of lipids; 2. Functional significance of fatty acids, triglycerides and steroids; 3.Types and properties of lipoproteins); 4. Formation of lipid bi-layer; 5. Lipid metabolism (β-oxidation of saturated fatty acids, Ketogenesis),

3.2. **Intermediary pathway 2L**
Interconversion pathway and inter relationship between carbohydrates, proteins and fats metabolism.

3.3. **Oxidative phosphorylation 4L**
1. Oxidative phosphorylation in mitochondria; 2. ATP synthesis and Respiratory complexes; 3.Inhibitors and uncouplers.

UNIT 4 –Enzymes and the laws of thermodynamics and Nucleic Acids (14L)

4.1. **Enzymes 8L**
1. Introduction, properties and classification of major types of enzymes; 2. Factors of enzyme activity, Biological significance of enzymes; 3. Mechanism of enzyme action, enzyme kinetics (Michaelis–Menten hypothesis)and Inhibition; 4.Allosterism.

4.2. Thermodynamics 1L
Laws of Thermodynamics and its biological application

4.3. **Nucleic Acids and protein synthesis 5L**
1. Types of Nucleic Acid (DNA and RNA) and their function and differences; 2.Structure of DNA (Watson and Crick Model of DNA); 3. Different types of RNA and its functional significance; 4. Protein synthesis: transcription and translation.

PRACTICAL: (Credit -2)

1. Qualitative detection of carbohydrates (Benedict test for reducing sugars and Iodine test for starch), lipids and proteins.
2. Study of enzymatic activity of trypsin/ pepsin, lipase and their inactivation by heat.
3. Detection of ninhydrin test for amino acids through paper chromatography.
4. Quantitative estimation of protein by Lowry's method.
5. Quantitative estimation of lipid.
6. Estimation of Alkaline Phosphatase and LDH from serum/tissue.
7. Preparation of models of nitrogenous bases, nucleosides, nucleotides, amino acids, dipeptides.

**** Lab notebook with labelled diagrams, methods (wherever applicable) and results must be incorporated.**

Recommended books –
1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H Freemanand Co.
3. Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W. (2009). Harper's Illustrated Biochemistry, XXVIII Edition. Lange Medical Books/McGraw-Hill.
4. Concept of biochemistry, L.M. Srivastava, third edition
5. Lehninger Principles of Biochemistry, Indian edition, English, Hardcover, David L. Nelson, Michael Cox).

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PAPER: ZOO402C

BIOINSTRUMENTATION, INFORMATIONAL BIOLOGY, BIOINFORMATICS AND BIOSTATISTICS
(Credits: 3+0+2=5)

Unit 1: Bioinstrumentation: Biological technique. 16L

1.1 Analytical technique:
Principle and application of Analytical instrument- pH meter, colorimeter and spectrometer, Centrifuge and Ultracentrifuge.

1.2 Microscopical technique:
1. Working principle of Light microscope, Electron microscope, Phase contrast and Fluorescence microscope.

1.3 Separation technique:
Chromatographic separation and their types with application, Principle and application of electrophoresis

1.4 Preservation technique:

Preparation and application of cryopreservation, Cryobank

Unit 2: Informational Biology/ Bioinformatics 20L

1.1 Introductionto Bioinformatics
Definition, aim and branches, scope and application of bioinformatics

1.2 Database in bioinformatics
1 Types of biological database, Data formatting and its types; 2.Biological database retrieval system (SRS, Entrez), 3. National Centre for Biotechnological Information (NCBI), Tools and databases NCBI, 4. Database Retrieval tool, sequence submission tool, nucleotide, protein and Gene expression database; 5. Nucleotide database EMBL, DDBJ, Protein information Resource (PIR) and Swissprot.

Unit3 : Computer in biology 4L
1. Application of computer in biology; 2. Data processing in computer; 3. Basic knowledge of computer language: Basic, C++/ COBALT, Citran, etc.

Unit 4 : Statistics in biology 8L
1. Application of statistics in biology; 2. Measures of central tendency: Mean, Median,Mode and their uses; 3. Standard Deviation in data analysis and Standard error and their calculation; 4. Regression and Correlation; Application of computer programs and softwares, their uses in biological data analysis.

PRACTICAL: (Credit 2)
1. Preparation of buffer and determination of pH.
2. Centrifuge
3. Demonstration of functioning spectrophotometer and colorimeter
4. Dentification of amino acid in mixture using ninhydrin through paper chromatography
5. Familiarity with tissue culture lab (Lab visit).
6. Assessing of different information biological database, nucleic acid and protein databases
7. Retrieval of Nucleotide and protein sequence from databases
8. Performance of pairwise (Blast) and multiple sequence alignment
9. Construction of phylogenetic tree and interpretation
10. To perform standard deviation and two sample t-test for a set data collected from vicinity of garden of any organism.
11. To learn graphical representation in given statistical data with help of computer (MS-EXCEL)
**** Lab notebook with labelled diagrams, methods (wherever applicable) and results must be incorporated.**

Recommended Books-
1. Biostatistics in Brief Made Easy: K Visweswar.
2. Categorical Data Analysis by Alan Agresti.
3. Campbell, A. M. and Heyer L P., Discovering genomics, proteonomics and Bioinfomatics, II Edition, Benjamin Cummings.
4. Ghosh, Z., and Bibekananda M, Bio informatics: Principles and Applications, Oxford University Press.
5. Pevsner, S. Bio-informatics and Functional genomics, Wiley-Black well.
6. Statistics by Murray R Spiegal, Larry J Stephens.

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U.G. 4th SEMESTER SYLLABUS
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PAPER: ZOO403C

EVOLUTIONARY AND ADAPTIVE BIOLOGY
(Credits: 3+0+2=5)

Unit I: Evolution 19L
1. Organic evolution-Meaning, Morphological and anatomical, Embryological: Paleontological, biochemical and molecular evidences of organic evolution; 2. Theories of Evolution-Lamarckism, Neo-Lamarckism, Darwinism, DeVries mutation theory, Present or modern concept of evolution; 3.Evolution of Horse; 4. Evolution of Man.

Unit II: Zoogeography 12L
1.Definition, Biogeographical realms-Discontinuous, Restricted distribution, factors influencing animal distribution; 2.Genetic Drift, Species concept, Speciation, Genetic and Geographical, Reproductive Isolating mechanisms, Natural selection in action (industrial melanism, antibiotic and DDT resistance);

Unit III: Fossils 5L
1. Fossils: definition, fossilization and significance, dating of fossils; 2.Geological Time Scale; 3. Extinction and mass extinction- Causes, impact.

Unit IV: Adaptive Biology 12L
1.Adaptation-Definition, Significance, Principles of adaptation, Types of adaptation – Aquatic, terrestrial and Volant adaptation; 2.Strategies of Adaptation in Animals-Migration, Camouflage (Cryptic Appearance), Mimicry, Warning colouration, Hibernation and Aestivation, Adaptation to water scarcity and cold, Bioluminescence; 3. Adaptive radiation in mammals.

PRACTICAL: (Credit:2)

List of practicals-
1. Demonstration of geological scale through chart.
2. Study of homologous and analogous organs through suitable museum specimen (wings of birds & insect, forelimbs of bat & rabbit)
3. Study of lung fishes (Dipnoi- from museum) and their evolutionary significance.
4. Study of animals (from museum specimens) as an evolutionary connecting link and its significance (Peripatus, Neoplina, Protopterus ,Balanoglossus, Archeopteryx, Duck billed Platypus).
5. Study of Embryological evidences of evolution(through charts and models) (mammalian embryos).
6. Graphical representation and interpretation of data of height/ weight from human samples in relation to their age and sex.
9. Study of adaptive modification in feet and mouth parts of birds and mouth parts of insects (from slides).
10. Construction of phylogenetic trees and its interpretation (silico study through anyone software-clustalX/W, Phylip NI).
**** Lab notebook with labelled diagrams, methods (wherever applicable) and results must be incorporated.**

Recommended Books -
1. Rastogi: Organic Evolution (1988, Kedarnath&Ramnath)
2. Campbell, N.A. and Reece J.B (2011). Biology.IX Edition. Pearson, Benjamin, Cummings.
3. Douglas, J. Futuyma (1997). Evolutionary Biology.Sinauer Associates.
4. iGeneics: A Molecular Approach. 3rd edition. Peter.J.Russell.
5. Ridley. M, Evolution, Blackwell Publishing.

6. Barton, N. H., et.al. Evolution Cold Spring Harbon Laboratory Press.
7. Hal, B. K. et al. Evolution Jones and Barlett Publishers.
8. Lemurs, Ecology and adaptation, (Development in Primatology: Progress and Prospects) Edited by L Gould M LSeuther.
9. Parker G., Adaptation and Ecology.
10. Rose E., Animal adaptation for survival; The Rosen Publishing Group.
11. Moody: Introduction to Evolution (1978, Kalyani).

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(Generic Elective Paper -4)

PAPER: ZOO404G

HUMAN PHYSIOLOGY
(Credits: 2+1+0=3)

Unit 1: Digestion and Absorption of Food 8L
Structure and function of digestive glands; digestion and absorption of carbohydrates, fats and proteins; nervous and hormonal control of digestion (in brief)

Unit 2: Functioning of Excitable Tissue (Nerve and Muscle) 6L
Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, mechanism of muscle contraction (Sliding filament theory), neuromuscular junction

Unit 3: Respiratory and Renal Physiology 8L Ventilation, external and internal respiration, transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases; Functional anatomy of kidney, mechanism and regulation of urine formation, Nitrogenous wastes.

Unit 5: Cardiovascular, Endocrine and Reproductive Physiology 10L
Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG; Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), brief account of spermatogenesis and oogenesis, menstrual cycle.

PRACTICAL: (Credits- 1)

1. Preparation of temporary mounts: Neurons and Blood film.
2. Preparation of haemin crystals.
3. Estimation of haemoglobin using Sahli's haemoglobinometer.
4. Study of permanent histological slides of mammalian oesophagus, stomach, duodenum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.
5. Preparation of temporary mounts of squamous epithelium, striated and non-striated muscles.
6. DLC of blood.

**** Lab notebook with labelled diagrams, methods (wherever applicable) and results must be incorporated.**

Recommended Books-

1. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Company Ltd.
2Kesar, S. and Vashisht, N. (2007).Experimental Physiology, Heritage Publishers.

3. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley and Sons, Inc.
4. Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, XI Edition, McGraw Hill.
5. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
6. Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley.

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(Skill Enhancement Course -2)

PAPER: ZOO102SEC

MEDICAL DIAGNOSTICS
(Credits: 2+0+0=2)

Unit 1: Common diagnostics methods for Analysis of Blood (14L)
Introduction to medical diagnostics and its importance**,** Blood composition (separation of serum from blood cells), Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's/ Wrights/Gymsus stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.), Calculation of RBC related indices (MCV,MCH,MCHC) from P.C.V haemoglobin and total count of RBCs.

Unit II: Common Diagnostic techniques for Urine Sample Analysis 4L
Urine Analysis: Examination of Physical characteristics; Abnormal constituents (albumin, blood, sugar, uric acid).

Unit III: Non-infectious and Infectious Diseases 6L
Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Testing of blood glucose using Glucometer/ Kit; Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis.

Unit IV: Tumours 8L
Types (Benign/Malignant), Detection of the stage-1, stage-2 and stage-3 metastasis; Biopsy examination of tumour sample through microtomy and visit to a clinical laboratory or cancer institute for Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan /using photographs.

Recommended Books-

1. Park, K. (2007), Preventive and Social Medicine, B.B. Publishers.
2. Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House.
3. Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders.
4. Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders.
5. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

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