



**YBN UNIVERSITY**

Established by the Act of Government of Jharkhand Act 15, 2017  
Gazette Notification No. 505, Dated 17th July 2017  
As per Section 2(f) of UGC Act. 1956

**DEPARTMENT OF ZOOLOGY**

**COURSE-STRUCTURE**

**For**

**Two Years Master Course**

**ZOOLOGY**

**(To be implemented from the Academic Year 2020 onwards)**

**CHOICE BASED CREDIT SYSTEM**



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**COURSE-STRUCTURE FOR TWO YEARS**  
**MASTER DEGREE IN ZOOLOGY**

COURSE STRUCTURE OF M.Sc. ZOOLOGY FIRST SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subjectwise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y2 ZOO1 01	Foundation Course (Compulsory)	Animal systematics & Evolutionary Mechanism	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO1 02	Core Course-I	Invertebrate Diversity & Quantitative Biology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 103	Core Course-II	Methods in Biology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 104P	Core Course-III Practical 1	Practical of FC, CC-01 and CC-02	100	50	17	20	07	30	10	-	-	10	5
	Grand Total		400										20

**Minimum Passing Marks are equivalent to Grade D**

**Lectures T- Tutorials P- Practical, Major- Term End Theory Exam**

**Minor- Pre University Test**

**Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%**

COURSE STRUCTURE OF M.Sc. ZOOLOGY SECOND SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
1Y2 ZOO 201	Elective Course -I	Cellular Organization and fundamental processes	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 202	Core Course -IV	Vertebrate Diversity & Ethology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 203	Core Course -V	System physiology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO204 P	Core Course VI-Practical	Practical of EC-I, CC-IV and CC-V	100	50	17	20	07	30	10	-	-	10	5
	Grand Total		400										20

**Minimum Passing Marks are equivalent to Grade D**

**Lectures T- Tutorials P- Practical, Major- Term End Theory Exam**

**Minor- Pre University Test**

**Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%**

COURSE STRUCTURE OF M.Sc. ZOOLOGY THIRD SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subjectwise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y2 ZOO3 01	Core Course-VII	Comparative and molecular endocrinology & Developmental Biology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO3 02	Core Course-VIII	Biochemistry and Immunology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO3 03	Elective Course-II	Fish and Fisheries	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 304P	Core Course IX-Practical	Practical of CCVII, CCVIII and EC-II	100	50	17	20	07	30	10	-	-	10	5
	Grand Total		400										20

**Minimum Passing Marks are equivalent to Grade D**

**Lectures T- Tutorials P- Practical, Major- Term End Theory Exam**

**Minor- Pre University Test**

**Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%**

COURSE STRUCTURE OF M.Sc. ZOOLOGY FOURTH SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subjectwise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y2 ZOO 401	Core Course-IX	Applied Biology	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 402	Elective Course-III	Elective Course-III (Entomology)	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 403	Elective Course-IV Practical	Elective Course-IV Practical	100	50	17	20	07	30	10	5	1	-	5
1Y2 ZOO 404P	Project	Dissertation / Project	100	-	-	-	-	-	-	-	-	10	5
	Grand Total		400										20

**Minimum Passing Marks are equivalent to Grade D**

**Lectures T- Tutorials P- Practical, Major- Term End Theory Exam**

**Minor- Pre University Test**

**Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%**

**M.SC ZOOLOGY HONS. FIRST SEMESTER**

**COURSE TYPE – FOUNDATION COURSE (COMPULSORY)**

**ANIMAL SYMTEMATICE & EVOLUTIONARY MECHANISM**

**COURSE CODE: 1Y2ZOO101**

**Group A:**

**CREDITS (5)**

**Animal systematics**

- Different types of Classification: (Numerical / Phenetic, Cladistic, Evolutionary Systematics (Phylogenetic))
- Concept of Cytotaxonomy,
- Chemical and Molecular Taxonomy;
- Operative principles of nomenclature,
- Application of important rules, IUZN
- Concepts of species

**Group B:**

Evolution mechanisms Concept of Evolution, Evolutionary time scale; Synthetic theory of Evolution, Population, Gene frequency, Hardy Weinberg's law; concepts and rate of change In gene frequency through natural selection, migration and genetic drift. Adaptive radiation, Isolating mechanisms, speciation, Co Evolution. Molecular tools in taxonomy.

**Recommended Books:**

1. Pechenik J.A. – **Biology of Invertebrates. 4th edn. Tata McGraw-Hill 2002**
2. Riddle M. – **Evolution. 2nd edn. Blackwell 1996**
3. Piyanka E.R. - **Evolutionary Ecology 5th edn Harper Collins 1994**

**CORE COURSE – I INVERTEBRATE DIVERSITY & QUANTITATIVE  
BIOLOGY**

**COURSE CODE: 1YZOO102**

**Group: A**

**CREDITS (5)**

Invertebrate Diversity  
Protostomates and Deuterostomate groups  
Origin of coelom – Acoela, Pseudocoela, Schizocoela and Enterocoela.  
Locomotion: Protozoa, Echinodermata  
Osmoregulation in Protozoa  
Excretion: Annelida, Arthropoda respiration: Arthropods, Mollusca  
Concept of Host specificity and Host parasite relationship

**Group: B**

Quantitative Biology Measures of central tendency and dispersal;  
Probability distributions (Binomial, Poisson and normal); Sampling  
Distribution; Difference between parametric and non-parametric Statistics; Confidence Interval;  
Errors; Levels of significance; Regression and Correlation;  
T-test; Analysis of variance; X<sup>2</sup> test, Basic introduction to Multivariate statistics.

**Recommended Books:**

1. Barrington E.J.W. – Invertebrate structure and function. 2nd edn. ELBS/Nelson 1973
2. Meglitsch P.A. & Schram F.R – Invertebrate Zoology. 3rd edn. Oxford univ press 1991
3. Ruppert E.E. & Barnes, R.D.- Invertebrate Zoology. 6th edn. Harcourt Asia 1994
4. Zar J.H. – Biostatistical Analysis. 4th edn. Pearson 2005
5. Khan I.A. & Khanum A. – Fundamentals of Biostatistics 2nd edn. Ukaaz Publ. 2007
6. Pagano M. & Gauvreau K. – Principles of Biostatistics. 2nd edn. Thomson 2007

## **CORE COURSE –II METHODS IN BIOLOGY**

### **COURSE CODE: 1Y2ZOO103**

#### **Group: A**

**CREDITS (5)**

#### Spectroscopy & Spectrometry

Spectroscopy & spectrometry – ESR, Molecular structure determination using X-ray diffraction and NMR , Molecular analysis using light scattering, Microscopy - Resolving powers of different microscopes, scanning and transmission Electron Microscopes, different fixation and staining techniques for EM, freeze-etch and freeze fracture methods for EM, image processing methods in microscopy.

#### **Group: B**

#### Histochemical, Immunotechniques and electrophysiological techniques

Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, In situ localization by techniques: FISH. Electrophysiological methods:-Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.

#### **Recommended Books:**

1. Skoog D.A., Holler F.J. & Crouch S.R. – Principle of Instrumental Analysis. 6th edn. Thomson 2007
2. Narayanan P.- Essentials of Biophysics. New Age 2000
3. Tembhare D.B. – Techniques in Life Science. Himalaya 2008
4. Willard H.H., Merritt Jr. L.L., Dean J.A. & Settle Jr. F.A. – Instrumental Methods of Analysis. 6th edn. CBS 1986
5. Pearse A.G.E.- Histochemistry - Theoretical and Applied. vols I-III Churchill
6. Wilson K. & Walker J. - Principles of Biochemistry and Molecular Biology. 6th edn. Cambridge Univ. Press 2007



## CORE COURSE –III PRACTICAL OF FC, CC-01 AND CC-02

### COURSE CODE: 1Y2ZOO104P

CREDITS (5)

ITEMS	MARKS DISTRIBUTION
• Anatomical observation (Dissection)	25
• Preparation of Buffer solution for electrophoresis/DNA quantification, Paper chromatography,	10
• Study of olfactory response in native <i>Drosophila</i> sp.	10
• Spotting 6 spots (Instruments/ slides/ specimens) [6x5=30]	30
• Records and Sessional work	10
• Viva- voce	15

#### List of Practical

Invertebrate Diversity General Anatomy of: (Dissection) Leech/ Prawn / Squilla/ Aquatic Beetle/Pila

Museum specimens: Important representatives of different invertebrate phyla showing peculiarities/ adaptive features/ association/stages Specimen of connecting links and living fossils – limulus, peripatus Specimens showing mimicry and melanism; Slides of larval stages showing recapitulation of ontogeny (Helminthes, Crustacean) Preparation of taxonomic key upto order of the following Coelenterata – Hydra, Obelia (medusa and polyp), Physalia, Gorgonia, Aurelia, Metridium

Rotifera – Brachionus

Annelida –Neries and Heteronereis, Arenicola, Chaetopetrus, Hirudo Arthropods –Crab, Prawn, Lepus, Balanus, Butterfly, Study of *Drosophila* mutants, Water beetle, Cyclops Mollusca - Chiton, Pila, Unio, loligo, Sepia, Octopus, Aplysia, Dentalium Echinodermata – Asteria, Echinus, Antedon, Cucumaria, Holothuria Study of the following using permanent slides Trematode, Cestode,

Bio techniques

Use of Ph meter, water bath, autoclave, balance, centrifuge, colorimeter, spectrophotometer Measurement, photography through microscope Chromatographic separation of proteins (Paper) Separation of amino acids, Quantitative assessment of DNA and its separation by Agarose Gel electrophoresis.

Quantitative assessment of Glucose in a test solution by spectrophotometer/ Demonstration of P.C.R. Technique Histology and Histochemistry Preparation of fixatives for histological and different histochemical staining Paraffin sectioning Fixation of tissue Dehydration, clearing and embedding; Trimming and sectioning of paraffin blicks, Stretching and spreading of sections on slides

## **M.SC ZOOLOGY HONS. SECOND SEMESTER**

### **COURSE TYPE –ELECTIVE COURSE-I**

### **CELLULAR ORGANIZATION AND FUNDAMENTAL PROCESSES**

#### **COURSE CODE: 1Y2ZOO201**

#### **Group A:**

**CREDITS (5)**

Membrane structure and function: (Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes).

Structural organization: structure & function of cytoskeleton and its role in motility Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, and regulation of signaling pathways, Regulation of cell Cycle. Cellular communication: general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrin, neurotransmission and its regulation.

#### **Group B:**

#### **FUNDAMENTAL PROCESSES:**

DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, DNA damage and repair mechanisms, homologous and site-specific recombination). RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport); non coding long RNA. Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Posttranslational modification of proteins). Control of gene expression at transcription and translation level (prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

#### **Recommended Books:**

1. Lodish H., Berk A., Matsudaira P. Kaiser C.A. , Krieger M., Scott M.P., Zipurky S.L., & Darnell J. – Molecular Cell Biology. 5th edn. W.H. Freeman 2004 12
2. Cooper G.M. – The Cell: A molecular approach. Asm Press 1997
3. Freifelder D. & Malacinski G.M. – Essentials of Molecular Biology 2nd edn. Panima 1993
4. Alberts B., Johnson A., Lewis J., Raff M., Roberts K. – Molecular Biology of the Cell. 4th edn. Garland Science 2002

## **CORE COURSE – IV VERTEBRATE DIVERSITY & ETHLOGY**

### **COURSE CODE: 1Y2ZOO202**

#### **Group A: Vertebrate Diversity**

**CREDITS (5)**

Fish – Air breathing organs, Lateral Line system Amphibia – Origin of Amphibia, Metamorphosis and its neuroendocrine regulation. Reptiles – Extinct Reptiles and cause of extinction. Sphenodon: Anatomical features, affinity, evolutionary significance Birds- Common Indian birds, Nest building, Migration Mammals- Common Indian Mammals, Prototheria, Marsupials, Dentition.

#### **Group B: Ethology**

Approaches and methods in study of behavior; Proximate and ultimate causation; Neural basis of learning, memory, cognition, sleep and arousal; Biological clocks; Development of behavior; Social communication; Social dominance; Use of space and territoriality; Mating systems, Parental investment and Reproductive success; Parental care; Aggressive behavior; Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioral changes.

#### **Recommended Books:**

1. Pough F.H., Janis C.M. & Heiser J.B. – Vertebrate Life. 6th edn. Pearson 2003
2. Young J.Z. – Life of Vertebrates. 3rd edn. Oxford 1982
3. Hildebrand M. – Analysis of Vertebrate Structure. John Wiley 1974.
4. Manning A. & Dawkins M.S. – An Introduction to Animal Behaviour. Cambridge 1995
5. Prasad S. – Animal Behaviour. CBS 2004
6. Mathur R. – Animal Behaviour. Rastogi 2002

## **CORE COURSE – V SYSTEM PHYSIOLOGY**

### **COURSE CODE: 1Y2ZOO203**

#### **Group A:**

**CREDITS (5)**

Blood and circulation - haemopoiesis and formed elements, blood volume, blood volume regulation, haemoglobin, haemostasis. Cardiovascular System: myogenic heart, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above. Respiratory system - transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration. Nervous system - action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Sense organs - Vision, hearing and Taste.

#### **Group B:**

Excretory system -urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, electrolyte balance, acid-base balance. Thermoregulation - Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization. Reproductive system- Sperm maturation in male reproductive tract and the role of testicular hormones in eutherian mammals Ovarian and uterine cycles and their hormonal control

#### **Recommended Books:**

1. Guyton A.C. & Hall J.E. – Text Book of Medical Physiology. 9th edn. Saunders 1996.
2. Talwar G.P. & Srivastava L.M. (edt.) – Text Book of Biochemistry and Human Biology. 3rd edn. Prentice Hall India 2003.
3. Sherwood L., Kalandorf H. & Yancey P.H. - Animal Physiology from Genes to Organisms. Thomson 2005
4. Schmidt- Nelson K. - Animal Physiology Adaptation and Environment. 5th edn. Cambridge Univ. Press 1998
5. Hoar W.S. - General Comparative Physiology. 3rd edn. Prentice Hall India 1983.

**CORE COURSE -VI PRACTICAL OF EC-I, CC-IV AND CC-V**

**COURSE CODE: 1Y2ZOO204P**

	<b>CREDITS (5)</b>
<b>ITEMS DISTRIBUTION</b>	<b>MARKS</b>
<b>Anatomical observation (Dissection)</b>	<b>25</b>
<b>Physiology experiments – 1</b>	<b>20</b>
<b>Colorimetric estimation [Protein/ Glucose/ Measurement of blood pressure. Spotting (Bone/ Instrument and Models) (6x5=30)</b>	<b>30</b>
<b>Records and Sessional work</b>	<b>10</b>
<b>Viva - voce</b>	<b>15</b>

**List of Practical**

**Vertebrate diversity**

Anatomical observation of: (Dissection) General Anatomy of any bony fish Accessory respiratory organs in fish – Channa/Heteropneustes/Clarias, Anabus Cranial nerves and blood vessels in Labeo / Wallago

**Museum studies**

Models/Photographs – Latimeria, Sphenodon, different types of beaks and feet in birds, nest of birds,; Specimens – Petromyzon, Myxine, Electric ray, Acipenser, Caecilian, Hyla/ Rhacophorus, Axolot larva / Salamander, Draco, Turtle, Snakes : Cobra, Krait, Rattle snake, Sea snake, Water snake, Bat,; Bones - Skeleton of a bony fish, Chelonia, Snake, Dentition

**Mammals Physiology**

Measurement of metabolic rate in small animals – effect of stress on gill ventilation in fish. Determination of blood pressure in man in different physiological conditions with help of Sphygmomanometer by auscultation Method to show effects of exercise plotting time of acclimation. Determination of Haemoglobin content by haemocytometer. Permeability of erythrocyte membrane as a function of osmolality of salt solution. Demonstration ECG Ethology- Study of Activity patterns and reproductive behavior of native Drosophila sp.

## **M.SC ZOOLOGY HONS. THIRD SEMESTER**

### **CORE COURSE –VII COMPARATIVE AND MOLECULAR ENDOCRINOLOGY & DEVELOPMENTAL**

**COURSE CODE: 1Y2ZOO301**

**BIOLOGY**

**CREDITS (5)**

#### **Group A: Comparative and molecular endocrinology**

Chemical Nature of Hormones, half-life and mechanism of their action. Receptor types, second messenger system, Mammalian endocrine glands and their hormones: Pineal, Pituitary, Thyroid and Adrenal Function of the hormones secreted from – Hypothalamus (mammals only) Urophysis, Parathyroid, Ultimobranchial glands, Corpuscles of stannius Internal and chromaffin cells, Gut endocrine cells, kidney, Heart, thymus, Pancreatic hormones.

#### **Unit B: Developmental Biology**

Basic concepts of development and embryogenesis : Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development, cell surface molecules in sperm-egg recognition; embryo sac development; embryonic fields, gastrulation and formation of germ layers; Morphogenesis and organogenesis : Pattern formation in Drosophila. Yulva formation in Caenorhabditis elegans, eye lens induction, differentiation of neurons,

#### **Recommended Books:**

1. Gilbert – Developmental Biology
2. Berril N.J. – Developmental Biology. Tata McGraw – Hill 1982
3. Norris D.O. – Vertebrate Endocrinology 3th edn. Elsevier / A.P. 2006
4. Bolander F.F. – Molecular Endocrinology 3rd edn Elsevier / A.P. 2006
5. Hadley M.E. – Endocrinology 5th edn. Prentice Hall int. 2000

## **CORE COURSE –VIII BIO CHEMISTRY AND IMMUNOLOGY**

### **COURSE CODE: 1Y2ZOO302**

**Group A:**

**CREDITS (5)**

#### **Biochemistry:**

Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Bioenergetics, oxidative phosphorylation, coupled reaction, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds). Conformation of nucleic acids (A, B, Z), t-RNA. Stability of proteins and nucleic acids. Metabolism of nucleotides.

**Group B:**

#### **Immunology**

Innate and adaptive immune system Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiency, vaccines.

#### **Recommended Books:**

1. Delves P.J., Martin S.J., Burton D.R. & Roitt I.M. – Roitt's Essential Immunology. 11th edn. Oxford 2006
2. Kubly, J. – Immunology
3. Murray R.K., Granner D.K., Mayes P.A. & Rodwell V.N. - Harper's Biochemistry. 21st edn. Lange 1988
4. Nelson D.L. & Cox M.M. - Lehninger Principles of Biochemistry. 3rd edn. 2000
5. Voet D., voet J. & Pratt C.W. - Fundamentals of Biochemistry. Life at the Molecular Level. 2nd edn. Wiley Asia 2006

## **COURSE TYPE – ELECTIVE COURSE-II FISH AND FISHERIES**

### **COURSE CODE: 1Y2ZOO303**

#### **Group: A**

**CREDITS (5)**

Classification of living fishes up to orders Aquaculture – Definition and classification Nutritional value and economic importance of fishes: brief account of byproducts  
Outlines of fish culture in ponds, Ornamental fishes, larvivorous fishes Freshwater and important marine fishes of India

#### **Group: B**

Adaptations in teleosts – hill stream, cave dwelling, antifreeze, colouration, bioluminescence Migratory behaviour in fishes, Aquatic respiration in teleosts Structure of gills, gills areas and its significance, gas exchange and ventilation of gills Alimentary canal and its modification in relation to food and feeding habits in teleosts

#### **Recommended Books:**

1. Wootton R.J. – Fish Ecology Blackie 1992
2. Nikolsky G.V. – The Ecology of Fishes Academic Press 1963
3. Greenwood P.H. – Norman's History of Fishes 3rd edn Ernest 1975
4. Lagler, Bardach, Miller & May Passino – Ichthyology Wiley 2003
5. Pillay – Aquaculture: Principle and Practice of Fishing 1st Indian edn New Books 2006



## CORE COURSE –IX PRACTICAL OF CC-VII, CC-VIII AND EC-II

### COURSE CODE: 1Y2ZOO304P

<b>ITEMS MARKS</b>	<b>CREDITS (5)</b>
	<b>DISTRUBUTION</b>
<b>Endocrinology (Dissection)</b>	<b>25</b>
<b>Biochemistry (protein estimation)</b>	<b>10</b>
<b>Immunology (Blood Group analysis)</b>	<b>10</b>
<b>Spotting (Slides/Models) (6x5=30)</b>	<b>30</b>
<b>Records</b>	<b>10</b>
<b>Viva - voce</b>	<b>15</b>

#### **List of Practical**

##### **Endocrinology**

##### **Dissection –**

- Endocrine glands of fish Study of permanent Slides

Different stages of development in frog (cleavage, blastula, gastrula, Organogenesis)

Different stages of development in chick (slides) Study of vaginal smear in rat by temporary mounting (methylene blue) Biochemistry; Biochemical estimation of protein: Bradford's method Estimation of glucose, Estimation of serum total cholesterol Determination of glycogen content of rat liver colorimetrically Quantitative analysis of lipid: Saponification value of fat Immunology Study of permanent slides: Thymus, Spleen, lymph node, Pituitary, thyroid, Adrenal

Antigen antibody interaction (Blood group analysis); Collection of serum & plasma,; Blood film preparation and identification of cell types Demonstration of ouchterlony double diffusion (ODD)



## **M.SC ZOOLOGY HONS. FOURTH SEMESTER**

### **CORE COURSE –APPLIED BIOLOGY**

#### **COURSE CODE: 1Y2ZOO401**

##### **Group: A**

**CREDITS (5)**

Microbial fermentation and production of small and macro molecules. Application of immunological principles, vaccines, diagnostics. Organ transplantation & its response  
Transgenic animals; Infertility and IVF. Genomics and its application to health and agriculture, including gene therapy. Bio resource and uses of biodiversity, Bioremediation, Biosensors

##### **Group: B**

Molecular Biology and Recombinant DNA methods: Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods. Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms, detection of post translation modification of proteins. DNA sequencing methods & next generation sequencing, strategies for genome sequencing. Methods for analysis of gene expression at RNA and protein level, large scale expression, micro array based techniques. RFLP, RAPD and AFLP techniques

##### **Recommended Books:**

1. Primrose S.B. – Molecular Biotechnology.
2. 2nd edn. Panima 2001 2. Glick B.r. & Pasternak J.J. – Molecular Biotechnology.
3. 3rd edn. ASM Press 2003 3. Golemis E. (edt) – Protein-Protein Interactions. Cold Spring Harbor Laboratory Press 2002
4. Brown T.A. – Gene Cloning. 4th edn. Blackwell 2005
5. Nicholl O.S.T. – An Introduction to Genetic Engineering. Cambridge Univ. Press 1994

## **ELECTIVE COURSE-III (ENTOMOLOGY)**

### **COURSE CODE: 1Y2ZOO402**

#### **Group: A**

**CREDITS (5)**

Ecological management of the crop environment: Sanitation, destruction or modification of alternate hosts and habitats Tillage, irrigation and water management Trap cropping and strip harvesting

Chemical control:

Insecticides – nomenclature, formulae and different types of formulations. Common insecticides used in pest control Mode of action of insecticides and toxicity to humans.

#### **Group: B**

Definition of Biological control, agents of Biological Control Parasites, Parasitoids, Predators and pathogenic microorganisms. Mass production and distribution. Advantages and disadvantages of Biological control. Integrated Pest Management (IPM) other methods of insect Pest Management Management of insect Pests by Sterile- Insect Technique (Chemosterilants) Attractants, Hepellants, Antifeedants and Pheromones.

#### **Recommended Books:**

1. Chapman – The Insects: Structure and Function 4th edn ELBS 1998
2. Imms A.D. – A General Text Book of Entomology 2 volsw. Asia Pubi 1997
3. Wigglesworth – Principles of Insect Physiology ELBS 197

**COURSE TYPE –ELECTIVE COURSE –IV PRACTICAL**

**COURSE CODE: 1Y2ZOO403P**

Entomology	CREDITS (5)
ITEMS	MARKS DISTRUBUTION
• Adapting feature of aquatic/ Semiaquatic/terrestrial insects	10
• Temporary mounting of any body parts of insects	05
• Calculation of species diversity of insects by Shnnon-Weiner • Index from generated data 15	
• Taxonomic description of a member of any order studied	15
• Spotting	(6x5=30) = 30
• Practical Records	10
• Viva voce	15

**List of Practical**

Taxonomy description & indentification of following order: Orthoptera, Dictyoptera, Hemiptera, Hymenoptera, Diptera, Coleoptera & Lepidoptera. Study of permanent slides of body parts. Study of Histological slides. Pest study on affected objects. Life history of beneficial insects like – lac & tasar. Study of parasites, predators, parasitoids & pattrogens. Embryological study through Drosphila culture. Study of adaptive features in some order of insects.

**Minor dissection:**

Temporary mounting of special type of mouth parts, wings, legs, ovpositer, sting apparatus antennae – adaptation – arista. Calculation of species diversity by Shannon-weiner index from generated data Study of the external morphology of an insect, wings, haltere, clytra Study of the adpative feature of terrestrial and aquatic insects Study of parasitic insects (Fleas and Lice). Study of the mouthparts of the representative of the order: orthoptera, Dictyoptera, Hemiptera, Lepidoptera and Hymenoptera. Study of respiratory structure of terrestrial, semi-aquatic and aquatic insects. Study of the life cycles of Termites, Honeybee, Mosquitoes

## **COURSE TYPE –DISSERTATION/ PROJECT**

**COURSE CODE: 1Y2ZOO404P**

### **PROJECT WORK/DISSERTATION**

**CREDITS (5)**

**FM-100**

**Time- Two semester (III & IV)**

The two typed copies of project work signed by the supervisor and certified by the Head of the department as a bonafide work of the examinee shall be submitted at least one month prior to the commencement of Semester IV examination. The project shall comprise of Introduction, Review of Literatures, Materials and Methods, Results, Discussion, Summary and References, along with the declaration by the candidate that the work is original and not submitted to any other university for the award of any degree, duly certified by the supervisor.

#### **The scheme of evaluation for dissertation shall be as follows:**

- Every student will be guided by one faculty member as the supervisor of the project.
- Project work would be assigned at the end of semester II to enable students to initiate work on the same.
- The project would formally begin from Semester III and has to be completed by end of Semester IV, one month prior to the end semester examination.
- The project will be evaluated on the basis of project report writing (60 marks) and viva – voce (40 marks).
- There shall be an oral presentation (conducted by the board of faculty members including one external member) at the end of semester IV on dissertation.