



# West Bengal State University

## Revised UG CBCS syllabus for SEM I, III & V 2020-2021

### Zoology Honours

(Credit values given within brackets)

SEM	COURSES					Total credits
	CORE	DSE	GEC	AEC	SEC	
<b>I</b>	ZOOACOR01T (4) ZOOACOR01P (2)  ZOOACOR02T (4) ZOOACOR02P (2)	!	CEMHGEC01T (4) CEMHGEC01P (2) <b>OR</b> GE course offered by any other science department	ENVSAECO1T (2)		<b>20</b>
<b>II</b>	ZOOACOR03T (4) ZOOACOR03P (2)  ZOOACOR04T (4) ZOOACOR04P (2)		CEMHGEC02T (4) CEMHGEC02P (2) <b>OR</b> Any other GEC course offered by any other science department	ENGSaec01T (2)		<b>20</b>
<b>III</b>	ZOOACOR05T (4) ZOOACOR05P (2)  ZOOACOR06T (4) ZOOACOR06P (2)  ZOOACOR07T (4) ZOOACOR07P (2)		BOTHGEC01T (4) BOTHGEC01P (2) <b>OR</b> Any other GEC course offered by any other science department		ZOOSSEC001 (2) <b>OR</b> ANY SEC offered by any other dept.	<b>26</b>
<b>IV</b>	ZOOACOR08T (4) ZOOACOR08P (2)  ZOOACOR09T (4) ZOOACOR09P (2)  ZOOACOR10T (4) ZOOACOR10P (2)		BOTHGEC02T (4) BOTHGEC02P (2) <b>OR</b> Any other GEC course offered by any other science department		ZOOSSEC003 (2) <b>OR</b> ANY SEC offered by any other dept.	<b>26</b>
<b>V</b>	ZOOACOR11T (4) ZOOACOR11P (2)  ZOOACOR12T (4) ZOOACOR12P (2)	ZOOADSE01T (4) ZOOADSE01P (2)  ZOOADSE02T (4) ZOOADSE02P (2)  ZOOADSE03T (4) ZOOADSE03P (2)  (ANY TWO TO BE CREDITED)				<b>24</b>

VI	ZOOACOR13T (4) ZOOACOR13P (2)	ZOOADSE04T (4) ZOOADSE04P (2)				24
	ZOOACOR14T (4) ZOOACOR14P (2)	ZOOADSE05T (4) ZOOADSE05P (2)				
		ZOOADSE06T (4) ZOOADSE06P (2)				
		(ANY TWO TO BE CREDITED)				
	14	4	4	2	2	140

## COURSE DETAILS:

### Cores

In view of the prevailing Covid pandemic situation the syllabus is reduced for the current Semester I, III & V 2020-2021 (strikethrough portions will be omitted till further notice)

### Semester I

#### **ZOOACOR01T (Theory, 4 credits= 60 classes): Non-Chordates I**

##### **Unit 1: Protista, Parazoa and Metazoa**

General characteristics and Classification up to classes

Study of *Euglena*, *Amoeba* and *Paramecium*

Life cycle and pathogenicity of *Giardia intestinalis*, *Leishmania donovani*, *Entamoeba histolytica* and *Plasmodium vivax*

~~Locomotion and Reproduction in Protista~~

~~Evolution of symmetry and segmentation of Metazoa~~

##### **Unit 2: Porifera**

General characteristics and Classification up to classes

Canal system and spicules in sponges

##### **Unit 3: Cnidaria**

General characteristics and Classification up to classes

~~Metagenesis in *Obelia*~~

Polymorphism in Cnidaria

Corals and coral reefs: types, formation, distribution, conservation significance

##### **Unit 4: Ctenophora**

General characteristics

## Unit 5: Platyhelminthes

General characteristics and Classification up to classes

Life cycle and pathogenicity of *Fasciola hepatica* and *Taenia solium*

## Unit 6: Nematelminthes

General characteristics and Classification up to classes

Life cycle, and pathogenicity of *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Wuchereria bancrofti*

Parasitic adaptations in helminths

Origin and evolution of parasitic helminths

## ZOOACOR01P (Practicals, 2 credits=30 classes): Non-Chordates I Lab

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramoecium*, Binary fission and Conjugation in *Paramoecium*

~~2. Examination of freshwater pond water collected from different places for diversity of protists in it.~~

3. Study of Sycon (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla* (Slides/photographs)

4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*, *Meandrina*, *Madrepora* (Slides/photographs)

5. One specimen/slide of any Ctenophore

6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/microphotographs)

7. Study of adult *Ascaris lumbricoides* and its life stages (Slides/micro-photographs)

~~8. To submit a Project Report on any related topic on pond water protozoan or invertebrate diversity/ life cycles of mosquitoes, butterfly/moth etc /coral and coral reefs.~~

### Note:

1. Only conspicuous characters required to identify the organism to be noted along with the known systematic positions of it (for Protozoans up to Phylum and others up to Class)
2. It is wise to study the coloured photographs of the organisms suggested for the study as available from internet sources along with the preserved specimens, if are there, or otherwise.

### Text Book:

- Biology of the Invertebrates by Jan A Pechenik
- Invertebrates by Brusca and Brusca 2<sup>nd</sup> Ed

### References:

- An introduction to Invertebrates by Janet Moore 2<sup>nd</sup> ed.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
- Bose, Mala. Parasitoses and Zoonoses, New Central Book Agency , 2017.
- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

- Students are encouraged to explore authentic websites (for e.g. wikipedia, different university websites, OCWs) at internet for reading / audio-visual materials on a particular topic if they don't find enough in the text books)

## **ZOOACOR02T (Theory, 4 credits= 60 classes): Ecology**

### **Unit 1: Introduction to Ecology**

History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.

### **Unit 2: Population**

Unitary and Modular populations

Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion.

Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors

Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition.

### **Unit 3: Community**

Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification, Ecotone and edge effect. Ecological succession and example of it.

### **Unit 4: Ecosystem**

Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with an example of Nitrogen cycle Human modified ecosystem

### **Unit 5: Applied Ecology**

Wildlife Conservation (in-situ and ex-situ conservation).

Management strategies for tiger conservation; Wild life protection act (1972)

## **ZOOACOR02P (Practicals, 2 credits = 30 classes): Ecology Lab**

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/data provided
2. Determination of population density of a natural/hypothetical population. Study of species diversity of a community by quadrat or any other suitable sampling method and calculation of Shannon-Weiner diversity index for the same community.
3. Study of an aquatic ecosystem: Sampling of Phytoplankton and zooplankton, Measurements of temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO<sub>2</sub>.
4. Excursion: Visit to a National Park/Wild life sanctuary/ any other Protected Forests within West Bengal. Report (including the actual field diary) on the study of the landscape and habitat features, Types of Forests, Major Flora and Fauna, Man-animal conflicts and other problems, Management and conservation measures.

### **Text book:**

1. Ecology: Theories and Applications by Peter Stiling; Pearson 4<sup>th</sup> Ed. 2001.

2. Ecology: The Experimental Analysis of Distribution and Abundance (Indian Paperback edition) by Charles Krebs
3. for Unit 5, also read Conservation Biology: A Primer for South Asia by Kamaljit S. Bawa, Meera Anna Oommen, and Richard B. Primack, University Press, India)

#### References:

- A Primer of Ecology by Gotelli; 3<sup>rd</sup> Ed. Sinauer Associates. 2000.
- Students are encouraged to explore authentic websites (for e.g. different university websites and OCWs) at internet, wikipedia for reading / audio-visual materials on a particular topic if they don't find enough in the text books or otherwise)

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## Semester III

### **ZOOACOR05T (Theory, 4 credits= 60 classes): Chordates**

#### **Unit 1: Introduction to Chordates**

General characteristics and outline classification of Phylum Chordata

#### **Unit 2: Protochordata**

General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes. Metamorphosis in Ascidia

Chordate Features and Feeding in Branchiostoma

#### **Unit 3: Origin of Chordata**

Dipleurula concept and the Echinoderm theory of origin of chordates

Advanced features of vertebrates over Protochordata

#### **Unit 4: Agnatha**

General characteristics and classification of cyclostomes up to order

#### **Unit 5: Pisces**

General characteristics and classification of Chondrichthyes and Osteichthyes up to Subclasses Accessory respiratory organ, migration and parental care in fishes Swim bladder in fishes. Classification up to Sub-Classes

#### **Unit 6: Amphibia**

General characteristics and classification up to living Orders  
Metamorphosis and parental care in Amphibia

#### **Unit 7: Reptilia**

General characteristics and classification up to living Orders  
Poison apparatus and Biting mechanism in Snake

#### **Unit 8: Aves**

General characteristics and classification up to Sub-Classes  
Exoskeleton and migration in Birds  
Principles and aerodynamics of flight

#### **Unit 9: Mammals**

General characters and classification up to living orders  
Phylogenetic significance of Prototheria

## Exoskeleton derivatives of mammals

Adaptive radiation in mammals with reference to locomotory appendages

Echolocation in Microchiropterans and Cetaceans

## Unit 10: Zoogeography

Zoogeographical realms,

Plate tectonic and Continental drift theory,

Distribution of birds and mammals in different realms

**Note:** Classification schemes are to be followed as given in Kardong, 2004. All groups are to be studied up to order, except for Mammals up to class.

## ZOACOR05P (Practicals, 2 credits= 30 classes): Chordates Lab

Lab/field study of –(Slides/photographs)

### 1. Protochordata

*Herdmania, Branchiostoma,*

Colonial Urochordates; Sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions, *Herdmania* spicules

### 2. Agnatha

*Petromyzon, Myxine*

### 3. Fishes

*Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeuis, Anguilla, Hippocampus, Tetraodon, Anabas, Flat fish*

### 4. Amphibia

*Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra*

### 5. Reptilia

*Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus* Key for Identification of poisonous and non-poisonous snakes

### 6. Aves

Study of six common birds from different orders (Stork, Owl/Falcon, Sun Bird, Jacanna, Duck)- types of beaks and claws.

### 7. Mammalia

*Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus.*

### 8. Mount of weberian ossicles of *Mystus* or *Grass Carp,*

*Pecten from Fowl head, Dissection of Fowl head (Dissections and mounts subject to permission)*

*Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)*

### Note:

1. Only conspicuous characters required to identify the animal are to be noted. Along with it, the systematic positions of the animal mentioned (up to Class) and a short note on its habits and habitat are to be noted.
2. It is wise to study the coloured photographs of the whole animal and/or its parts mentioned above for the study, as available from internet sources along with the preserved specimens (if, they are already in the museum). New collection/purchase of animals or their body parts, especially for those which are protected by conservation laws are to be avoided. Dissections of animals other than common pests are discouraged.

### Text Book:

- Kardong, K. V. (2002). *Vertebrates: Comparative anatomy, function evolution*. McGraw Hill 4<sup>th</sup> Ed. 2005.
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.

- Pough H. Vertebrate life, VIII Edition, Pearson International.

### References:

- Students are encouraged to explore authentic websites (for e.g. wikipedia, different university websites and OCWs) at internet for reading / audio-visual materials on a particular topic if they don't find enough in the text books or otherwise)
- Comparative Anatomy of the Vertebrates 9<sup>th</sup> Ed (2015) by Kent; McGrew-Hill
- Elements of Chordate Anatomy by Weichert and Presch, 2017, Amazon.in

## **ZOOACOR06T (Theory, 4 credits= 60 classes): Physiology: Controlling and Coordinating Systems**

### **Unit 1: Tissues**

Structure, locations, classification and functions of epithelial tissues, connective tissues, muscular tissues and nerve tissues

### **Unit 2: Bone and Cartilage**

Structure and types of bones and cartilages, **Ossification**

### **Unit 3: Nervous System**

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and Neuromuscular junction; **Reflex action and its types**

### **Unit 4: Muscular system**

Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; **Characteristics of muscle fiber**

### **Unit 5: Reproductive System**

Histology of testis and ovary; Physiology of Reproduction

### **Unit 6: Endocrine System**

Histology and function of pituitary, **thyroid**, pancreas and **adrenal**; Classification of hormones; Mechanism of Hormone action; Signal transduction pathways for Steroidal and Non steroidal hormones; Hypothalamus (neuroendocrine gland) - **principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones**

## **ZOOACOR06P (Practicals, 2 credits= 30 classes): Physiology: Controlling and Coordinating Systems) Lab**

1. Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. **Preparation of temporary mounts: Squamous epithelium, Striated muscle fibers and nerve cells**
3. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid (Slides/microphotographs)
4. **Microtomy: Preparation of permanent slide of any five (lung, salivary gland, stomach, small intestine, large intestine only) mammalian (white rat) tissues**

### **Text Book:**

1. Campbell's Biology, 11th Edition by Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, Published by Pearson Copyright © 2017.
2. Sembulingam K, Sembulingam P. 2012. Essentials of Medical Physiology. 6th Edn. Jaypee.

Or

Ganong's Review of Medical Physiology by Barret; 25<sup>th</sup> Ed, McGraw-Hill, 2016

### Reference Books

1. Cormack DH. 2003. PDQ Histology. B.C. Decker Ins., London.
2. Gunasegaran JP. 2010. A Text book of Histology and a Practical Guide. Elsevier
3. Junquera LC, Carneiro J. 2005. Basic histology text and atlas.
4. Randall D , Burggren W. 2001. Eckert Animal Physiology by. 4th edition. W. H. Freeman.
5. Ross MH, Pawlina W. 2010. Histology: A Text and Atlas. Sixth Edition. Lippincott Williams & Wilkins.
6. Eroschenko VP. 2008. diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott & Wilkins.

## ZOOACOR07T (Theory, 4 credits= 60 classes): Biochemistry

### Unit 1: Fundamentals of biochemical reactions and metabolism

Ionization of water, weak acids and bases, buffering and pH changes in living systems

Metabolism: Catabolism and Anabolism, ~~Compartmentalization of metabolic pathways~~, Shuttle systems and membrane transporters; ~~ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms~~

### Unit 2: Carbohydrates

Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosachharides

Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis

### Unit 3: Lipids

~~Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids.~~

Lipid metabolism:  $\beta$ -oxidation of fatty acids; Fatty acid biosynthesis

### Unit 4: Proteins

Amino acids Structure, Classification, ~~General and Electro-chemical properties of  $\alpha$  amino acids; Physiological importance of essential and non-essential amino acids~~

Proteins Bonds stabilizing protein structure; Levels of organization

Protein metabolism: Transamination, Deamination, Urea cycle, ~~Fate of C-skeleton of Glucogenic and Ketogenic amino acids~~

### Unit 5: Nucleic Acids

Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids

Types of DNA and RNA, Complementarity of DNA, ~~Hypo-Hyperchromaticity of DNA~~  
~~Outlines of nucleotide metabolism~~

### Unit 6: Enzymes

~~Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes;~~

Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions;

Enzyme inhibition; Allosteric enzymes and their kinetics; ~~Strategy of enzyme action-Catalytic and Regulatory (Basic concept with one example each)~~

### Unit 7: Oxidative Phosphorylation

Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System



## **ZOOACOR07P (Practicals, 2 credits= 30 classes): Biochemistry Lab**

(Demonstration/ppt. presentation)

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Quantitative estimation by Lowry Method
4. Demonstration of proteins separation by SDS-PAGE
5. Study of the enzymatic activity of Trypsin and Lipase.
6. Performing the Acid and Alkaline phosphatase assay from serum/ tissue (Theory)

### **Text Book**

1. Campbell's Biology, 11th Edition by Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, Published by Pearson Copyright © 2017.
2. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.

### **References:**

1. Principles of Biochemistry by Voet, Pratt and Voet; Wiley International Student Ed. 2012
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
4. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

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## **Semester V**

## **ZOOACOR11T (Theory, 4 credits= 60 classes): Molecular Biology**

### **Unit 1: Nucleic Acids**

Salient features of DNA and RNA Watson and Crick Model of DNA

### **Unit 2: DNA Replication**

Mechanism of DNA Replication in Prokaryotes, Semi-conservative, bidirectional and discontinuous Replication, RNA priming, Replication of telomeres

### **Unit 3: Transcription**

Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.

### **Unit 4: Translation**

Mechanism of protein synthesis in prokaryotes, Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation

## **Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA**

Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

## **Unit 6: Gene Regulation**

Regulation of Transcription in prokaryotes: lac operon and trp operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing, Genetic imprinting

## **Unit 7: DNA Repair Mechanisms**

Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair

## **Unit 8: Molecular Lab Techniques**

PCR, Western and Southern blot, Northern Blot, Sanger DNA sequencing, cDNA technology

## **ZOOACOR11P (Practicals, 2 credits= 30 classes): Molecular Biology Lab**

### **List of Practical**

1. Demonstration of polytene Chromosome from Drosophila /Chironomid larvae
2. Isolation and quantification of genomic DNA using spectrophotometer (A260 measurement)
3. Demonstration of Agarose gel electrophoresis for DNA

### **Text Book:**

1. Campbell's Biology, 11th Edition by Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, Published by Pearson Copyright © 2017.
2. Molecular Biology of The Gene by Watson. 7th Edition. Pearson.

### **References:**

- Molecular Cell Biology by Harvey Lodish. 7th Edition. W.H. Freeman.
- iGenetics: A Molecular Approach by Peter. J. Russell. 3rd edition. Pearson Benjamin Cummings.
- Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker, Cambridge Univ. Press, Paperback

## **ZOOACOR12T (Theory, 4 credits= 60 classes): Genetics**

### **Unit 1: Mendelian Genetics and its Extension**

Background of Mendel's experiments

Principles of Mendelian inheritance,

Incomplete dominance and co-dominance, Epistasis, Multiple alleles, Lethal alleles,

Pleiotropy, Sex-linked, sex- influenced and sex-limited inheritance, Polygenic Inheritance.

### **Unit 2: Linkage, Crossing Over and Chromosomal Mapping**

Linkage and Crossing Over, molecular basis of crossing over, Measuring Recombination frequency and linkage intensity using three factor crosses, Interference and coincidence

### Unit 3: Mutations

1. Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example of each), Chromosomal aberrations, gene mutations and human diseases (Down's, Klienfelter's, Turner's, ~~Cri du Chat, Sickle cell, Haemophilia, Thallassimia, Albinism~~ only genetical aspects here, details of physiological consequences not required), Sex chromosomes and sex-linked inheritance

~~2. Non-disjunction and variation in chromosome number; Molecular basis of mutations in relation to UV light and chemical mutagens~~

### Unit 4: Sex Determination

Mechanisms of sex determination in Drosophila with reference to alternative splicing

Sex determination in mammals

~~Dosage compensation in Drosophila & Human~~

### Unit 5: ~~Extra-chromosomal Inheritance~~

~~Criteria for extra chromosomal inheritance, Antibiotic resistance in Chlamyadomonas, Kappa partiele in Paramoecium Shell spiralling in snail~~

### Unit 6: Recombination in Bacteria and Viruses

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

### Unit 7: Transposable Genetic Elements

Transposons in bacteria,

Ac-Ds elements in maize and P elements in Drosophila,

LINE, SINE, Alu elements in humans

## **ZOOACOR12P (Practicals, 2 credits= 30 classes): Genetics Lab**

### List of Practical

1. Chi-square analyses

Statistical tests of data and decision making

Chi square test for goodness of fit and student t test for comparing means of two small samples from normal populations (paired/unpaired)

2. Pedigree analysis of some inherited traits in human

~~3. Identification of chromosomal aberration in Drosophila from photographs~~

### Text Book

1. Campbell's Biology, 11th Edition by Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, Published by Pearson Copyright © 2017.

2. Principles of Genetics by Robert Tamarin; McGraw Hill, 7<sup>th</sup> Ed. 2017

Or

Principles of Genetics by Snustad, D.P., Simmons, M.J. (2009). 5<sup>th</sup> Ed. John Wiley and Sons Inc



## **ZOADSE01P (Practical, 2 Credits=30 Classes): Animal Behaviour and Chronobiology Lab**

**List of Practical (any four) [Either by Demonstration/slides/photographs, ppt. presentation where applicable]**

1. To study nests (non-invasively) and nesting habits of the birds and social insects (e.g. Social Wasps).
2. To study the behavioural responses of rice weevil /wood lice to dry and humid conditions.
3. To study geotaxis behaviour in earthworms.
4. To study the phototaxis behaviour in insects/defensive behaviour in mosquito larvae.
5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park (within West Bengal) to study behavioural activities of animals and prepare a short report.
6. Study and actogram construction of locomotor activity of suitable animal models.
7. Study of circadian functions in humans (daily eating, sleep and temperature patterns).

### **Text Book:**

1. Animal Behaviour: Mechanisms. Ecology. Evolution by Drickamar, Vessey, 5<sup>th</sup> Ed. Jakob; McGraw Hill.
2. Survival Strategies by Raghavendra Gadagkar, University Press

### **Reference:**

- An Introduction to Animal Behaviour by Manning and Dawkins; 5<sup>th</sup> Ed. Cambridge Univ. Press
- Measuring Behaviour: An Introductory Guide by Martin and Bateson; 3<sup>rd</sup> Ed. Cambridge Univ. Press
- Introduction to Behavioural Ecology by Krebs and Davies; Wiley-Blackwell

## **ZOOADSE02T (Theory 4 Credits = 60 classes): Entomology (Insects and their Biology)**

### **Unit 1: Introduction**

General Features of Insects

~~Distribution and Success of Insects on the Earth~~

### **Unit 2: Insect Diversity and Classifications**

Classifications of Arthropods with special reference to Insects (Insects are to be classified up to order ~~with estimated species richness of the orders globally, in India and in West Bengal.~~

~~Conspicuous/important families/Genera/species of each order have to be noted with their peculiar habits and habitats)~~

### **Unit 3: General Morphology of Insects (brief outlines)**

External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Thorax: Wings and wing types, ~~Types of Legs adapted to diverse habitats, Peculiar Abdominal appendages and genitalia-~~ only brief introduction.

### **Unit 4: Physiology of Insects**

Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system (brief outlines only)

~~Photoreceptors: Types, Structure and Function (brief introductions)~~

Metamorphosis: Types and Neuroendocrine control of metamorphosis (introductory)

### **Unit 5: Insect Society**

~~Social insects: different types of social insects with brief outlines of their social systems~~

~~Trophallaxis in social insects such as ants, termites and bees~~

### **Unit 6: Insect Plant Interaction**

Outline of the concept of co-evolution, role of allo-chemicals in host plant mediation, Host-plant selection by phytophagous insects; Major insect pests in paddy (brief introductions)

### **Unit 7: Insects as Vectors**

Insects as mechanical and biological vectors, Brief discussion on houseflies and mosquitoes as important vectors

## **ZOOADSE02P (Practical, 2 Credit=30 Classes): Biology of Insects Lab**

List of Practical **(Any four)** [either by Demonstration/slides/photographs, ppt. presentation where applicable]

1. Study of life cycle of Mosquito
2. Study of different kinds of antennae, legs and mouth parts of insects (any three variants of each)
3. Mounting of insect wings, spiracles and genitalia of any insect
4. Methodology of collection, preservation and identification of insects.
5. Morphological studies of various castes of *Apis*, *Camponotus*, any Termite (*e.g, Odontotermes*) 1

6. Study of major insect pests of paddy and their damages
7. Study of Mulberry silk moth as beneficial insect

#### Text Book:

1. The Insects: Structure and function, Chapman, R. F., Cambridge University Press,
2. A general text book of entomology, Imms, A. D., Chapman & Hall,

#### References

- Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
- Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F., M Saunders College Publication, USA
- The Insect Societies, Wilson, E. O., Harvard Univ. Press, UK
- Host Selection by Phytophagous insects, Bernays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA
- Physiological system in Insects, Klowden, M. J., Academic Press, USA
- Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA
- Medical Entomology, Hati A. K., Allied Book Agency, 2010

### ZOADSE03T (Theory, 4 Credit=60 Classes): Endocrinology

#### Unit 1: Introduction to Endocrinology

General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormones

#### Unit 2: Epiphysis, Hypothalamo-hypophysial Axis

Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction; Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms; Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophysial portal system, Disorders of pituitary gland.

#### Unit 3: Peripheral Endocrine Glands

Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis; Hormones in homeostasis, Disorders of endocrine glands

#### Unit 4: Regulation of Hormone Action

Mechanism of action of steroidal, non-steroidal hormones with receptors Bioassays of hormones using RIA & ELISA; Estrous cycle in rat and menstrual cycle in human; Multifaceted role of Vasopressin & Oxytocin; Hormonal regulation of parturition

### ZOADSE03P (Practical, 2 Credit=30 Classes): Endocrinology Lab

List of Practical (any 3) [Either by Demonstration/slides/photographs/ppt presentation, where applicable]

1. Dissect and display of Endocrine glands in rat.
2. Study of the permanent slides of all the endocrine glands (Slides/microphotographs)
3. Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland
4. Estimation of plasma level of any hormone using ELISA
5. Designing of primers of any hormone

#### Text Book:

1. Hall JE. 2015. Guyton and Hall Textbook of Medical Physiology. 13th Edition. Saunders publication.
2. Ross MH, Pawlina W. 2010. Histology: A Text and Atlas. Sixth Edition. Lippincott Williams and Wilkins.

3. Norris DO, Carr JA. 2013. Vertebrate Endocrinology. 5 editions Academic Press;

**References:**

4. Fox T, Brooks A, Baidya B. 2015. Endocrinology. JP Medical, London.
5. Gardner DG, Shoback D. 2011. Greenspan's Basic and Clinical Endocrinology. 9<sup>th</sup> Edn. McGraw Hill Lange.
6. Goodman HM. 2000. Basic Medical Endocrinology. 4th Edn. Academic Press.
7. Jameson JL. 2010. Harrison's Endocrinology. 2nd Edn. McGraw Hill.
8. Melmed S, Conn PM. 2005. Endocrinology: Basic and Clinical Principles. 2nd Edn. Humana Press.
9. Melmed S, Polonsky K, Larsen PR, Kronenberg H. 2016. William's Text Book of Endocrinology. 13<sup>th</sup> Edn. Elsevier.
10. Molina PE. 2013. Endocrine Physiology. 4th Edn. McGraw Hill Lange.
11. Neal JM. 2000. Basic Endocrinology; An Interactive Approach. Blackwell Science.
12. Norris DO. 2007. Vertebrate Endocrinology. 4th Edn. Elsevier Academic Press.
13. Strauss JF, Barbieri RL. 2014. Yen & Jaffe's Reproductive Endocrinology. Elsevier Saunders

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