Paper 9-ZOHT 304: ANIMAL PHYSIOLOGY AND FUNCTIONAL HISTOLOGY -I

(With reference to human)

THEORY                              Marks: 100

Unit 1. Tissues and Glands          (Ch 4, Tortora & Grabowski)
    Concepts and classification- Epithelial tissue, Connective tissue, Muscular tissue, Nervous tissue and Types of glands.

Unit 2. Bone                        (Ch 6, Tortora & Grabowski)
    Structure and types, Ossification, bone growth, resorption and bone disorders.

Unit 3. Nervous System              (Ch 12, 17, Tortora & Grabowski)
    General organization: Neuron resting membrane potential and its basis; Origin of action potential and its propagation in myelinated and unmyelinated nerve fibers; Synaptic transmission and types of synapsis, Neuromuscular junction; Reflex activity-reflex arc; Types of reflexes, Physiology of hearing and vision.

Unit 4. Muscle                     (Ch 6, 7, Guyton & Hall/ Ch 10, Tortora & Grabowski)
    Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation, tetanus and muscle dystrophies.

Unit 5. Reproductive System        (Ch 28, Tortora & Grabowski)
    Histology of male and female reproductive systems, Puberty, physiology of male and female reproduction; Methods of contraception (depicted through flow chart); Disorders of reproductive system.

Unit 6. Endocrine System           (Ch 18, Tortora & Grabowski)
    Histology and functions of endocrine glands; Nature of hormones; Regulation of hormone secretion; Mode of action of hormones, Signal transduction pathways utilized by steroidal and nonsteroidal hormones; Hypothalamus- principal nuclei involved in control of endocrine system, control of anterior pituitary hormones by hypothalamic releasing hormones (neuroendocrine mechanisms); Effects of abnormal secretions of hormones; Placental hormones.
PRACTICALS

1. Recording of simple muscle twitch with electrical stimulation.
2. Demonstration of the knee jerk reflex.
4. Examination of sections of Mammalian skin, Cartilage, Bone, Pancreas, Testis, Ovary, Pituitary, Adrenal, Thyroid, Parathyroid.
5. Preparation of permanent slide of any five mammalian tissues- Microtomy.

SUGGESTED BOOKS

Paper 10-MACT 303: MATHEMATICS AND STATISTICS

Marks: 100

Unit 1 (24 Periods)
Sets. Functions and their graphs: polynomial, sine, cosine, exponential and logarithmic functions. Motivation and illustration for these functions through projectile motion, simple pendulum, biological rhythms, cell division, muscular fibres etc. Simple observations about these functions like increasing, decreasing and periodicity. Sequences to be introduced through the examples arising in Science beginning with finite sequences, followed by concepts of recursion and difference equations. For instance, the Fibonacci sequence arising from branching habit of trees and breeding habit of rabbits. Intuitive idea of algebraic relationships and convergence. Infinite Geometric Series. Series formulas for $e^x$, $\log(1+x)$, $\sin x$, $\cos x$. Step function. Intuitive idea of discontinuity, continuity and limits. Differentiation. Conception to be motivated through simple concrete examples as given above from Biological and Physical Sciences. Use of methods of differentiation like Chain rule, Product rule and Quotient rule. Second order derivatives of above functions. Integration as reverse process of differentiation. Integrals of the functions introduced above.

Unit 2 (14 Periods)
Points in plane and space and coordinate form. Examples of matrices inducing Dilation, Rotation, Reflection and System of linear equations. Examples of matrices arising in Physical, Biological Sciences and Biological networks. Sum and Produce of matrices upto order 3.

Unit 3 (20 Periods)
SUGGESTED READINGS


*Note:* It is desirable that softwares should be used for demonstrating visual, graphical and application oriented approaches.
Paper 11-CBHT 301: CELL BIOLOGY-I

THEORY

Marks: 100

Unit 1. An Overview of Cells (Ch 1 Cooper et al./ Ch 1 Karp)
Overview of prokaryotic and eukaryotic cells, cell size and shape, Phages, Viriods, Mycoplasma and Escherichia coli.

Unit 2. Tools and techniques of Cell Biology (Ch 1 Cooper et al./ Ch 18 Karp/ Ch 3 De Robertis)
Microscopic-Principles of Light microscopy; Phase contrast microscopy; Confocal microscopy; Electron microscopy (EM)- scanning EM and scanning transmission EM (STEM); Fluorescence microscopy; Analytical-Flow cytometry- flurochromes, fluorescent probe and working principle; Spectrophotometry; Mass spectrometry; X-ray diffraction analysis. Separation-Sub-cellular fractionation- differential and density gradient centrifugation; Chromatography-paper, thin-layer, gel-filtration, ion-exchange, affinity and High-Performance Liquid Chromatography (HPLC).

Unit 3. Composition of Cells (Ch 2 Cooper et al.)
Molecules of cell, cell membranes and cell Proteins.

Unit 4. The Nucleus (Ch 9 Cooper et al.)
Nuclear Envelope- structure of nuclear pore complex, nuclear lamina, Transport across Nuclear Envelope, Chromatin: molecular organization, Nucleolus and rRNA Processing.

Unit 5. Protein Sorting and Transport (Ch 10 Cooper et al.)

Unit 6. Mitochondria, Chloroplasts and Peroxisomes (Ch 11 Cooper et al.)
Structural organization, Function, Marker enzymes, Mitochondrial biogenesis, Protein import in mitochondria, Semiautonomous nature of mitochondria and chloroplast, chloroplast DNA, Peroxisomes’ assembly

Unit 7. Cytoskeleton and Cell Movement (Ch 12 Cooper et al.)
Structure and organization of actin filaments; actin, myosin and cell movement; intermediate filaments; microtubules.
CBHP 301: CELL BIOLOGY-I

PRACTICALS

1. Separation of nucleic acid bases by paper chromatography.
3. Study of the following techniques through electron / photo micrographs: Fluorescence microscopy, autoradiography, positive staining, negative staining, freeze fracture, freeze etching, shadow casting.
4. Study of structure of cell organelles through electron micrographs.

Permanent slide preparation:
5. Cytochemical staining of DNA-Feulgen.
6. Cytochemical staining of DNA and RNA- Methyl Green Pyronin (MGP).
7. Cytochemical staining of Polysaccharides-Periodic Acid Schiff’s (PAS).
8. Cytochemical staining of Total proteins- Bromophenol blue.

SUGGESTED BOOKS

THEORY

Unit 1. Nucleic Acids convey Genetic Information  
DNA as the carrier of genetic information, Key experiments establishing-The Central Dogma, DNA Double helix, Genetic code, Direction of Protein Synthesis, Genomics.

Unit 2. The Structures of DNA and RNA / Genetic Material  
DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves.  
DNA topology - linking number, topoisomerases; Organization of DNA- Prokaryotes, Viruses, Eukaryotes.  
RNA Structure  
Organelle DNA -- mitochondria and chloroplast DNA.

Unit 3. Genome Structure, Chromatin and the Nucleosome  
Genome Sequence and Chromosome Diversity, Chromosome Duplication and Segregation, 
The Nucleosome  
Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.  
Regulation of Chromatin Structure and Nucleosome Assembly.  
Organization of Chromosomes

Unit 4. The Replication of DNA (Prokaryotes and Eukaryotes)  
Chemistry of DNA synthesis, general principles - bidirectional replication, Semi- conservative, Semi discontinuous,RNA priming, Various models of DNA replication including rolling circle, D-loop (mitochondrial), Θ (theta) mode of replication, replication of linear ds-DNA, replicating the 5’end of linear chromosome. Enzyme involved in DNA replication – DNA polymerases, DNA ligase, Primase, Telomerase and other accessory proteins

Unit 5. The Mutability and Repair of DNA  
Replication Errors, DNA Damage and their repair.
MBHP 301: MOLECULAR BIOLOGY-I

PRACTICALS

1. Preparation of Polytene chromosome from *Chironomous* larva/*Drosophila* larva
2. Demonstration of mammalian sex chromatin.
3. Preparations of temporary mount and study the different stages of Mitosis (Onion root tip).
4. Perform Southern Blot Hybridization (Restrict DNA for Southern Blot electrophoresis, perform electrophoresis of restricted DNA, perform southern transfer, hybridization and detection of gene of interest)
5. Demonstration of Northern Blotting.
6. Demonstration of Western Blotting.
7. Perform DNA amplification by PCR.
8. Study of semiconservative replication of DNA through micrographs/schematic representations.

SUGGESTED BOOKS