SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR

Programme: MSC (CBCS)
Syllabus with effective from: JUNE-2017

ZOOLOGY
Semester: III

PS03CZOO21: Human Physiology

Unit I

Homeostasis and the organization of body fluids, Control of Homeostasis, Positive and negative Feedback systems, Homeostatic Imbalances.

An overview of human circulatory system. Anatomy of heart, cardiac cycle, cardiac output, blood pressure and regulation, ECG. The arterial system, venous system, the microcirculation and mechanics of capillary fluid exchange. Control of blood flow to the tissues. Portal circulations. Arterial pressure and its regulation. Blood-components and functional significance. Blood buffer systems, Blood coagulation and factors involved in coagulation. Laboratory tests to measure coagulation and thrombolysis. Hemopoiesis and blood groups, Disorders of circulatory system: coagulation disorders, hypertension, thalassaemias and anemias.

Unit II

Digestive system – Composition, functions and regulation of saliva, gastric, pancreatic
intestinal and bile secretions – digestion and absorption of carbohydrates, lipids, proteins
nucleic acids, minerals and vitamins.
The Muscular System – Types of muscles and their functions. Physiology of muscle contraction in striated and non-striated muscle.

Unit III

Excretory system – structure of nephron formulation of urine, glomerular filteration, GFR, tubular reabsorption of glucose. renal and pulmonary control of blood pH, renal clearance.

Unit IV

Nervous System- Structure of neuron, function and organization of nervous system, Blood-brain barrier, Neurotransmitters, Nerve impulse transmission.
Reproductive physiology – secretion and function of reproductive hormones, pregnancy and lactation. Hormonal disturbances.

Reference Books:

Text book of Medical Physiology by A. C. Guyton and J. E. Harcourt.

Text book of Medical Physiology by Ganong.

Principles of anatomy and physiology by Gerard Tortora and Bryan Derrickson, 12th edition

PS03CZOO22: Biology of Animal Behaviour

Unit 1:

Introduction: Ethology as a branch of biology. Classification of behavioral patterns.
Perception of the Environment: Sensory mechanisms: Mechanical, Electrical, Chemical, Olfactory, Auditory and Visual. Neural and Hormonal Control of behavior. Role of nervous system in mergence of behavioral patterns. Role of endocrine secretions in behavioral expressions.

Unit 2:

Communication: Importance, types, components and evolution of communication. Role of Visual and auditory systems, hormones and pheromones. Language of communication in invertebrates and vertebrates.

Unit 3:

Social Behavior: Aggregations – Schooling in fishes, flocking in birds, herding in mammals - group selection, kin selection, altruism, reciprocal altruism, inclusive fitness, social organization in insects and primates.
Reproductive Behavior: Evolution of sex and reproductive strategies, Mating systems, courtship, Sexual Selection, parental care.

Unit 4:

Biological Rhythms: Circadian and Circannual rhythms, Orientation and navigation Migration of fish, turtles and birds.
Learning and Memory: Conditioning, Habituation, Insight learning, Association learning, reasoning, cognitive skills.

Reference Books:
- An Introduction to Animal Behavior. Aubrey Maning and Dawkins, M. S. Cambridge University press, U.K.
- Animal Behavior: An Evolutionary approach. Alcock J., Sinauer Associates Inc. Sunderland, Massachusetts.
- Animal Behaviour – psychobiology, Ethology and Evolution, McFarland, D. pitman publication Ltd. London.
- Animal Behavior – Reena Mathur, Rastogi and Co. Meerut
- Ethology: The Biology of Behavior. Eibl – Ebesfeldt, I. Holt, Reinhart & Winston, New York.
- Animal Behavior, Arora, M. P. Himalaya publishing House, Bombay
- An Introduction to Animal Behavior, Harjindra singh, Anmol Publications, New Delhi.
- An Introduction to Behavioral Ecology, Krebs, J. R. and Davis, N. B. Blackwell Scientific publications, Oxford.

PS03CZOO23: Aquaculture Technologies

Unit 1:

General characters and classification of fishes and prawns.
Culture practices: Indian major carps and exotic carps; Shrimps and prawns
Induced Breeding: Hormonal regulation of gonadal development, Activity of Gonadotropin releasing hormone, application of hormones in aquaculture. Sex determination and control. Induction of maturation and spawning.

Unit 2:

Fish and Prawn/ Shrimp Diseases: Types of Diseases- viral, bacterial, fungal, protozoan and other parasitic diseases; Diagnosis; Control measures; Water quality parameters, Role of biopesticides; Application of monoclonal antibodies; Vaccines and immunostimulants; Drug resistance

Unit 3:

Aquafeed: Nutrition, Feed formulation, Feed additives, Alternative feed ingredients. Fish products and byproducts, fish processing, production of fish sauce by lactic acid fermentation. Microbial hazards in seafood.

Unit 4:

Cytogenetics and molecular techniques in fisheries: Comet Assay, Micronuclei Test, Fish Cell Culture, Application of Hybridoma Technology, Transgenesis and Androgenesis and recent developments in marine biotechnology. Inheritance of quantitative traits. Jellyfish Green Fluorescent Proteins and their applications.

Recommended References:

- Jayaram K. C. 1981. The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.
- Jhingran V. G. 1985. Fish and Fisheries of India.
- Kurian, C. V. and Sebastian, V. O. 1986. Prawns and Prawn fisheries of India.
- Jones, F. R. H. 1968. Fish Migration.
- Rao, K. L. 1975. India's water wealth.
- Balakrishnan, N. N. and Thampy, D. M. 1980. A textbook of marine ecology.
- Lakra W. S., Abidi SAH, Mukherjee SC and Ayyappan S. 2004. Fisheries Biotechnology.
- Harvey, B. J. and Hoar, W. S. 1979. Theory and practice of induced breeding in fishes.
- T. V. R. Pillay. 1993. Aquaculture – Principles and Practices. Fishing News Book.

PS03CZOO24: Laboratory I (Practicals based on PS03CZOO21 and PS03CZOO22)

PS03CZOO25: Laboratory II (Practicals based on PS03CZOO23 and PS03EZOO2X)

PS03EZOO21: Molecular Biology

Unit I: DNA structure
DNA structure: Chemistry of DNA, DNA structure, Different conformations of DNA (B, A and Z), Denaturation and Renaturation of DNA.
DNA topology: Supercoiling, Biology of Supercoiled DNA, DNA topoisomerases and their mechanism of action.
DNA- protein interactions: General features, Sequence specific DNA binding protein motifs, ss DNA binding proteins.

Unit II: Organization of genome and its replication
Organization of DNA into chromosomes: Packaging of DNA and organization of chromosome in bacterial cells; Packaging of DNA in eukaryotic nucleosome and chromatin condensation, assembly of nucleosomes upon replication, chromatin modification.
DNA replication: Mechanism of DNA polymerase catalyzed synthesis of DNA, Types of DNA polymerases in bacteria, Initiation of DNA replication and its regulation in prokaryotes, assembly of replisome and progress of replication fork, termination of replication. DNA replication in eukaryotes and archaea. Inhibitors of DNA replication.

Unit III: Gene expression in prokaryotes and eukaryotes
Transcription: RNA polymerases, features of prokaryotic and eukaryotic promoters, assembly of transcription initiation complex in prokaryotes and eukaryotes, and its regulation; synthesis and processing of prokaryotic and eukaryotic transcripts.
Translation: structure and role of t-RNA in protein synthesis, ribosome structure, basic features of genetic code and its deciphering, translation (initiation, elongation and termination in detail in prokaryotes as well as eukaryotes).

Unit IV: Regulation of gene expression
Regulation of gene expression in prokaryotes: Operon concept, positive and negative regulation. Examples of lac, ara, and trp operon regulation; global regulatory responses.
Regulation of gene expression in eukaryotes: Transcriptional, translational and processing level control mechanisms.

References Books:
Genes X: Lewin
Molecular Biology of the Gene: Watson et al
Molecular Genetic of Bacteria: Snyder and Champness
Molecular Biology, 4th Edition: Burton E Tropp
Principles of Genetics: Snustad and Simmons

PS03EZOO22: Omics and Computational Biology

Unit I Genomics and methods in genomics

Introduction to the proteome and the genome, codon bias, gene expression, Genome size-C value paradox, DNA sequencing: Maxam- Gilbert, Sanger, Pyrosequencing, automated DNA sequencing. Other features of nucleic acid sequencing. Analysis and Annotation-ORF
Exon-intron boundaries, DNA Microarray technology:The generation of cDNA expression libraries, their robotic arraying, Complex hybridization on DNA chips.
Transcriptomics: Comparative transcriptomics, Differential gene expression; Genotyping/SNP detection; Detection technology; Computational analysis of microarray data.

Unit II Proteomics and methods in proteomics

Relationship between protein structure and function, Identification and analysis of proteins by 2D analysis; Spot visualization and picking; Tryptic digestion of protein and peptide fingerprinting; Common ionization methods for peptide/protein analysis; Introduction to Mass spectrometers; MALDI-TOF and LCMS analyses
Protein-protein interactions: Solid phase ELISA, pull-down assay (using GST-tagged protein), far western analysis, surface plasmon resonance technique, Yeast two hybrid system, Phage display; Protein interaction maps.
Protein arrays-definition, applications- diagnostics, expression profiling. Uses of automated technologies to generate protein arrays and chips.

Unit III Introduction to computational biology basics and biological databases

Computers in biology, Overview of biological databases, nucleic acid & protein databases, primary, secondary, functional, composite, structural classification database, Sequence formats & storage **Pairwise and multiple sequence alignments:** Local alignment, Global alignment, Scoring matrices - PAM, BLOSUM, Gaps and penalties, Dot plots. Dynamic programming approach: Needleman and Wunsch Algorithm, Smith and Waterman Algorithm, Hidden Markov Model: Viterbi Algorithm. Heuristic approach: BLAST, FASTA. Building Profiles, Profile based functional identification.

Unit IV Genome analysis

Polymorphisms in DNA sequence, Introduction to Next Generation Sequencing technologies, Whole Genome Assembly and challenges, Sequencing and analysis of large genomes, Gene prediction, Functional annotation, Comparative genomics, Probabilistic functional gene networks, Human genome project.**Structure visualization:** Retrieving and drawing structures, Macromolecule viewing platforms, Structure validation and correction, Structure optimization, Analysis of ligand-protein interactions; Tools such as PyMol or VMD.

References:

- Discovering Genomics, Proteomics and Bioinformatics, A,M, Campbell, C,S,H, Press,
- (2003).
- Essential of Genomics and Bioinformatics C,W, Sensen, Wiley (2003).
- Hand book of Comparative Genomics: Principle and Methodology by Cecilia Saccone,
- GrazianoPesole, Wiley-LISS publication (2003).
- Proteomics: From protein sequencing to function by S.R. Pennington and M.J. Dunn,
- Private Ltd (2001).
- Introduction to Proteomics by Daniel C, Liebler, Humana Press.
- Mount, D. W. (2001). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
- Bourne, P. E., & Gu, J. (2009). Structural Bioinformatics. Hoboken, NJ: Wiley-Liss.
- Lesk, A. M. (2004). Introduction to Protein Science: Architecture, Function, and Genomics. Oxford: Oxford University Press.
- Campbell, M &Heyer, L. J. (2006), Discovering Genomics, Proteomics and Bioinformatics, Pearson Education.