



Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

No.AC.2(S)/486/16-17

Dated: 20-06-2017

NOTIFICATION

Sub: Revision of syllabus and examination pattern, regulations pertains to M.Sc. Applied Zoology from the Academic year 2017-18.

Ref:1. Decision of the Faculty of Science & Technology Meeting held on 03-03-2017.

2. Decision of the Academic Council meeting held on 30-03-2017.

The Board of Studies in Applied Zoology (PG) which met on 20-12-2016 has recommended to revise the regulation, scheme of examination pattern and syllabus of M.Sc. Applied Zoology from the academic year 2017-18.

The Faculty of Science and Technology and the Academic Council at their Meetings held on 03-03-2017 and 30-03-2017 respectively have approved the above said proposal and the same is hereby notified.

The Revised syllabus, scheme of examination pattern & regulations of M.Sc Applied Zoology Course is annexed. The contents may be downloaded **from the University Website i.e., www.uni-mysore.ac.in**.

Draft approved by the Registrar

Sd/-

Deputy Registrar (Academic)

To:

1. The Registrar (Evaluation), University of Mysore, Mysore.
2. The Principal, Maharani's College for Women (PG wing), Mysore - for needful.
3. The Dean, Faculty of Science & Technology, DOS in Physics, MGM.
4. The Chairman, BOS in Applied Zoology, DOS in Zoology, MGM.
5. The Co-ordinator, Directorate of Online and Outreach Program, Parakalamata, Manasagangotri, Mysore.
6. The Director, College Development Council, Moulya Bhavan, Manasagangotri, Mysore.
7. The Deputy/Assistant Registrar/Superintendent, AB and EB, UOM, Mysore.
8. The P.A. to the Vice-Chancellor/Registrar/Registrar(Evaluation), UOM., Mysore.
9. Office file.

University of Mysore

Choice Based Credit Based System
Proposed Revised Syllabus of
M. Sc., Applied Zoology Programme
With effect from 2017-2018

M. Sc., Applied Zoology Course structure

Semester	Title of the papers	HC/SC	Credit pattern L:T:P	Total Credit
I SEM	Animal Systematics	HC-1	2:0:2	4
	Animal Physiology	HC-2	2:0:2	4
	Cell & Molecular Biology	HC-3	2:0:2	4
	Wildlife Biology & Conservation*	SC-1	3:1:0	4
	Evolutionary Biology*	SC-2	3:1:0	4
	Biostatistics*	SC-3	3:1:0	4
Total credits				20

*Students have to opt any two soft core papers in this semester

Semester	Title of the papers	HC/SC	Credit pattern L:T:P	Total Credit
II SEM	Aquaculture & Fishery Technology	HC-4	2:0:2	4
	Genetics	HC-5	2:0:2	4
	Environmental Biology	HC-6	2:0:2	4
	Apiculture & Vermiculture *	SC-4	2:0:2	4
	Endocrinology*	SC-5	3:1:0	4
	Animal Behavior*	SC-6	3:1:0	4
	Parasitology**	OE-1	3:1:0	4
	Ornithology**	OE-2	3:1:0	4
Total credits				20

*Students have to opt any two soft core paper in this semester

** Non Zoology M. Sc., Students have to opt any one open elective paper

Semester	Title of the papers	HC/SC	Credit pattern L:T:P	Credit
III SEM	Animal Husbandry	HC-7	2:0:2	4
	Animal Biotechnology	HC-8	2:0:2	4
	Immunology & Toxicology*	HC-9	2:0:2	4
	Reproductive Biology*	SC-7	3:1:0	4
	Sericulture*	SC-8	3:1:0	4
	Basic Zoology**	OE-4	3:1:0	4
	Sericulture Technology**	OE-5	3:1:0	4
Total credits				20

*students have to opt any one soft core papers in this semester.

** Non Applied Zoology M. Sc., Students have to opt any one open elective paper

Semester	Title of the papers	HC/SC	Credit pattern L:T:P	Credit
IV SEM	Biodiversity	HC-10	2:0:2	4
	Major Research Project	HC-11 & 12-PRJ	0:2:6	8
	Zoo Management*	SC-9	3:1:0	4
	Vector Biology*	SC-10	3:1:0	4
Total credits				16

*Students have to opt any one soft core paper in this semester

Note: Hard core 48 Credits (Minimum required 42 Credits)

Soft Core 40 Credits (Minimum required 16 Credits)

Open Elective = Minimum required 04 Credits

Total Credits required for completing M. Sc., programme is 76.

M.Sc., APPLIED ZOOLOGY I Semester
A Z 1.1 (Hard Core - 1)
ANIMAL SYSTEMATICS (L2+T0+P2)

32 HOURS

- Unit I :- Definitions and Concepts 08 Hours
- a) Importance of Systematics and its History
 - b) Vertical and Horizontal classification
 - c) ICZN- Origin of the code and rules governing Nomenclature
 - d) New Trends in taxonomy- Chemotaxonomy, Cytotaxonomy and Molecular Taxonomy
- Unit II :- Procedures in Taxonomy 08 Hours
- a) Collection, Preservation, Cataloguing and Curating
 - b) Types of identification keys
 - c) Cladistic, evolutionary and Phenetic classification
 - d) Biometric Techniques
- Unit III:- Concept of Species 08 Hours
- a) Concept of Species- Limitations, Origin of higher Categories.
 - b) Species concepts- varieties, sub species, sibling species, race
 - c) Speciation- Isolating mechanisms- Allopatric, Peripatric, Parapatric and Sympatric Species
 - d) Causes of Speciation- Chromosomal, Hybrid and Symbiotic. Adaptive radiation
- Unit IV:- Taxonomy of Fishes and Ants as representative groups 08 Hours
- a) Classification of fishes- up to orders with an emphasis on Indian species
 - b) Biocode - Comparison with existing code
 - c) Classification of insects. Major orders and their characteristics.
 - d) Detailed classification of formicidae

Animal Systematics Practicals:-

64 Hours

- 1) Construction of Dichotomous key by using comparative feature of organism using museum specimens. 4x 2 = 08
- 2) Use of character to build phenogram 4x 2 = 08
- 3) Use of character to build cladogram 4x 2 = 08
- 4) Identification of fresh water fish- any one family 4x 2 = 08
- 5) Identification of marine fish- any one family 4x 2 = 08
- 6) Use of taxonomic keys- Dichotomous keys 4x 3 = 12
- 7) Identification of major formicidae group of insects- (classification of any ten ant species) 4x 3 = 12
- 8) Field trip for Entomological collection - two locally available insect species.

References:

1. Kapoor V. C, (1998) Theory and practice of Animal Taxonomy, 2nd Edition. Oxford and IBH publishing co New Delhi.
2. Kitching *et al* (1998) Cladistics, The theory and Practice of Parsimony Analysis
3. Judith Winston (1999) Describing species practical taxonomic procedures for biologists. Columbia University Press.
4. Blackwelder, R. E., (1967). *Taxonomy- A text and reference book*. John Wiley & Sons.
5. Forey, P. L. *et al*. (1992) *Cladistics - A practical course in systematics*. Clarendon Press.
6. Mayr, E. (1969). *Principles of Systematic Zoology*. Tata McGraw-Hill.
7. Mayr, E. & Ashlock, P. D. (1991). *Principles of Systematic Zoology*. 2 ed., McGraw-Hill.

8. Mayr, E. (1997). *This is biology: the science of the living world*. Belknap, Harvard University Press, Cambridge, Mass.
9. Scott-Ram, N. R. (1990). *Transformed cladistics, taxonomy and evolution*. Cambridge University Press.
10. Simpson, G. G. (1961). *Principles of Animal Taxonomy*. Columbia University Press. New York.
11. Quicke, D.A.J. (1993). *Principles and Techniques of Contemporary Taxonomy*. Blackie

I Semester
AZ 1.2 (Hard Core - 2)
ANIMAL PHYSIOLOGY (L2+T0+P2) 32 Hours

Unit I:- Respiration	8 Hours
a) Contrast between aquatic and terrestrial respiration	
b) Special features of respiration in insects and birds	
c) Regulation of respiration and transport of respiratory gases.	
d) Cellular respiration: Glycolysis, Krebs cycle, ET System and energy budget	
Unit II:- Physiology of osmoregulation and excretion	8 Hours
a) Salt and water balance in tissues	
b) Osmoregulation in aquatic, amphibious and terrestrial animals and their control mechanisms	
c) Patterns in Nitrogen excretion	
d) Physiology of nephron in formation of Urine and Regulation of renal activity	
Unit III:- Physiological Ecology	8 Hours
a) Various environmental variables	
b) Concept of homeostasis, acclimation and acclimatization	
c) Adaptations to temperature variations: endothermy and ectothermy	
d) Heat shock proteins	
Unit IV:- Neuro and Muscle Physiology	8 Hours
a) Ionic basis of resting membrane potential	
b) Generation and conduction of action potential	
c) Neuro transmission	
d) Mechanism of muscle contraction with emphasis on sliding filament theory	
Animal Physiology Practicals:-	64 Hours
1. Estimation of on liver and muscle glycogen (Slaughter house sample)	4x 2= 08
2. Detection of amylase activity on starch (slaughter house samples)	4x 2= 08
3. Detection of protease activity on proteins	4x 2= 08
4. Detection of lipase activity on lipids	4x 2= 08
5. Estimation of glucose	4x 2= 08
6. Detection of excretory and pathological constituents in urine	4x 2= 08
7. Determination of Respiratory Quotient in fish	4x 2= 08
8. Active transport in Malphigian tubules in insects	4x 2= 08

References

1. Schmidt-Nielsen K, 1995, *Animal Physiology, Adaptation and environment* Cambridge University press
2. Kay I, 1998, *Introduction to Animal physiology*, Bios Scientific Publishers, UK

1. Verne R.M and Levy M.N(Eds) (1990) Principles of Physiology, C.V.Mosby Company, St.Louis.
2. Campbell et.al(1984)clinical Physiology 5th Edn. Blackqwell Scientific publications, Oxford
3. Dacie I.V and Lewis S.M(1984) Practical Haematology. 6th Edn. International Student edition) Churchill, Livingstone, Edinburgh.
4. Ganong U.F(1989) Review of Medical Physiology, Lange California
5. Guyton A.C(1991) Text Book of Medical physiology, VIII edn. Saunders Co., Jovanovich
6. Jensen D (1976) The principles of physiology ,Appleton Century crafts New York
7. Louco G N(1993) Physiology Animal Ecology, Longman Scientific and Technical, Essex.
8. Oser B L(1976) Hawkis physiological chemistry 14th edn(INDIAN editon) Tata Mc Graw-Hill Pub CO.New Delhi
9. Paganelli C V and Farhi L E (1989) physiological function in special; environmental. Springer Verlag, New York
10. Shepherd G M. Neurobiology -Principles of Neurol science, E. Kandel and P Schwart
13. Wilson I .A(1979) Principles of Animal physiology 2Nd edition Macmillan Pub .Co.Inc. New York

I Semester
A Z 1.3 (Hard Core 3)
CELL AND MOLECULAR BIOLOGY (L2 +T0+P2) 32 Hours

- Unit I :- Overview of animal cell and cell organelles. 8 Hours
- 1.1 Membrane composition, structural arrangement and function - structure of membrane, lipid bilayer, Fluid Mosaic model.
 - 1.2 membrane proteins, diffusion, osmosis, passive transport, active transport, uniport, symport, antiport, membrane pumps, mechanism of sorting and regulation of intracellular transport.
 - 1.3 Structure and Functions of microfilaments, microtubules and their role.
- Unit II:- Cell Division and Cell Signaling 8 Hours
- 2.1 Cell junctions, extra cellular matrix, matrix biomolecules, cell matrix interactions, cell to cell interactions, cell adhesion junction- tight junction, gap junction, plasmadesmata
 - 2.2 Cell division and cell cycle - phases of cell cycle, checkpoints of cell cycle, Cyclins and Cyclin dependant kinases, regulation of cell cycle, mitosis, meiosis.
 - 2.3 Cell signaling - hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, Receptor protein- tyrosin kinase and ion chanel receptors.
 - 2.4 Signal transduction pathways, primary and secondary messenger systems, regulation of signaling pathways.
- Unit 3:- Cancer Biology 8 Hours
- 3.1 Cancer definition and types of Cancers, properties of cancer cells, genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis. Treatment for cancer: chemotherapy, radiation therapy, immunotherapy. Nano-robots in cancer detection and treatment.

3.2 Apoptosis, Ageing, Programmed cell death, Caspases, regulation of apoptosis, intrinsic and extrinsic regulation, genetic control of apoptosis.

Unit 4:- DNA replication and repair mechanism 8 Hours

4.1 DNA replication - Types of replication. molecular mechanisms of DNA replication, regulation of replication.

4. 2 DNA damage and repair - types of DNA repair mechanisms, Photo activation repair, excision repair system. Mismatch repair, recombination repair, double strand break repair.

Cell and Molecular Biology Practicals:- **64 Hours**

- 1) Preparation of fixatives and Stains for chromosome study (Hematoxylin & Aceto Orcin, Aceto Caramin, Giemsa)
4x 1= 4
- 2) Study of Mitotic stages using plant materials 4x 1= 4
- 3) Study of Meiotic chromosomes of Grasshopper testis permanent slides. 4x 2 =8
- 4) Preparation of Meiotic chromosomes using grasshoppers testis squash 4x 2 =8
- 5) Calculation of Chiasmata frequency by Diakinesis score 4x 2 =8
- 6) Observation of polytene chromosomes of *Drosophila melanogaster* 4x 2 =8
- 7) Preparation of Human Karyotype using metaphase plate (Normal) 4x 2 =8
- 8) Preparation of Human Karyotype using metaphase plate (abnormal) 4x 2 = 8
- 9) Study of sex chromatin (Barr body/drum stick) through preparation of buccal smear/ blood smear. 4x 2=8

References

- 1) James D Watson . 2004. Molecular Biology of Gene, 5th ed. Pearson Education Publishers
- 2) Williams S Klug: 2007 Concepts of Genetics. 7th Ed . Pearson Education Publishers
- 3) Gerald Karp. 2008. Cell and Molecular biology, Concepts and experiments 2008.
- 4) Charles Fox. 2006. Evolutionary Genetics, Concepts and Case studies. Oxford univ
- 5) Peter Snusta. 2010. Principles of Genetics. 5th Ed. Wiley International Publications.
- 6) Hartwell and others 2011. Genetics from genes to genome. Tata McGraw Hill Publ.
- 7) Cooper G.M. and Hansman R.E 2009. The Cell. Sinauer Associates Inc. Sunderland,MA
- 8) Atherly A G and J R Mc Donald 2006. The Science Of Genetics, saunders college Publishing,Harcourt Brace College Publisher
- 9) Brooker R J 2003 Genetic Analysis and Principles, Benjamin Cummings Longman Publ.Inc
- 10) Garden E L, M J Simmons and D P snustad 1998. Principles of Genetics. John wiley and sons
- 11) Lewin B 2008 Gene VII Oxford university press NY
- 12) Snustad D P and M J Simmon. Principles of Genetics 2008 John wiley and sons Inc NY

I Semester

AZ 1.4 (Soft Core - 1)

WILDLIFE BIOLOGY & CONSERVATION (L3+T1+P0)

48Hours

Unit I:- Techniques- Capturing and Tracking Wildlife Population 12 Hours

- a) Techniques for capturing wildlife: Capturing devices - entrapment, drugs and electrofishing
- b) Handling, Marketing, Tagging and Banding techniques.
- c) Methods of documenting wildlife - Radiotelemetry, still and video-photography
- d) Estimation of wildlife population
- e) Demographic studies, genetic bottle necks, population viability analysis

f) Territory mapping, line transect, capture- recapture, pellet count, call/tract count removal methods

Unit II :- Wildlife Depletion

12 Hours

- a) IUCN Red list criteria and categories- Endangered, Critically endangered, Vulnerable, Extinct.
- b) Loss of wildlife: Reasons:- Human interaction habitat destruction, fragmentation, Degradation. Alien species introduction and Over-exploitation
- c) Important wildlife Diseases and their control.

Unit III :- Wildlife Management Strategies

12 Hours

- a) Identification of priority areas in conservation research
- b) Habitat management and establishment of wildlife corridors
- c) *In-situ* conservation - establishment of protected areas, National parks, Sanctuaries, and Biosphere reserves.
- e) *ex-situ* conservation - captive breeding and repopulation programme- role of Zoo's, botanical gardens and Aquaria

Unit IV:- Conservation efforts and legal aspects

12 Hours

- a) National and international conventions concerned with wildlife conservation: CITES, TRAFFIC
- b) Important Indian fauna and their distribution - Lion, Tiger, Rhino, Deer, Wild buffalo, Crocodile, Great Indian bustard, etc.
- c) Regional, National and Global efforts in conservation - Special projects - Project Forest Laws and wildlife laws in wildlife conservation- Wildlife Tiger, Gir lion projects, Project elephant, Crocodile breeding Hangul, etc. 1972. Role of NGO` in conservation. Project Protection act, Projects, Project
- d) Other measures for conservation of biodiversity and sustainable use of its components.

References:

1. Burt W.H. (1943) Territoriality and home range concepts applied to mammals J. Mam. 24:346-352.
2. Sagreiya K.P.,(1967) Forests and Forestry, National Book Trust, India.
3. Schaller G.B. (1967) The deer and the Tiger, University of Chicago press, Chicago
4. Giles, R.H . Wildlife (1971) Wildlife Management techniques, The wild life society, Washington DC. III Edn.
5. Mukherjee A.K (1982) Endangered animals of india, Zoological survey of india, Calcutta.
6. Miller S.D and Everett D D , Seidensticker J . (1986) Large carnivores and consequences of habitat insulasazation ecology and conservation of tigers in Indonesia and Bangladesh.
7. Daniel J.C and Gerroa J.S (1990) Vegetation types of India in relation to environmental conditions in : Conservation in developing countries, problems and prospects eds., Bombay Natural History Society, Bombay
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10. Negi S.S (1993) bio diversity and its conservation in India, Indus publishing co .
11. Canghley , Graene and Sinclair, Anthony R.E (1994) Wild life ecology and management , Blackwell Sceintific pub.
12. R.K Sinha (1996) Biodiversity global concerns, common wealth pub.
13. Charles G. Scalet , L.D. Flake and D.W willis (1996) introduction to wild life and fisheries - An integrated approach.

I Semester
AZ 1.5 (Soft Core - 2)
EVOLUTIONARY BIOLOGY (L3+T1+P0) 48 Hours

- Unit I: Introduction to evolutionary theories 12 Hours
- a) Nature of evolution: Neodarwinism and Neolamarkism, Basic forces of evolution- Hardy Weinberg Equilibrium, Selective forces.
 - b) Natural selection and classifying selection, strength of selection and rate of evolutionary response. Selectinists hypothesis v/s. Neutral theory of evolution, Genetic variation and fitness, bottleneck phenomenon. Micro and macro evolution. Origin and maintenance of genetic variation.
- Unit II: Population genetics and evolution 12 Hours
- a) The expression of variation: Population genetics and evolution, quantitative traits and genetic variation, methods for analyzing patterns of gene expression.
 - b) Developmental pattern genes, seasonal polyphenism in butterflies, adaptive plasticity.
 - c) Evolution of sex: Variations in sexual cycle, Consequences of sex. Evolutionary maintainance of sex-theoretical approach and empirical evidence. Sexual dimorphism.
 - d) The evolution of life histories and sex ratio. Evolution of age and size at maturation, Evolution of clutch size and reproductive investment, evolution of life span and aging, Evolution of sex allocation.
- Unit III: Selection and speciation 12 Hours
- a) Sexual selection and speciation: Sexual selection and its origin, competition for mates, Mate choice, Evidence for sexual selection, Sperm competition and choice by eggs.
 - b) Speciation: Defining species. Types of species, mechanism of speciation. Experimental evidence for speciation, Hybridization and speciation.
- Unit IV: Molecular evolution 12 Hours
- a) Molecular evolution: Phylogeny, cladistics, Molecular data and homoplasy theory and rationale of tree building. The geneology og genes and the phylogeny of species.
 - b) Molecular evolution: Detecting selection at Molecular level, Rates of Molecular evolution, Molecular clocks, Weak selection on non coding gene features, evolution of Eukaryotic genome structure – New genes, New gene functions: Gene family, Evolution and phylogenetics, Gene Geneologies.

References

1. Stephen C Stearns and Hoekstra R F (2000) Introduction to evolution 2nd Ed. Oxford Pub.,
2. Harvey P H and Pagel M D (1994) The comparative method in evolutionary biology- Oxford in press.
3. Mayr. E (1963) Animal species evolution. Harvard university press.
4. Charles W Fox (2006) Evolutionary genetics concepts and case studies, Oxford publications.
5. Lull, Organic Evolution.
6. Riddle M (1999) Evolution, Black well scientifics.

AZ 1.6 (Soft Core - 3)
BIOSTATISTICS (L3+T1+P0)

48Hours

- Unit-I Introduction to statistical methods 16 Hours
- a) Definition and scope of statistical methods in biological studies.
 - b) Descriptive statistics- Population and sample collection of data- tabular and graphical representation of data- attributes and variables- discrete and continuous variables.
 - c) Frequency distribution- preparation of frequency table- relative and cumulative frequencies. Diagrammatic representation of frequency distribution- histogram, polygon, frequency curves and ogives
 - d) Measures of central tendency and dispersion/ scales and skewness
 - e) Linear correlation and regression- Spearman's rank correlation

- Unit-II Sampling methods in statistics 16 Hours
- a) Elementary idea of probability- introduction, Definition, Concepts of probability- classical and empirical relative frequency of probability, addition and multiplication theories.
 - b) Binomial, poisson and normal distribution properties
 - c) Elementary sampling theory- sampling theory, random sample, random numbers , sampling distribution, standard errors

- Unit-III Significance tests 16 Hours
- a) Tests of significance- normal student 't' test, chi-square, F-tests, tests of hypothesis about population, mean and variance of normal population- level of significance
 - b) Analysis of variance. Assumption, one way classification with equal numbers of observations per cell multiple comparison- tests for normality and homogeneity of variances, CRD and RBD.

References:

- 1) Prasad. S (2005) Elements of Biostatics. Rostogi publications Meerat
- 2) Dhamu K P and Ramamurthy K (2008) Statistical methods- Agrobios India
- 3) Ludwig J A and Reynolds J F (1988) Statistical ecology- Jonwiley and sons- Singapore
- 4) Gerstman B B (2008) Basic Biostatistics Jones and Bertlett Publisher Singapore

II Semester

AZ 2.1 (Hard Core - 4)

AQUACULTURE & FISHERY TECHNOLOGY (L2+T0+P2)

32 Hours

- Unit I :- Aquaculture Practice in India 8 Hours
- a) Scope and importance of aquaculture. Common cultivable species and their distribution
 - b) Prawn culture- common cultivable species (*Penaeus monodon*, *P. indicus*, *Macrobrachium rosenbergii*), their distribution. Traditional prawn filtration. New technology for prawn culture, seed production- eye stalk ablation. Common diseases.
 - c) Mussel culture- muscle culture :seed production- natural collection and artificial production. Different culture methods, harvesting and processing.
 - d) Pearl culture- Types of pearls and culture techniques, preparation of nuclei, host implantation, rearing and harvesting.

Unit II:- Introduction to Fish culture

8 Hours

- a) Historical background, role and scope of pisciculture. Present scenario of fisheries. fishes as a food commodity
- b) Culture of fresh water fish: types of fish ponds pond maintenance and improvement- liming, manuring (organic and inorganic fertilizers), feeding.
- c) Factors effecting fish culture- physical, Chemical, and biological factors.
- d) Composite fish culture, Paddy cum fish culture. Brackish water fish culture - *Mugil*, *Chanos*, *Etroplus*. Ornamental fish culture- Biology.

Unit III :- Fish Processing Technology

8 Hours

- a) Types of fish nets. Purseine. Detection of fish schools. Ecolocation. Baits Trawlers.
- b) Fish preservation and processing - Chilling, freezing, freeze drying, salting, smoking and canning
- c) Fish by products- fish meal, fish oil, fish protein concentrate, isinglass, fish manure, fin rays, chitin, chitosan , biochemical and pharmaceutical compounds.
- d) Fish diseases- Bacterial, viral, fungal and other pathogens of fishes.

Unit IV: Fish Dynamics

8 Hours

- a) Study of growth and age of fish - length weight relationship, linear growth and condition factor of fish. Age determination.
- b) Fecundity, mortality, survival rates of fishes.
- c) Fish production and its measurement. Density and abundance, their fluctuations.
- d) Study of aquatic pollution with reference to fisheries.

Practicals:

64 Hours

1. Field visit to various fish farms in and around Mysore for getting hands on experience for pisciculture practices. 4x 2= 08
2. Visit to fish processing industries to know fish processing and by products. 4x 2= 08
3. Aquarium: Design, equipments and execution of aquarium. 4x 2= 08
4. Maintenance of aquarium, Ornamental fishes. 4x 2= 08
5. Morphometric measurements of locally available fresh water fish and marine fish 4x 2= 08
6. Identification of fish based on their morphology. 4x 1= 04
7. Identification of prawn and mussels. 4x 1= 04
8. Water quality analysis and its relation with fisheries - pH, Dissolved oxygen, Total alkalinity, Salinity, Calcium, Magnesium, Nitrates, Nitrites, Phosphates, total dissolved solids, Suspended solids, Turbidity. 4x4= 16

References:-

1. Kurein and Sebastain: Prawn and Prawn Fisheries in India.
2. Sing VPP and Ramachandran : Fresh Water Culture ; IACR, New Delhi,
3. Tripathi SD: Technique of Composite Fish Culture; IIT Karaghpur.
4. Govindan T K : Fish processing technology ; Oxford and IBH.
5. James : Handbook on Aqua Farming Molluscs; CMFRI , Kochi.
6. Alikunhi : Fish Culture in India.
7. Jhingran V.g. 1997. Fish and Fisheries of India. Hindustan Publishers New Delhi.

AZ 2.4 (Hard Core- 5)
GENETICS (L2+T1+P2)

32 Hours

Unit 1:-Mendelain genetics

8 Hours

- 1.1 Mendelian inheritance - mono/dihybrid cross, laws of heredity, types of dominance, multiple allelism,
- 1.2 Extensions of Mendelian principles - co-dominance, incomplete dominance, gene interactions, linkage and crossing over, sex linkage, sex limited and sex influenced characters.
- 1.3 Quantitative Genetics - polygenic traits and mode of inheritance, genetic and environmental factors, heritability, inbreeding and consequences, coefficient of inbreeding and consanguinity.
- 1.4 Mutation - types, causes and detection, mutant types- lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, Molecular Mechanism of mutation, trasnition and transversion . chemical mutagens: base analogues, alkylating agents, nitrous acid, dyes. Radiation mutations.

Unit-II:-Human Genetics

8 Hours

- 2.1 Mobile DNA elements - transposable elements, AC, Ds elements in maize. IS elements, P elements, retroviruses, retrotansposons. Molecular mechanism of transposition.
- 2.2 Structural and numerical alterations of chromosomes - deletion, duplication, inversion, transversion, translocation, ploidy and their genetic implications.
- 2.3 Extra chromosomal inheritance - cytoplasmic inheritance, inheritance of mitochondrial genes, maternal inheritance.
- 2.3 Human genetics- pedigree analysis, some important human genetic diseases, karyotypes, genetic disorders and syndromes (Phenylketonuria, Lesch-Nyhan syndrome, Tay-Sachs disease, Alkaptonuria, Albinism, Congenital adrenal hyperplasia, Emphysema, Glucose-6-phosphatedehydrogenase deficiency, Achondroplasia. Dermatoglyphics and genetic analysis.

Unit-3:- Protein synthesis

8 Hours

- 3.1 Transcription in prokaryotes: RNA Polymerase, Initiation, elongation and termination of transcription in prokaryotes. Post-transcriptional modification of mRNA in prokaryotes and eukaryotes. Splicing mechanism in eukaryotes.
- 3.2 Translation: Translation machinery, Genetic code, properties of triplet code.. Basal transcription apparatus, Polypeptide chain initiation, elongation and termination of translation.

Unit - 4: Gene Regulation

8 Hours

- 4.1 Gene regulation in prokaryotes. Negative and positive regulation, Lac operon regulation, Tryptophane operon regulation and Arabinose operon gene regulation in E coli, Lambda logic regulation in viruses.
- 4.2 Gene regulation in eukaryotes, Factors effecting regulation in eukaryotes. Enhancers, silencers, Gene silencing, RNA interference.

Practicals:-

64 Hours

1. Preparation of Wheat cream ager media for *Drosophila* culture. 4x 1= 04
2. Morphological study of *Drosophila melanogaster* male and female 4x 1= 04
3. Mounting the wing and sex comb of *Drosophila melanogaster*. 4x 1= 04

4. Mounting the genital plate of <i>D. melanogaster</i>	4x 2= 08
5. Mounting the wing and sex comb of <i>Drosophila anonassae</i> .	4x 1= 04
6. Mounting the genital plate of <i>Drosophila anonassae</i> .	4x 2= 08
7. Mounting the wing and sex comb of <i>Drosophila bipectinata</i> .	4x 1= 04
8. Mounting the genital plate of <i>Drosophila bipectinata</i>	4x 2= 08
9. Mounting the wing and sex comb of <i>Drosophila malerkotliana</i>	4x 1= 04
10. Mounting the genital plate of <i>Drosophila malerkotlyana</i>	4x 1= 04
11. Observation of mutants of <i>Drosophila melanogaster</i> . Body mutants, wing mutants, eye mutants.	4x 1= 04
12. Genetic problems using <i>Drosophila</i> : Monohybrid and Dihybrid experiments	4x 2= 08

References:

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
2. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
4. Molecular Biology by Freifelder D., narosa publication House.
5. Gene VI by Benjamin Lewis, Oxford press.
6. Gene IX by Benjamin Lewis, Oxford press.
7. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
8. Molecular cell Biology by Darnell J. Scientific American Books USA.
9. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
10. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
11. Introduction to genetic analysis by Suzuki, Griffith and Miller. Freeman eds.
12. Essentials of Molecular Biology by Freifelder D., narosa publication House.
13. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
14. The Cell: Molecular Approach by Cooper G. M.
15. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication
16. Principals of Genetics 2008, by Snustard and simmonds, Willies Pub. Inc

II Semester

AZ 2.3 (Hard Core - 6)

ENVIRONMENTAL BIOLOGY (L2+T0+P2)

32 Hours

Unit I: Introduction and scope of ecology	8 Hours
Environmental Microbiology	
a. Microbial Diversity in the Environment	
b. Bioindicators in the environment	
c. Microbial degradation of recalcitrant organic pollutants	
d. Methods in Environmental Microbiology	
e. Bioremediation	
Unit II :- Ecotoxicology	8 Hours
a. Bioaccumulation and biomagnifications of toxicants.	
b. Environmental toxicity of heavy metals	
c. Environmental impact of pollutants and analysis of Dose-Effect relationship	
d. Biopesticides and Integrated Pest Management	
e. Modeling of Bioreactors	
Unit III:-Eco-Biotechnology	8 Hours
a. Bioremediation	
b. Bioabsorption of metals	

- c. Biofertilisers
- d. Biofuels and biodiesel
- e. Biopolymers and bioplastics

Unit IV: Remedial Ecology 8 Hours

- a. Biodegradation of organic pollutants
- b. Biodegradation of pesticides in the environment
- c. Microbial transformation of heavy metals
- d. Bioleaching and Biomining for recovery of resources
- e. Microbial transformation of Pesticides

Practicals:

1. Estimation of Dissolved Oxygen content and Biological Oxygen Demand of various water samples 4x 2= 08
2. Estimation of Total Hardness and Chloride in different water samples 4x 2= 08
3. Estimation of chemical Oxygen Demand of various water samples 4x 1= 04
4. Estimation of Total Dissolved Solids and Suspended solids 4x 2= 08
5. Estimation of Nitrate and Nitrite in water samples 4x 1= 04
6. Estimation of Phosphate in various water samples 4x 2= 08
7. Estimation of Sulphate in water samples 4x 2= 08
8. Estimation of turbidity of water 4x 2= 08
9. Study of planktons in the water samples. 4x 2= 08

References

1. Mohapatra P K (2006). Textbook of Environmental Biotechnology. I K International publishing house, New Delhi
2. Thakur I S (2006). Environmental Biotechnology- Basic concepts and Applications. I K International Publishing house, New Delhi
3. Moriarty F (1983) Ecotoxicology, II edition, Academic Press, London.
4. Shashi Kanth (1989) Trends in environmental pollution and pesticide toxicology, Jagmandar Book Agency, New Delhi
5. Duffus J H (1980) Environmental Toxicology, Edward Arnold Publishers, London.

II Semester

AZ 2.2 (Soft Core - 5)

APICULTURE & VERMICULTURE (L3+T1+P02) 48 Hours

A-APICULTURE

Unit- I:- Apiculture Biology 12 Hours

- a. History, scope and importance of apiculture
- b. Classification of honeybees with special reference to Indian species
- c. Morphology and structural adaptations of honey bees
- d. Bee plants, pollen calender, collection of propolis and water
- e. Social organization, division of labour, comb building, communication in honeybees.

Unit -II Bee keeping practice

12 Hours

- a. Beekeeping- rearing equipments, honey bee species employed in rearing, queen rearing, bee nursing, seasonal management, migratory beekeeping.
- b. Flora and seasonal management
- c. Bee hive products- Honey and Wax extraction
- d. Honey- Chemical composition, medicinal importance and apitherapy
- e. Honey bee diseases, pests and predators and their control.
- f. Economics of apiculture.

VERMICULTURE

Unit-III : Vermiculture and earthworm biology 12 Hours

- a. History, scope and importance of vermiculture.
- b. Earthworm species and their role in vermiculture.
- c. Organic wastes- sources and their use
- d. Present status of vermiculture at global and national level.
- e. Vermiculture technology- Equipments, raw materials and steps involved in compost preparation
- f. Preparation of vermiculture pit- types of tanks

Unit- IV:- Management of vermicompost unit 12 Hours

- a. Management of verminary Unit- diseases, predators and their control.
- b. Management during different seasons
- c. Vermicompost- Vermicast and Vermiwash and their chemical composition
- d. Field applications of vermicompost
- e. Economics of vermiculture

Practicals:- **64 Hours**

- | | | |
|-----|---|----------|
| 1) | Morphological study of different castes of honeybee colony. | 4x 2= 08 |
| 2) | Study of honeybee species | 4x 2= 08 |
| 3) | Mounting of mouth parts, pollen basket and stinging apparatus | 4x 2= 08 |
| 4) | Testing for adulteration of honey | 4x 2= 08 |
| 5) | Spectrophotometer analysis of honey for its quality | 4x 2= 08 |
| 6) | Study of honeybee flora- nectar and pollen plants | 4x 1= 04 |
| 7) | Pest, predators, enemies of honey bees | 4x 1= 04 |
| 8) | Morphological study of earthworms | 4x 1= 04 |
| 9) | Analysis of solid waste for earthworm culture. | 4x 2= 08 |
| 10) | Pests, predators and enemies of earthworms. | 4x 1= 04 |

References:-

- 1) Mishra R C (1999). Perspectives in Indian Apiculture. Allied Scientific Publishers, Bikaner, India.
- 2) Srivastava (1979). Applied Entamology. Vol.II
- 3) Singh S (1962). Beekeeping in India. ICAR, New Delhi, India.
- 4) Snodgrass R E (1956). Anatomy of the Honeybee. Cornell University Press, Ithaca, New York.
- 5) Winston M (1984). The Biology of the Honeybee. Harvard Uni Press, London, U K

- 6) Shukla G S and Upadhyay V B (2007). Economic Zoology, 4th revised edn. Rastogi publications, Meerut, india.
- 7) Hand book of Biofertilizers and Vermiculture (2010). Published by Mr. Sudhir Gupta(Director) 4449, Nai Sarak, main road, Delhi, India-110006.
- 8) Sathe T V (2004). Vermiculture and Organic Farming. Daya Publishing House, Delhi.

II Semester
AZ 2.5 (Soft Core- 5)
ENDOCRINOLOGY (L3+T1+P0) 48 HOURS

Unit I:-

12Hours

- a) Hormones: chemical messengers: Autocrine, Paracrine and endocrine secretions, Types of hormones, an overview of human endocrine system
- b) Role of Hormones in homeostasis-Glucose and water balances
- c) .Neuro-endocrine integration; Milk ejection reflex
- d) .Methods in endocrinology studies- Principal and application of Histology and cytology, Bioassay , RIA, Immunohisto-chemistry, ELISA

Unit-II

12Hours

- a. Hormone synthesis-molecular aspects of peptide and steroid hormone, biogenic amine synthesis.
- b. Mechanism of hormone action: Regulation of receptor numbers, second messengers concept-cAMP,DAG,IP3 ,prostaglandins and calmodulin, RTK, Genomic action -regulation of gene expression.
- c. Termination of hormone action and metabolism of hormones.

Unit- III

12Hours

- a) Hypothalamo-hypophysial system in mammals- Structure and function of endocrine hypothalamus, chemical structure and control of hypothamic hormones. pituitary gland development, Hypothalamo-hypophysial portal system. Pituitary hormones and their physiological actions.Feedback regulation.Pathophysiology.
- b) Pineal- Morphology and physiological actions of melatonin

Unit- IV

12Hours

- a) Structure and biosynthesis and actions of hormones of Thyroid, parathyroid and adrenal gland
- b) Gastro intestinal hormones
- c) Endocrine pancreas- Structure and secretions of hormones. Mechanisms of action of insulin. Diabetes mellitus-Types, symptoms, diagnosis and management
- d) Insect and crustacean hormones with special reference to reproduction

Reference

- 1) Bolander Jr F.F. (2004) Molecular Endocrinology Third Edition. Academic press. SanDiego
- 2) Goodman. H.M (2003) Basic Medical Endocrinology. Third Edition. Academic press Sandiego

- 3) Negi. C.S (2009) Introduction to Endocrinology. PH1 learning PvtLtd. New Delhi. Norris D.O.(2006) Vertebrate Endocrinology. Third Edition. Avademic press.Sandiego.
- 4) Highnam, K.C and Hill L. 1977. Comparative Endocrinology of Invertebrates.Edward Arnold Ltd/ London.

II Semester

AZ 2.6 (Soft Core- 6)

ANIMAL BEHAVIOR (L3+T1+P0)

48Hours

Unit -I:

12Hours

Descriptive versus experimental approaches
 Reflexes and complex behaviour- Latency, after discharge, summation, warm up, fatigue inhibition and feedback control
 Instinctive Behaviour- Fixed action pattern, Types of sign stimuli and releasers as triggers, Genetic basis of instinctive behavior.

Unit -II:

12Hours

Learning - Classical conditioning experiment, latent and insight learning. Social learning, learning sets and play.
 Development of behavior- Causes of behavioural changes during development, development of bird song.
 Importance of early experience- critical period- Filial imprinting, Sexual imprinting in birds, Imprinting like process in mammals.

Unit -III:

12Hours

Foraging and anti-predator behavior: Anti-predator- avoiding detection through colour and markings (Mullerian mimicry); Warning colouration; Batesian mimicry
 Biological communication: Forms of signals, vision, audition and chemicals

Unit -IV: Sexual Behavior

12Hours

Hormones and sexual behavior- Selected examples of courtship and mating behavior. Pheromones in Insects and Mammals; Lee Boot, Whitten, Bruce, Collidge and Castro-Vandenbargh effects; Selected examples of courtship and mating behavior; Social organization: Introduction, Advantages of grouping; Social organization in insects with special reference to ants and honeybees; Social organization in sub human primates
 Altruism

References

1. Goodenough J E, Mc Guire B and Wallace R A (1993) Perspectives on Animal Behaviour. John Wiley and sons, New York.
2. Manning A. and Dawkins M S (1997).
3. Tinbergen (2006) Social behavior in animals. J.V. Publishing House Jodhpur India.
4. Vandenbergh J E (Ed) (1983). Pheromones and Reproduction in mammals. Academic Press. New York.

II Semester

AZ 2.7 (Open Elective 1.1)

PARASITOLOGY (L3+T1+P0)

48Hours

Unit I: Introduction to Parasitology

12 Hours

- a) Definition and types of parasites, Significance, General properties of parasites and parasitic environment like alimentary canal, Blood, Lymph and tissues, etc.
- b) Morphology, Mode of infection, disease caused , Symptoms and Preventing measures of following parasites, *Trypanosoma*, *Plasmodium*, *Balantidium* and *Entamoeba histolytica*

- Unit II: Helminthes 12 Hours
- a) Morphology, mode of infection, disease caused, Symptoms and preventive measures of Tape worm, Liver fluke, *Ascaris* and Filarial worm.
 - b) Ectoparasites: Morphology and Behaviours of Ticks, Mites, Bedbugs, Headlouse and Mosquitoes

- Unit III: Parasitic Adaptations 12 Hours
- a) Parasitic adaptations in *Plasmodium*, *Entamoeba histolytica*, Tapeworm, Hook worm, *Ascaris*, Liver fluke, Filarial worm, Mosquitoes and Leech.

- Unit IV: Immuno- Parasitology 12 Hours
- a) ImmUnity against parasites, Parasitic antigen, Antiparasitic responses, Evasion of immUnity, vaccination and diagnosis.

Reference

1. Chandler A C and Read C P (1961). An introduction to Parasitology. Wiley International Tokyo
2. Smyth J D (2005). Animal Parasitology. Cambridge University Press, New York.

II Semester AZ 2.8 (Open Elective 1.2) ORNITHOLOGY (L3+T1+P0)

48Hours

- Unit I: Introduction 12 Hours
- a. Origin of birds- Theropod and Dinosaur Hypothesis
 - b. Specialized adaptive features, respiration, digestive system, food habits, vision.
 - c. Birds of Karnataka,
 - d. Important migratory birds of India.

- Unit II: Biogeography of Birds 12 Hours
- a) Birds of India
 - b) Habitats
 - c) Economic importance of birds- useful and harmful agriculture birds.

- Unit III: Feathers and Flight 12 Hours
- a) Structure of feathers, types of feathers, Adaptation for flight
 - b) Migration and navigation, bird ringing, radio telemetry in ornithology

- Unit IV: Birds Behavior 12 Hours
- a) Territorial and colonial behavior
 - b) Communication in birds
 - c) Reproductive behavior, mating, nests, eggs pre and post fertilization, incubation, hatching and parental care.

Tutorials:

1. Identifying local birds
2. Recording feeding habits.

Reference

1. Salim Ali, Birds of India, BNHS Bombay.

III Semester A.Z 3.1 (Hard Core - 7) ANIMAL HUSBANDRY (L3+T0+P2) 48 Hours

Unit I: -Poultry 12 Hours

- a) History and scope of poultry Science
- b) Classification and systematic position of poultry birds
- c) Commercially important breeds of poultry, Turk lings and Ducks.
- d) Poultry breeding: Principles, Techniques and methods
- e) Poultry farming, types of farm houses and equipments
- f) Hatcheries and its importance
- g) Growers, layers and Broilers ration in poultry farming.
- h) Poultry feed; raw materials, feed/ration manufacture, nutritional requirements of breeding chicks, broilers and layers
- i) Poultry management, diseases and their control and vaccination.
- j) Poultry products: egg, meat and other by-products and their economic Importance
- k) Nutritional value of egg and meat.

Unit II:- Diary farming 12 Hours

- a) History, scope and importance of Diary farming.
- b) Dairy breeds: Exotic and indigenous cattle breeds
- c) Buffalo breeds: Swamp and Riverine buffaloes
- d) Breeding programs: Methods of breeding and Artificial Insemination
- e) Nutritional requirements of dairy animals
- f) Fodder and Feeds

Unit III:- Dairy Management 12Hours

- a) Dairy management: Housing, care of calf, cow and bull
- b) Microbial and parasitic diseases and their control and vaccination
- c) Milk: Physico-chemical and biological properties of cow and buffalo milk, nutritional value.
- d) Processing, preservation and marketing of milk
- e) Milk products and their economic importance

Unit IV:- Sheep, Pig and rabbit farming 12 Hours

- a) Sheep farming: Breeds/races used in sheep farm.
- b) Sheep rearing techniques, Food and Fodder and its economics.
- c) Piggery: Rearing of pigs and meat production.
- d) Economics of piggery
- e) Rabbit culture: Rearing, management of Rabbit culture during different seasons
- f) Economics of Rabbit culture.

Practicals:

64 Hours

- 1.Morphological features of broilers, layers and breeders. 4x 1= 04
- 2.Quality parameters of chick egg. 4x 1= 04
- 3.Incubation of chick egg and candling of egg. 4x 2= 08
- 4.Estimation of protein, carbohydrate and lipid contents in chick egg. 4x 3= 12
- 5.Estimation of protein, carbohydrate and lipid contents in chicken meat. 4x 3= 12
- 6.Estimation of protein in milk. 4x 1= 04
- 7.Estimation of Fat in milk. 4x 1= 04

8. Tests for adulteration of milk products. 4x 2= 08
9. Estimation of protein, carbohydrates and lipid contents in sheep meat. 4x 2= 08

Reference

1. Banerjee, G.C. 1997. A Text Book of Animal Husbandry, 7th Edition, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
2. Mukherjee and Banerjee, 1998. Genetics and Breeding of Farm animals. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
3. Stephen Rere, 1988. Introduction to Animal Science, 1st Edition, UBS Publishers and Distributors, New Delhi.
4. Indian Society of Agriculture Science, Live Stock Economy of India. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
5. Sunil Kumar Das, 1994. Poultry production. CBS Publishers and Distributors, New Delhi.
6. Ensminger, 1992. Poultry Science. International Book Distribution Co., Lucknow.
7. Jagdish Prasad, 2000. Poultry production and Management. Kalyani Publishers, New Delhi.
8. Shukla, G. S and Upadhyay, V. B. 2007. Economic Zoology, 4th revised edn. Rastogi Publications, Meerut, India.

III Semester

A.Z 3.2 (Hard Core - 8)

ANIMAL BIOTECHNOLOGY (L2+T0+P2)

32 Hours

Unit-I:- Introduction to Animal Biotechnology

8 Hours

- a) Introduction to Animal Biotechnology- Animal models, alternatives to animal models. Regulation of animal research, clinical trials.
- b) Cell/ tissue culture- requirements and techniques of animal cell culture, tissue culture, organ culture, Hybridoma technology, tissue engineering
- c) Stem cells- types and sources of stem cells, stem cell cloning- embryonic and adult stem cells- potential of stem cell therapy.

Unit-II:- Genetic Engineering

8Hours

- a) Genetic engineering- concepts of recombinant DNA technology and scope, basic methodology-DNA modifying enzymes, vectors- viral, bacterial, cloning and expression of vectors, DNA transformation, methods of screening recombinant DNA
- c) Construction of cDNA and gene libraries- methods of labeling DNA, nick translation, random priming

Unit-III:- Cloning

8 Hours

- a) Cloning- cDNA cloning, human gene cloning- techniques of gene cloning, animal cloning.
- b) PCR technique- methods of DNA replication, PCR based mutations, types of PCR. Blotting techniques- Southern, Northern and Western blotting-DNA finger printing techniques and application- Artificial chromosomes- BAC, YAC, HAC.

Unit- IV:- Transgenic animals, Bio safety & bioethics

8 Hours

- a) Production and use of transgenic animals- methods of production of transgenic animals (with suitable examples). Transgenic animals- Biopharming- use of transgenic animals in life stock. Pharmaceuticals, therapeutic proteins
- b) Nano biotechnology- introduction, scope and importance.
- c) Bioethics and bio safety

Practical;

64 Hours

- 1) Isolation of genomic DNA rapid method using plant material. 4x 2= 08
- 2) Isolation of genomic DNA by chloroform phenol method using animal cell (Blood cells) 4x 2= 08
- 3) Agarose gel electrophoresis of DNA 4x 2= 08
- 4) PAGE for proteins/enzymes 4x 2= 08
- 5) Estimation of DNA by Diphenylamine method 4x 2= 08
- 6) Estimation of RNA by Orcinol method 4x 2= 08
- 7) Isolation of cloning vector 4x 2= 08
- 8) Restriction digestion 4x 1= 04
- 9) DNA ligation 4x 1= 04

Reference

- 1) William J Thieman (2009). Introduction to BIOTECHNOLOGY. 2ND Pearson Education Publishers
- 2) Wold and Primrose (2001) Principles of gene manipulation. 6th ED SB University press.
- 3) Glazer ANX Nikiad. OH (1995) Microbial biotechnology and Fundamentals of Applied Microbiology- Freeman Pubs.
- 4) Meenakshi Banerjee (2005) Biotechnology, APH publishing House New Delhi.

III Semester

A.Z 3.3 (Hard Core - 9)

IMMUNOLOGY & TOXICOLOGY (L2+T0+P2)

32 Hours

Immunology:

Unit 1 Fundamentals of Immunology

8 Hours

- 1.1 .History, development and scope of immunology
- 1.2. Immunity-classification-innate, acquired, active and passive immunity
- 1.3. Lymphoid organs-Primary and secondary lymphoid organs
- 1.4. Antigens and antibodies
- 1.5. Immune responses-Primary and secondary immune, humoral and cell mediated responses
- 1.6. The compliment system-Classical and alternative pathways

Unit II- Cells of Immunity

8 Hours

- 2.1. Major histocompatibility complex-MHC antigens, HLA Functions of MHC
- 2.2. Hypersensitivity-Types, prevention and treatment
- 2.3. Tumor immunology
- 2.4. Immunology of transplantation
- 2.5. Autoimmune diseases
- 2.6. Immunological techniques

Toxicology

Unit III:- Essentials of toxicology

8Hours

- 3.1 Definition, Scope of toxicology – Major subdivisions of toxicology
- 3.2 Factors influencing toxicity – Dosage, Route of exposure -species and strain differences , sex, age, environmental conditions.
- 3.3 .Toxicological evaluation, selection of test organisms – Acute and chronic toxicity tests. Nonacute toxicity tests.
- 3.4 Ecotoxicology and Environmental alteration of toxic substance, Biomagnifications,

- 3.5 Bioaccumulation and Bio-magnification
- 3.6 Variability of responses by biological systems.

Unit 1V:- Sources and cellular mechanism in Toxicology	8 Hours
4.1 Toxicity of pesticides and heavy metals, mode of exposure and their action.	
4.2 Sources and mode of action of plant toxins, Mycotoxins, microbial toxins.	
4.3 Metabolism, detoxification and excretion of toxic substances: Primary processes, conjugation systems.	
4.4 Tissue specific toxicity, hepato-cardiac, and renal toxicity,	
4.5 Genotoxicity.	
4.6 Treatment of toxicity - Principles of antidotal therapy.	

Practicals:	64 Hours
1. The concept of Blood grouping	4x 2= 08
2. Estimation of Total number of RBC count By Hemocytometer	4x 2= 08
3. Estimation of Total number of Leukocyte (WBC) Count By Hemocytometer	4x 2= 08
4. Differential counting of leucocytes by blood smear technique method.	4x 2= 08
5. Preparation and identification of hematin crystal in blood.	4x 1= 04
6. Bioassay by using chemicals on insect larvae.	4x 2= 08
7. Different extraction methods for plant Or Different techniques for plant extraction	4x 2= 08
8. Bioassay by using medicinal plants on insect larvae.	4x 2= 08
9. Evaluating lethal concentrations/dose by using Probit analysis software.	4x 1= 04

Reference:

1. Dulsy Fathima and Armugam N (2007) Immunology, Saras publication, Nagercoil
2. Reddy K R. Text book of Immunology. (2007). AITBS publishers Delhi
3. W. Dekant and H.G. Neumann (1992) Tissue - specific Toxicity: Biochemical mechanisms, Academic Press, Harcourt Brace Fovanovich, Publishers, London.
4. Loomis T. A. and A. Wallace Hayes (1996) Loomis's Essentials of Toxicology, IV edition, Academic Press Ltd., London.
5. P. D. Sharma, (1999) Toxicology, Rastogi Publishers Meerut.
6. Anna M. Fan and Louis W. Chang (Ed) (1996) Toxicology and Risk assessment : principles and methods and applications, Marcell Dekker publishers, New York
7. Wayland J. Hayer, Edward R. Laws (Ed) (1991) Vol. 1, 2, and 3, Hand book of pesticide Toxicology ,Academic press, California.
8. G .G. Habermehl (1981) Venomous animals and their toxins, Springer - Verlag, Benlin.
9. Kenji Urayuchi, Mikio Yamazaki (Ed) (1978) Toxicology, Biochemistry and pathology of Mycotoxins. Halsted press book Kadansha Ltd., Tokyo.
10. R. Prakash (Ed) (1989) Recent trends in Toxicology, Agarwal Printers, Meerut, India.
11. Charles A. Tyson & John M. Frazier (1993) Methods in Toxicology Vol.1 Academic Press, London.
11. F. Moriarty (1983) Ecotoxicology, II edition, Academic Press, London.
12. Shashi Kanth (1989) Trends in environmental pollution and pesticide toxicology, Jagmandar Book Agency, New Delhi
13. Duffus J. H. (1980) Environmental Toxicology, Edward Arnold Publishers London.

III Semester

AZ 3.4 (Soft Core - 7)

REPRODUCTIVE BIOLOGY (L3+T1+P0)

48 Hours

Unit-I : FEMALE REPRODUCTION

12 Hours

- a) Genetic and hormonal control of sex differentiation in mammal

- b) Mammalian ovary – Functional morphology : Hormonal control of follicular development – Recruitment and selection of follicles and follicular dominance
- c) Ovulation, Atresia, Regulation of corpus luteum
- d) Hormonal control of female reproductive organs

Unit-II: REPRODUCTIVE CYCLES IN MAMMALS

12 Hours.

- a. Over view-estrous and menstrual cycles
- b. Onset of puberty in human being, Hormonal control of menstrual cycle
- c. Implantation- Types and hormonal control
- d. Pregnancy- Gestation , hormonal control of gestation
- e. Parturition- Hormonal control
- f. Lactation- Hormonal control of mammary gland development and lactogenesis

Unit- III : MALE REPRODUCTION

12Hours

- a. Functional morphology of mammalian testis
- b. Kinetics of spermatogenesis – wave and cycle
- c. Hormonal control of spermatogenesis
- d. Brief description of histomorphology and hormonal control of male accessory organs viz., epididymis , vas deferens, seminal vesicles, ventral prostate, bulbourethral gland and preputial gland
- e. Sperm maturation – morphological and biochemical events, influence of accessory organ secretions
- f. Ultrastructure of spermatozoa
- g. Abnormalities of sperm
- h. Biochemistry of semen and capacitation

Unit- IV : FERTILITY CONTROL AND INVITRO FERTILIZATION

12 Hours

- a. Contraceptive techniques – Physical barrier methods, IUD, Hormonal methods Surgical methods.
- b. Termination of gestation
- c. Gamete specific antigens, antibody mediated fertilization block
- d. In vitro fertilization

Reference

1. Adler N.T (1981) Neuro-endocrinology of Reproduction, Physiology and Behaviour. Austin C .R and R.V Short (eds) (1972) Reproduction in mammals. (1) Germ cells and Fertilization (2) Embryonic and Foetal development (3) Hormones in Reproduction (4) Reproduction pattern (5) Artificial Control of Reproduction, Cambridge University Press, London.
2. Balin .H and Glasser S (eds) (1976) Reproductive Biology, ExpertaMedica, Amsterdam.
3. Barrington, E.J. W(1976) An Introduction to General and Comparative Endocrinology, Oxford University Press, London.
4. Bullgh, W .S (1951) Vertebrate Sexual Cycles. Ketuen, London.
5. Chester – Jones, I. Ingleton, P.M and Philips, J. G (1987) Fundamentals of comparative vertebrate endocrinology. Plenum press . N. Y
6. Frazer, J.F.D (1959) The sexual cycles of vertebrates. Hu Jones , R>E (1980) The vertebrate ovary . Comparative biology and evolution, Plentum press N.Y

7. Knobil, E and Neil J.D (1994) The Physiology of Reproduction , Vol.I& II Raven press N. Y
8. Paul Wassar man and Jimmy D. Neil (2005) Knogbil and neil's physiology of reproductive volume 1st ,2nd and 3rd edition
9. Moudal, N.R Yoshinaga K Rao , A.J and P .R Adiga (1991) Perspectives in primate reproductive biology. Wiley Eastern Ltd., New Delhi, Bangalore.
10. MuneethKainth(2005)Chordate Embryology, Domonant Publishers and Distributors, New Delhi.
11. RaghavendraPuri (2003) Mammalian Endocrinology Vol.I & II , Dominant Publishers and Distributors , New Delhi.
12. Saidapur R (2006) Reproductive cycles of Indian Vertebrates Allied publishers Ltd., New Delhi .
13. Sasidhara R (2006) Animal Biotechnology recent coacepts and development, MJP Publishers, Chennai.
14. Sawant K C (2001)Human Physiology 1st Edition Dominant Publishers and Distributors , New Delhi.
15. tchinson, University Library, London.
16. Hoganth, P. J (1978) Biology of Reproduction , Blakie Glasgow, U.K
17. Jones, R.E (1991) Human Reproductive Biology press N Y

III Semester

AZ. 3.5 (Soft Core - 8)

SERICULTURE (L3+T1+P0)

48 Hours

Unit- I Introduction to silkworm biology	12 Hours
<ul style="list-style-type: none"> a. Introduction to sericulture- Origin and history of sericulture- scope of sericulture Silk Road. b. Mulberry and Non mulberry silk worms- complete metamorphosis endocrine control of metamorphosis c. Silkworm rearing- rearing equipments- incubation of silkworm eggs mulberry leaves for silkworms- environmental factors for silkworm rearing 	
Unit- II Silk worm egg production	12 Hours
<ul style="list-style-type: none"> a. Silkworm egg production- Grainages- mother moth examination- oviposition- acid treatment b. Silkworm seed organization- seed areas c. Silkworm races/breeds- classification- univoltine races, bivoltine and multivoltine d. Pests and diseases of silkworms and their management- Pebrine, Grasserie, Flacherie and Viral diseases- Uzifly and their management 	
Unit-III Commercial charactes of cocoons	12 Hours
<ul style="list-style-type: none"> a. Physical and commercial characteristics of cocoons- cocoon sorting- cocoon stifling- cocoon cooking. b. Cocoon reeling- different methods of reeling- reeling water, re-reeling. c. Raw silk properties- Testing of silk fibers d. Silk exchange, weaving and dyeing of silk. 	

Unit-IV By products of silkworm industry

12 Hours

- a. By products of sericulture industries and their utilization- spun silk, silk wastes
- b. A brief account of sericulture biotechnology- utilization of larva, pupa and raw silk in sericulture biotechnology
- c. Employment generation from sericulture- industry
- d. Extension and sericulture

Reference

1. Krishnaswami S (1990). New technology of silkworm rearing. Central silk board Bangalore.
2. Jolly.M.S.(1987) appropriate sericulture techniques. International Centre for Trading and Research in Tropical Sericulture, Mysore.
3. Text book of Tropical Sericulture (1975") Japan Overseas Corporation Volunteers.

III Semester

AZ 3.6 (Open Elective 3.1)

BASICS OF ZOOLOGY (L3:T1:P0)

48 Hours

Unit: 1 Cell structure

12 Hours

- a. Structure of animal cell.
- b. Structure and function of Plasma membrane, Mitochondrion, Endoplasmic reticulum.
- c. Structure and function of Golgi complex, Ribosomes Lysosomes and Nucleus.
- d. Morphology and types of chromosomes.

Unit: 2 protozoa to cnidaria

12 Hours

- a. Principles of animal classification. Binomial nomenclature.
- b. General characters and classification of Protozoa upto classes with examples.
- c. General characters and classification of Porifera upto classes with examples.
- d. General characters and classification of Coelenterata upto classes with examples.

Unit; 3:- Helminthes

12 Hours

- a. General characters and classification of Platyhelminthes upto classes with examples.
- b. General characters and classification of Aschelminthes upto classes with examples.
- c. General characters and classification of Annelida upto classes with examples.
- d. General characters and classification of Arthropoda upto classes with examples.

Unit: 4:- Chordata

12 Hours

- a. General characters and classification of Mollusca upto classes with examples.
- b. General characters and classification of Echinodermata upto classes with examples.
- c. General characters and classification of Chordata upto subphyla with examples.
- d. General characters and classification of Vertebrata upto classes with examples.

References:

1. Ekambaranth Iyer, Invertebrate Zoology
2. Ekambaranth Iyer, Vertebrate Zoology

3. Verma and Jordon, Invertebrate Zoology, Himalaya Publication
4. P K Gupta, Chordate Zoology Chand & Co.
5. Parker and Haswell, Invertebrate Biology,
6. Powar C B, Cell Biology, Himalaya Publications.

III Semester
AZ 3.7 (Open Elective 3.2)
SERICULTURE TECHNOLOGY (L3+T1+P0)

48 Hours

Unit - I

12 Hours

- a. Classification of sericigenous insects, characteristics features of the order Lepidoptera , detailed study of families - saturnidae and Bombycidae - life Cycle of Bombyxmori, life cycle of non mulberry silkworms metamorphoses.
- b. Classification of silkworm based on moultnism, voltinism and Geographical distribution - popular silkwprms breeds and hybrids in India.
- c. Morphology and Anatomy of silk gland and reproductive system.

Unit-II

12 Hours

- a. Silkworm rearing - Rearing operation - incubation of eggs, brushing, young and Late - age rearing, environmental requirements - feeding cleaning, spacing - Moulting - care during moulting - moulting and spinning - cocoon harvesting.
- b. Silkworm seed organisation and its significance - seed area - Grainage operations - egg preparation - Hibernating and non hibernating eggs - mother moth examination

Unit- III

12 Hours

- a. Pests and Diseases of silkworm - Management - Microsporidian (Pebrine) Bacterial (Flacherie), viral (Grassarie) and Fungal diseases of silkworm B. mori - and integrated Management of silkworm diseases - Disinfection and disinfection methods - pests of silkworm.
- b. Silk reeling technology - cocoon marketing - cocoon cooking - cocoon reeling - Re reeling and packing - quality of water for reeling

Unit- IV

12 Hours

- a. Seri Biotechnology - By products of sericulture industry - silkworm as a bioreactor for the production of antibacterial proteins - Baculovirus vectors in silkworm
- b. Utilization of pupa for the production of madinally important fungal strains - utilization of silk for the production cosmetics material. Transgenic silkworm - molecular mechanism of silk protein synthesis

Reference

- a. Krishnaswmi S (1990) New Technology Of Silkworm Rearing, Central Silk Board Bangalore.
- b. Jolly .M.S (1987) Appropriate Sericulture Techniques, International Centre For Training And Research In Tropical Sericulture, Mysore
- c. Text book of Tropical Sericulture (1975) Japan Overseas Corporation Volunteers.

IV Semester
AZ 4.1 (Hard Core -11)
BIODIVERSITY (L2+T0+P2)

32 Hours

Unit- 1 BIODIVERSITY CONCEPTS: 8 Hours
Genetic Diversity, Species diversity, Ecosystem diversity. Importance of Biodiversity.
Biodiversity from a taxonomic and Evolutionary perspective.
Uniqueness of Indian Wildlife
Endemism and Biodiversity

Unit-II BIODIVERSITY AND ECOSYSTEM FUNCTIONING 8Hours
Ecosystem development - Trophic levels, Energy nutrient relationships, Biotic succession, Ecotone and Edge.
Keystone Species and Species interactions - Competition and community Organization
Zoogeographical regions of the World
Biodiversity hotspots

Unit- III WIDL LIFE HABITATS AND RELATED ASPECTS 8 Hours
Biome essays- Arctic and Alpine systems, tropical and temperate forests, boreal forests, Tundra, Coastal ecosystems, coral reefs, Mangrove system, Esturian system, Lakes and rivers, caves, mountains and deserts
Concept of Niche, Territory and Home range
Sources of Information - Botanic Garden, Zoo- garden, Aquaria
Gene Bank and sequence Data Bank

Unit- IV: BIODIVERSITY ASSESSMENT: 8Hours
Diversity Index (Shannon- Weaver) and Dominance Index (Berger- Parker and Simpson)
Species heterogeneity Index and Species richness Index
Evenness Index, Breadth of Utilization and Jaccard Index
Sequential Comparison Index and Goodnight and Whitley's Index.

Practicals: 64 Hours

1. Estimation of Biodiversity on a following transect and quadrat method. 4x 2= 08
2. Study of Avian diversity in agricultural area/undisturbed area/Mountain area. 4x 2= 08
3. Study of insect diversity on a insect in agricultural field/undisturbed area/wild. 4x 2= 08
4. Study of wildlife and birds in a National park/Sanctuary/Zoo/Western Ghats. 4x 2= 08
5. Study of Ichthyofauna in local market/along the plane/forest zone. 4x 2= 08
6. Study of Butterfly diversity along the campus/city 4x 3= 12
7. Study of Ants diversity in field ecosystem. 4x 3= 12
8. Visit to various National Research Institutes of Zoological importance /Animal Breeding Centers/Fishery Research Institute.

1. Field Visit to observe and record different types of Ecosystem- Evergreen Forest, Sholes Forests, Deciduous Forest, Mangrove, Greelands.
2. Visit to Biodiversity hottest hot spot- Western Ghat.
- 3.

Reference

1. Burt. W. H. (1943) Territoriality and Home range concepts a applied to mammals J. Mam. 24: 346-352.
2. Sagreiya . K. P. (1967). Forests and Forestry, National Book Trust, India.
3. Schaller. G. B. (1967). The Deer and The Tiger, University of Chicago press, Chicago.

4. Giles. R. H. (1971) Wild life management techniques, the wildlife Society, Washington Dc. III Edn.
5. Prater. S. H. (1971). The book of Indian animals. Bombay Natural History Society.
6. Shaw. J. H. (1975) Introduction to Wildlife Management, MC Graw Hill, New York.
7. Wilson . E. O. (1975). Sociology the new synthesis, Belknap Press, Cambridge Mass US.
8. Mukherjee. A. K. (1982). Endangered animals of India, Zoological Survey of India, Calcutta.
9. Saharia. V. B. (1982) Wildlife in India, Natray Publishers.
10. Miller. S. D and Everett D. D., Seidensticker. J (1986) Large Carnivores and Consequences of habitat insulasazation ecology and conservation of tigers in Indonesia and Bangladesh.
11. Daniel. J. C and Gerrao J. S. (1990) Vegetation types of India in relation to environmental conditions In: Conservation in developing countries, problems and prospects eds., Bombay Natural History Society, Bombay.
12. Nair, S.M (1992) Endangered animals of India and their Conservation, National Book Trust, India.
13. Negi S. S (1993) Biodiversity and its conservation in India, Indus Pub Co.
14. Canghaiy, Graeme and Sinclair, Anthony R. E (1994) Wildlife Ecology and management, Blackwell Scientific Pub.
15. V. H. Heywood and R. T. Watson (1995). Global Biodiversity Assessment published United National Environmental programme, Cambridge University Press.
16. R. K. Sinha (1996) . Biodiversity Global Concerns, Common Walth Publishers.
17. Charles G. Scalet, L.D. Flake and D. W. Willis (1996) Introduction to wildlife and fisheries - an integrated approach.

Primack. R. B. (1999) Essentials of conservation Biology, Sunderland, Boston University,
Massichersettes U.S.A

IV Semester

AZ 4.1 (Soft Core -10)

ZOO MANAGEMENT (L2+T2+P0)

32 Hours

Unit - I

8Hours

The concept of zoos - Definition, principles of animal collection and their maintenance, Historical development of concept of zoo, Modern zoos, significance of zoo(Educational, Recreational and Conservational), Zoo legislation - National Zoo rules - 1992, National Zoo Policy 1998

Design of Zoos - Types of Zoos - Large, Medium and Small, Housing of Animals in the zoos, Types of enclosures, Construction and design of Zoos, Types of visitors and safety of visitors and management.

Unit-II

8 Hours

Management of animals in captivity - Management of Mammals , Birds, Reptiles, Amphibians, Fishes and Invertebrates, Butterfly parks

Animals which requires special care with one case study from each group - Birds, Marsupials, Eutherian Mammals, Primates Herbivorous and Carnivorous Mammals

Unit- III

8 Hours

Diseases of Zoo Animals and their control – Viral, Bacterial, Protozoan and Fungal, Veterinary parasites – Bacterial, Protozoan, Helminthes and insects. Infectious diseases of Zoo animals, their transmission and control, Vectors of zoo animals – insects and non insects. Accidents and trauma, Tranquilization.

Animal food and nutrition – Nature of zoo diet, Food for herbivorous animals – composition of fresh food, artificial food, important nutrients, procurement of food. Food for carnivorous animals – composition, nutrients, procurement, Feeding methods, feeding equipments, Food contaminants, Storage and preservation of different types of food, Food Safety and hygiene.

UNIT- IV

8 Hours

Breeding and Management of zoo animals – Preparation of breeding plants, conservation and management of animals under the verge of extinction. Breeding and reproduction of animals in captivity, creating conditions for breeding various animals, collection and storage of sperms, Natural and Artificial insemination, care of pregnant animals and new born

Collection, translocation and procurement of zoo animals, veterinary care, nutrition and feeding during collection and transportation, creation of natural environments for different animals, construction of hideouts and safety places, modern methods of feeding, nursing and maintenance of animals.

Tutorials:

16 Hours

1. Visit to Bannerghatta Zoo, Shimoga (Tyavarekoppa) Lion safari.
2. Visit to Mysore Zoo:- Observation of animal housing, kitchen and zoo hospital
3. One or two visits could be made to Mysore Zoo exclusively to observe the behavior of animals in the cages.

Reference:

1. Miller, S. D and Everett D. D., Seidensticker, J (1986) Large Carnivores and Consequences of habitat insularization ecology and conservation of tigers in Indonesia and Bangladesh.
2. Daniel, J. C and Gerrao J. S. (1990) Vegetation types of India in relation to environmental conditions In: Conservation in developing countries, problems and prospects eds., Bombay Natural History Society, Bombay.
3. Nair, S.M (1992) Endangered animals of India and their Conservation, National Book Trust, India.
4. Negi S. S (1993) Biodiversity and its conservation in India, Indus Pub Co.
5. Coughley, Graeme and Sinclair, Anthony R. E (1994) Wildlife Ecology and management, Blackwell Scientific Pub.
6. V. H. Heywood and R. T. Watson (1995). Global Biodiversity Assessment published United National Environmental programme, Cambridge University Press.
7. R. K. Sinha (1996) . Biodiversity Global Concerns, Common Walth Publishers.
8. Charles G. Scalet, L.D. Flake and D. W. Willis (1996) Introduction to wildlife and fisheries – an integrated approach.

IV Semester

AZ 4.2 (Soft Core -11)

VECTOR BIOLOGY (L3+ T1 + P0)

48 Hours

Unit- I vector born diseases

12 Hours

- a. Introduction to vector borne disease and vectors- World scenario; Indian scenario.

- b. Historical perspective- Epidemics, discoveries; Scientists and major events involved in the discovery of vectors and pathogens of communicable diseases
- c. Epidemiology, biology of vectors and pathogens, transmission cycles and symptoms of malaria, filariasis, yellow fever, leishmaniasis and anthrax.

Unit- II;- Protozoan pathogens

12 Hours

- a. Epidemiology, biology of vectors and pathogens, transmission cycles and symptoms of dengue, chikungunya, japons encephalitis, schistosomiasis and plague.
- b. Distribution, epidemiology and control of yellow fever, African sleeping sickness, oncocerciasis and chagas disease

Unit- III Vectors

12 Hours

- a. Mechanical Vectors – House flies, cockroaches and bedbugs-life cycle & mode of infection transfer.
- b. Transmission of dysentery, diarrhea, typhoid, cholera, epidemic conjunctivitis and skin infections.

Unit- IV:- Control of vector borne diseases

12 Hours

- a. Control of vector borne disease; Vector control – Chemical, Biological, Genetic and Environmental methods
- Insecticide resistance in Vectors. Drug resistance in pathogens. Importance of education, awareness and Community participation.

Reference

1. Clements, A.N., 1992. The biology of Mosquitoes, Vol-I Chapman and Hall, London.
2. Clements, A. N., 1999. The Biology of Mosquitoes, Vol- II, Chapman and Hall, London.
3. Fenemore, P.G and Alka Prakash., 1992. Applied Entomology, Wiley Eastern Ltd., New Delhi.
4. Gullan, P.J and Cranston. 1994. The Insects: An outline of Entomology, Chapman and Hall, London.
5. Kenneth, G.V. Smith, 1973. Insects and other arthropods of medical importance. Trustees of British Museum, London.
6. Manson- Bahr, P.E.C and Bell, D.R., (Ed) 1987. Manson's tropical diseases. English Language Book Society, Barillien Tindall.
7. Metcalf, R.L and W. B. Flint. 1962. Destructive and useful insects, their habits and control. McGraw Hill Publ. Co., New York.
8. Rao, T.R., 1984. The Anophelines of India. Publ. by Malaria Research Centre, New Delhi.
9. Service, M.W., 1976. Mosquito Ecology. Applied Science Publication Ltd., London.
10. Srivastava, K.P., 1988. A Textbook of Applied Entomology. Publ. Kalyani Publishers, New Delhi.
11. WHO (Geneva), 1989. Geographical distribution of arthropod borne diseases and their principal vectors. WHO. Geneva.

SC 11 & SC 12: PRJ: Major Research Project (L0+T2+ P6)

Every M. Sc., Student has to carryout independent Major Research project during the M Sc., programme compulsorily. Major Research Project work should be initiated in the 3rd Semester and

at the end of 4th Semester after the submission of Dissertation/ major research Project report, it should be evaluated with project presentation and viva.

Theory question paper Pattern

Duration 3 Hours

Max. Marks: 70 M

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|--|-------------------------|
| I. Answer all questions (Two questions from each unit) | 2x 8 = 16Marks |
| II. Answer any five of the following
(Eight questions to be set with two questions in each unit) | 6x 5 = 30 Marks |
| III. Answer any two of the following
(One question in each unit) | 12x 2 = 24 Marks |

Practical examination Pattern

Duration: 4 Hours

Max. Marks: 70

- | | |
|---------------------------------|-----------------|
| I. Major experiment | 25 |
| Marks | |
| II. Minor Experiment | 20 Marks |
| III. Experiment/ Comment | 15 Marks |
| IV. Viva | |

10Marks