Madras Christian College(Autonomous)

East Tambaram, Chennai 600059

Department of Zoology

B.Sc. ZOOLOGY

&

B.Sc. ZOOLOGY VOCATIONAL- Syllabus

CBCS Curriculum for students admitted from 2014- 2015 onwards)

Revised Curriculum

Madras Christian College, **Dept. of Zoology** : **B. Sc.(vi) Zoology** Curriculum for students admitted from 2014-2015 onwards

Semes	Paper	Title	Hrs	Credit	CA	ESE
I	1	**PART I - Tamil**	4	3	50	50
	2	**PART II** - English	4	3	50	50
	3	**PART III a. MAJOR -**Animal Life I	6	5	50	50
	4	-Microbiology	4	5	50	50
	5	**PART III c. ALLIED – I –** Botany I *(Zoology I)*	4	3	50	50
		- Practical	2	2	--	--
	6	**PART IV a. BT/AT/NM –(**Life style RelatedAilments)	4	2	50	50
		PART IV d. VALUE EDUCATION	2	1	--	--
II	7	**PART I - Tamil**	4	3	50	50
	8	**PART II** - English	4	3	50	50
	9	**PART III a. MAJOR -**Animal Life II	6	5	50	50
	10	- Animal Life & Microbiology Practical	4	5	50	50
	11	**PART III c. ALLIED – I -** Botany II (*Zoology II)*	4	3	50	50
	12	**-** Practical	2	2	50	50
	13	**PART IV a. BT/AT/NM**	4	2	50	50
	14	**PART IV d. VALUE EDUCATION**	2	1	50	50
III	15	**PART I - Tamil**	4	3	50	50
	16	**PART II** - English	4	3	50	50
	17	**PART III a. MAJOR-**Cell Biology & Dev. Biology	6	5	50	50
	18	Endocrinology	4	5	50	50
	19	**PART III c. ALLIED II –** Biochemistry I	4	3	50	50
		Practical	2	2	--	--
	20	**PART IV b.SKILL BASED-**Personality Development	2	--	--	--
		PART IV b. Inter Disciplinary– Wild Life Management	4	3	50	50
IV	21	**PART I - Tamil**	4	3	50	50
	22	**PART II** - English	4	3	50	50
	23	**PART III a. MAJOR-** Mole. Bio &	6	5	50	50
	24	Molecular Genetics Cytogenetics	2+2	5	50	50
	25	+Develop.Bio &Endocrinology Prac	4	3	50	50
	26	**PART III c. ALLIED – II –**	2	2	50	50
	27	Biochemistry II	2	3	100	--
	28	Practical	4	3	50	50
		PART IV b.SKILL BASED-Personality Development				
		PART IV c. Environmental Studies				
V		**PART III a. MAJOR**				
	29	Biotechnology	5	4	50	50
VI		**PART III a. MAJOR**				
	35	Animal Physiology & Immunology	7	5	50	50

30	Biophysics, Evolution & Animal Behavior 2+2+2	6	4	50	50
31		5	4	50	50
32	Bioinformatics, Biostatistics Biotechnology, Bioinformatics, Pract	2+2	4	50	50
	PART III b. ELECTIVES				
	a)Agricultural Entomology / Seri-biotechnology	2	2	--	--
	b)Bioprocess Engineering & Technology /Vermitechnology	2	2	--	--
33		4	2	50	50
34	**PART IV b. SKILL BASED – (*Vermiculture)***	2	3	50	50
	PART IV b. SKILL BASED-Computer Basics				
36	Environmental Biology & Biodiversity	7	4	50	50
37	Animal Physiology & Immunology and Environmental Biology & Biodiversity Practical	3+3	4	50	50
	PART III b. ELECTIVES				
38	**a)**Agricultural Entomology / Seri-biotechnology	3	3	50	50
39		3	3	50	50
40	**b)**Bioprocess Engineering & Technology /Vermitechnology	2+2	2+2	50	50
	c) On-site Training of (a) & (b)				
		--	1		
	V –EXTENSION ACTIVITIES –				

Part V – Extension Activities:- Service Learning-2Hrs./Physical Education-2Hrs./Dept. Assn. activity-1Hr/NCC-1Hr./NSS-Hr./Sports-Hr/Scrub Society-1Hr.

Part III a. Major	15 courses	70 credits
Part III b. Electives	3courses	15 credits
Part III c Allied	4 courses	20 credits

Revised Curriculum

Madras Christian College, Dept. of Zoology : B. Sc.(vi) Vocational Industrial Fish & Fisheries -

Curriculum for students admitted from 2014-2015 onwards

Semes	Paper	Title	Hrs	Credit	CA	ESE
I	1	**PART I - Tamil**	4	3	50	50
	2	**PART II** - English	4	3	50	50
	3	**PART III a. MAJOR -**Animal Life I	6	5	50	50
	4	-Microbiology	4	5	50	50
	5	**Part III b. Elective - Vocational-** Fish BiologyTheory + Practical	4+2	4	50	50
	6	**PART IV a. BT/AT/NM –(***Biotechnology & Ethics)*	4	2	50	50
		PART IV d. VALUE EDUCATION	2	1	--	--
II	7	**PART I - Tamil**	4	3	50	50
	8	**PART II** - English	4	3	50	50
	9	**PART III a. MAJOR -**Animal Life II	6	5	50	50
	10	- Animal Life & Microbiology Practical	4	5	50	50
	11	**Part III b. Elective - Vocational-** CaptureFisheries Theory+ Practical	4+2	4	50	50
	12	**PART IV a.BT/AT/NM**	4	2	50	50
	13	**PART IV d. VALUE EDUCATION**	2	1	50	50
III	14	**PART I - Tamil**	4	3	50	50
	15	**PART II** - English	4	3	50	50
	16	**PART III a. MAJOR-**Cell Biology & Dev. Biology	6	5	50	50
	17	Endocrinology	4	5	--	--
	18	**PART III c. ALLIED II –** Biochemistry I	4	3	50	50
		Practical	2	2	--	--
	19	**PART IV b.SKILL BASED-**Personality Development	2	--	--	--
	20	**Part III b. Elective Vocational-** AquacultureTheory + Practical	4+2	4	50	50
IV	21	**PART I - Tamil**	4	3	50	50
	22	**PART II** - English	4	3	50	50
	23	**PART III a. MAJOR-** Molecular Biology &	6	5	50	50
	24	Genetics Cytogenetics +Develop.Bio	2+2	5	50	50
	25	&Endocrinology Prac**PART III c.**	4	3	50	50
	26	**ALLIED – II –** Biochemistry II	2	2	--	--
	27	Practical	2	3	100	--
	28	**PART IV b.SKILL BASED-**Personality Development	4	2	50	50
		PART IV c. Environmental Studies				
V		**PART III a. MAJOR**				
	29	Biotechnology	5	4	50	50
	30	Biophysics, Evolution & Animal Behavior 2+2+2	6	4	50	50
VI		**PART III a. MAJOR**				
	36	Animal Physiology & Immunology Environmental	7	5	50	50
	37	Biology & BiodiversityAnimal	7	4	50	50

31	Bioinformatics, Biostatistics	5	4	50	50	38	Physiology & Immunology & Environmental Biology & Biodiversity Practical	3+3	4	50	50
32	Biotechnology, Bioinformatics, Pract	2+2	4	50	50						
	PART III b. ELECTIVES- Vocational										
33	**Fish Diseases & Post Harvest Technology The + Prac**	4+2	4	50	50	39	**PART III b. ELECTIVES - Vocational**	4+2	5	50	50
34	**Part IV b.SKILL BASED** Entrepreneurship program	4	3			40	Aquarium Science Theory + Practical Fish Biotechnology Theory + Practical	4+2	5	50	50
35	**PART IV b. SKILL BASED-Computer Basics**	2	3	50	50	41	**V –EXTENSION ACTIVITIES –**	--	1		

Part V – Extension Activities:- Service Learning-2Hrs./Physical Education-2Hrs./Dept. Assn. activity-1Hr/NCC-1Hr./NSS-Hr./Sports-Hr/Scrub Society-1Hr.

Part III a. Major	15 courses	70 credits
Part III b Electives	6 courses	25 credits
Part IIIc Allied	3 courses	10 credits

B.Sc. (vi) –SEMESTER I – Part III a MAJOR

ANIMAL LIFE I ***6 Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I

Introduction to Animal Kingdom. Outline classification, major hierarchies. Definition of Taxonomy, systematics, classification, identification, nomenclature, International code of Zoological Nomenclature & International Congress of Zoology and International Commission on Zoological Nomenclature

UNIT II

Phylum : Protozoa

General characters and classification up to the classes with examples. Type Study: *Plasmodium* sp. Life cycle, different species, symptoms, health care, control measures. Protozoan parasites and disease: *Leishmania, Entamoeba, Trypanosoma, Balantidium.*

UNIT III

Phylum: Porifera

General characters and classification upto the classes with examples.

Type Study: *Sycon sp.* Reproduction of sponges, Gemmules, Canal system of sponges.

UNIT IV

Phylum: Coelenterata

General characters and classification upto the classes with examples.

Type Study: *Aurelia sp.*

Corals and coral reefs.

UNIT V

Phylum: Platyhelminthes

General characters and classification upto the classes with examples.

Type Study: *Taenia solium*

Common Cestode and Trematode parasites of man.

UNIT VI

Phylum: Aschelminthes

General characters and classification upto classes with examples.

Type Study: *Wuchereria bancrofti*

Common nematode parasites of man.

UNIT VII

Phylum: Annelida

General characters and classification upto classes with examples.

Type Study: *Megascolex sp.*

Vermiculture.

UNIT VIII

Phylum: Arthropoda

General characters and outline classification

Type Study: *Periplaneta sp.*

Economic importance of insects in relation to agriculture and human health.

UNIT IX

Phylum: Mollusca
General characters and classification with examples.
Type Study: *Pila sp.* Pearl culture

UNIT X

Phylum : Echinodermata
General characters and classification with examples
Type Study: *Asterias*
Water - vascular system, Larval forms of Echinodermata.

UNIT XI

Phylum: Hemichordata
General characters and classification with examples.
Type Study: *Balanoglossus sp.* Phylogenetic significance.

***Reference Books**:*

Hickman, Jr.C.P. 1981 Integrated Principles of Zoology 7th Ed.
Terera Andesirk and Gerald A 1990 Biology Life of earth
Ayyar, E.A., Manual of Zoology Part I
Jordan E.L. 2004 Invertebrate Zoology Chand & Co
Jordan and Verma 2006 Invertebrate Zoology, Chand & Co
Kotpal series, Rastogi Publication

B.Sc. (vi) - SEMESTER I – PART III a MAJOR

MICROBIOLOGY **4 *Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

Objective: To expose the students to various micro-organisms and their applied aspects.

UNIT I

History of Microbiology

Pasture, Listen, Alexander Flemming - General Classification of microorganisms - Salient features of bacteria, viruses, algae, fungi, and yeast.

UNIT II

Structure of the Bacterial cell - cell wall - Gram +ve and – ve.

Bacterial photosynthesis, Respiration - aerobic and anaerobic,. Fermentation/ nutrition and growth. Reproduction, genetic transfer system in microbes.

UNIT III

Industrial Microbiology: Microbes in the production of alcohol and antibiotics.

Dairy microbiology: Microbiology of milk and milk products, milk-borne diseases.

Agricultural microbiology: Nitrogen cycle, phosphorous cycle, nitrogen fixation, soil fertility and biogas.

UNIT IV

Microbiology of Drinking water.

Methodology of bacterial analysis of water - Waterborne diseases.- Sewage - biological sewage purification methods. Chlorination of water and its implication – Trihalomethane (THM).

UNIT V

Medical Microbiology – study of common bacterial (10), fungal (5) and viral (5) diseases of man and their preventive measures.

Reference Books:

Microbiology – Anna K. Joshua
Microbiology – Norten C.F.
Microbiology – Pelcazar, Reid and Chan
Text Book of Microbiology – Ananthanarayanan and Jayaram
Food Microbiology – Frazier
Industrial Microbiology – Casida L.F
Microbiology of water and Sewage-Geinyl and Lord
General Microbiology – Boyd
Microbiology – Atlas – Biology of Microorganisms – Brock and Madigan
General Microbiology – Stainer, John, Mark
Microbiology – Zinsser

B.Sc (vi) - SEMESTER I: Part III c. ALLIED I
ANCILLARY ZOOLOGY –I ***4 Hours/ week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

Invertebrata

UNIT – I
Outline Classification of Animal Kingdom.

UNIT – II
Protozoa: General characters, Classification upto classes, Life history, Mode of infection & preventive measures of *Entamoeba histolytica, Trypanosoma gambiense, Plasmodium vivax.*

UNIT – III
Porifera: General characters, Classification upto classes, General organization of a simple sponge, spicules, Parenchymula, Amphiblastula, Gemmule, canal systems, Economic importance of sponges.

UNIT – IV
Coelenterata: General characters, Classification upto classes, General organization of sea anemone, Basic knowledge about polymorphism, coral reef.

UNIT – V
Platyhelminthes: General characters, Classification upto classes, structure, life history, Mode of infection of *Fasciola hepatica*, parasitic adaptations, Platyhelminth parasites of man.

UNIT – VI
Aschelminthes: General characters, Aschelminthic parasites of man and their significance.

UNIT – VII
Annelida: General characters, Classification upto classes, Metamerism – Cephalisation.

UNIT – VIII
Arthropoda: General characters, Classification upto classes, Pests of paddy, brinjal,sugarcane,vectors and household insects (mosquito, housefly, flea, bed bug, termite, silver fish, carpet beetle, cockroach).
Commercial importance of Insects – Lac culture, Apiculture, Sericulture

UNIT – IX
Mollusca: General characters, Classification upto classes, Pearl culture. Economic importance of Molluscs.

UNIT – X
Echinodermata: General characters, Classification upto classes with local examples.

Reference Books:

1. Manual of Zoology – Ekkambaranathan Ayyar and Ananthakrishnan.

B.Sc. (vi) - SEMESTER I & II – PART III c : ALLIED - I

ANCILLARY ZOOLOGY PRACTICAL ***2 Hours / week*** ***2 Credits***

(for students admitted from 2008-'09 onwards)

Observation:

1. *Amoeba sp., Euglena sp., Paramecium sp., E. histolytica, Noctiluca sp., Euplectella, Spongilla sp., Sycon sp., Physalia sp., Aurelia sp.,* Sea anemone, *Faciola sp.,* Miracidium, Redia, Cercaria, *Taenia sp.,* Scolex and Proglottids of *Taenia sp.,* Lac insect, Silkworm cocoon, *Mytilus sp., Chiton sp., Dentalium sp., Octopus sp., Asteropecten sp., Holothuria sp., Salmacis sp.*
2. Two major pests of Paddy and Brinjal
3. Four specimens of insects of public health importance
4. Dissections: Cockroach- All systems
5. Mountings: mouth parts of Cockroach, Honey bee, House fly, Mosquito, Honey bee – antenna cleaner and Pollen basket
6. Field visit to observe the damage caused by pests of paddy and brinjal

Observation :

1. Amphioxus – entire, C.S. through pharynx and intestine
2. 5 Elasmobranchs and 5 Teleosts of South India
3. Exocoetus
4. Parental care in Amphibia (*Ichthyophis sp. and Alytes sp.*)
5. 5 poisonous reptiles – Cobra (*Naja sp*.), Krait (*Bungarus sp*.), Viper (*Echis sp*.), *Enhydrina sp., Phrynosoma sp*.
6. Chameleon
7. 2 Aquatic birds
8. Echidna, Platypus, Bat, Loris
9. Demonstration : Frog, - Digestive system, circulatory system, urinogenital system -
10. Mounting: Placoid scales

B.Sc. (vi) - SEMESTER I – Part IV a : NON - MAJOR

LIFESTYLE RELATED AILMENTS ***4 Hours / week*** ***2 Credits***

(for students admitted from 2014- 2015 onwards)

Objective

To enable non-Zoology students to get the basic insights to various functions and malfunctions.

UNIT I: Changing patterns in health foods. Obesity, gall bladder stones, ulcers, structure of the stomach, role of enzymes. Liver cirrhosis, Fatty liver, regenerative capacity of liver etc. How can we safeguard the liver?Importance of maintaining blood sugar through production of insulin. Diabetes mellitus. Role of Pancreas. Can we reduce the diabetic problem?

UNIT II: Understanding the role of stress. Study of the basic structure of heart and its functions. Understanding bypass, stenting, angioplasty, angina, AF (atrial fibrillation), myocardial infarction and arteriosclerosis / atherosclerosis, ECG.

UNIT III: Allergies leading to wheezing, asthma-causes, smoking and its ill effects, their influence on the alveoli of the lung. Pollution through inhalation of carbon monoxide etc.

UNIT IV: Importance of EEG, Dementia, Alzheimer's, Parkinson's, Stroke aneurysm.

UNIT V: Kidney stones, significance of urea, creatinine, electrolytes in blood, urinary infection, ultra-filtration, kidney transplants, dialysis.

UNIT VI: Concept of fertility and infertility- Male and Female reproductive systems, Impotency, Endometriosis, ectopic, IVF, ICSU, Surrogacy, STD, Birth control measures etc.

B.Sc. (vi) - SEMESTER II – Part III a MAJOR

ANIMAL LIFE II **6 *Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I
The Chordates: General characteristics, four chordate hallmarks (dorsal tubular nerve cord, notochord, gill slits and post anal tail) adaptations that have guided chordate evolution, ancestry and evolution. General characteristics and classification fo sub-phylum- Urochordata and Cephalochordata.
Type Study: *Ascidian, Amphioxus*.

UNIT II
Agnatha: Ostracoderms and Cyclostomata – classification and general characteristics.

UNIT III
Gnathostomata : Placoderms – classification and general characteristics.

UNIT IV:
Fishes: Evolution and phylogeny, cartilagenous fishes (Elasmobranchii, Holocephali), Bony fishes (Teleostomi); Dipnoi, Crossopterygii, Branchiopterygii and Actinopterygii : Chirolepis – chondrostei, Holostei and Teleostei. Fins and locomotion, swim bladder, accessory respiratory organs, deep sea fishes, specialized organs: Electric organs, sound producing organs, light producing organs, poison glands. Migration and parental care. Food fishes of India (10 marine and 10 FW).

UNIT V
Amphibians : Movement onto land – physical contrast between aquatic and land habitats. Origin and relationships of amphibians, appearance of lungs, development of limbs for travel on land, earliest amphibians, amphibian contribution to vertebrate evolution. General characteristics and classification – Coecilians (Apoda) Salamanders and newts (Urodela), frogs and toads (Anura) - parental care.

UNIT VI
Reptiles: origin and adaptive radiation of extinct reptiles – general characteristics and classification up to orders with local examples – poisonous and non-poisonous reptiles with special reference to snakes of India. – Reptiles of Mesozoic Era – Phylogeny of Reptiles

UNIT VII
Birds: Origin and relationship, general characteristics with local examples. Common Birds of India (any Ten)- Form and function, movement and integration, migration and navigation, Ratitae perching mechanism, flight adaptations.- Types of beak and feet, nesting and parental care

UNIT VIII
Mammals: General characteristics and Classification up to orders with examples – Dentition in mammals – Placentation – Flying mammals – Aquatic mammals – Adaptive radiation – Phylogeny – Human Skeletal System

UNIT VIII
Jaw suspension in vertebrates – Aortic arches in vertebrates – Development of brain and kidney in vertebrates.

Reference Books:
Hickaman,
E.K. Ayyar,
Jordan
J.Z.Young.

B.Sc. (vi) - SEMESTER II: Part III a MAJOR

ANIMAL LIFE & MICROBIOLOGY PRACTICAL **2+2 *Hours / week*** ***5 credits***

(for students admitted from 2008-'09 onwards)

Animal Life - Invertebrata

1. Identification and observation of features of taxonomic and economic importance (in relation to biological, agricultural and health) sketching and systematic position of the following specimens.

   Biological: *Paramoecium, Euplectella, Aurelia, Heteronereis, Limulus, Honeybee, Chiton, Sepia.*

   Agricultural: Earthworm, *Bombyx mori*, any one pest of paddy and brinjal.

   Health*: Entamoeba, Taenia solium, Anopheles* and *Musca domestica.*
2. Dissection: Digestive, reproductive and nervous systems of Cockroach/ Grasshopper
3. Study of larval forms: Miracidium, Redia, Cercaria, Nauplius, Glochidium and Pluteus, .
4. Mounting: Mouthparts of cockroach – Honey Bee: sting apparatus, pollen basket and antenna cleaner.

Animal Life - Vertebrata

1. Demonstration of dissections of various systems: Alimentary, circulatory and urinogenital systems of frog.
2. Mounting: Placoid scales of Shark.
3. Slides and specimens:

   Prochordates: *Herdmania, Amphioxus* (section through pharynx) Agnatha: *Petromyzon* and *Ammocoetus* larva.

   Fishes*: Trygon, Acipenser, Protopterus, Echeneis and Hippocampus*.

   Accessory respiratory organs: *Anabas.*

   Amphibia*: Ichthyophis, Salamander* and *Alytes.*

   Reptiles: *Chelonia,* poisonous and non-ponsonous snakes (Krait, Cobra, Eryx, Typhlops).

   Birds– one representative of ratitae and carinatae.

   Mammals: Echidna, Platypus and Loris.

   Microbiology

   1. Sterilization
   2. Culture preparation
   3. Culture of microbes
   4. Gram staining (+ve and -ve) (Demonstration)

B.Sc. (vi) - SEMESTER II – PART III c : ALLIED – I

ANCILLARY ZOOLOGY II ***4 Hours / week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

Chordata and General Principles

UNIT I: Prochordates:
Basic chordate characters – A*mphioxus* – anatomy.

UNIT II : Pisces
General characters – outline classification – type study – Shark – parental care in fishes – Common edible fishes of South India (about 10 fishes)

UNIT III: Amphibia:
General characters – outline classification upto orders with few examples in each – Parental care in Amphibia.

UNIT IV : Reptiles:
General characters – classification up to orders – Poisonous reptiles – identification of poisonous and non-poisonous snakes of India – Poison apparatus and its function, Reptiles of economic importance.

UNIT V : Birds
General characters – fossil birds – migration in birds – economic importance.

UNIT VI: Mammalia:
General characters – classification upto 3 major groups – Aquatic mammals – flying mammals.

UNIT VII: Physiology:
Blood – composition – functions – coagulation – groups.

UNIT VIII: Ecology:
Environmental pollution – wildlife conservation.

UNIT IX : Embryology:
Gametogenesis – fertilization – parthenogenesis – placentation in mammals.
Unit X: Genetics:
Sex determination – Syndromes.

Reference Books*:*

1.Manual of Zoology – Ekkambaranathan Ayyar and Ananthakrishnan.

B.Sc. (vi) - SEMESTER III – PART III a – MAJOR

CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY **3+3** ***Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

Cell Biology

Objective: *The Course is intended to enable the student to understand the structure and consequently to appreciate the functioning of the cell and its components. A brief history of the development and future of this field is included to enable the student to pursue higher studies in Cell Biology.*

Unit:I – Brief History of Cytology **(**6 classes)

Invention of the microscope -Discovery of the cell-Foundations of the cell theory and its contributions to Biology.

Unit: II – Methods of cell study **(**12 classes)

Principles of the light microscope - Histochemical techniques of fixation
Freeze-drying and autoradiography - Biochemical techniques of cell fractionation, Principles of Electron microscopes.

Unit: III – Ultrastructure, Biochemistry and functional role of **(**16 classes)

Plasma membrane -Endoplasmic reticulum -Ribosomes - Golgi Complex – Lysosomes - Mitochondria - Centrioles -Nuclear components, chromosomes, nucleic acids.

Unit: IV – Genetic code **(**12 classes)

Nature of Genetic code – characteristics of triplet code – cryptoanalysis of genetic code.

Unit :V- Protein Biosynthesis

Role of mRNA, tRNA – Activation - Initiation – Elongation – Termination process.

Unit:VI – Cell Division **(**10 classes)

Mechanics of Mitosis and Meiosis -Parthenogenesis.

Reference Books*:*

1. Cell Biology, Structure, Biochemistry and Function – Phillip Sheeler and Donald E. Bianchi, 2nd Ed. John Wiley And Sons, 1983

2. Cell Biology – DeRobertis *et al.,* VIIth Edition, W.B.Saunders Company, 1985

3. Cytology – P.S. Verma & V.K.Agarwal 8th Edition S.Chand & Company,2004

4. Cell and Molecular Biology- DeRobertis, 8th Ed., Lippincott,2005.

Developmental Biology

INTRODUCTION
Historical review – Ontogenic and Phylogenic development

UNIT I : GERM CELL
Structure of sperm and egg (Human) – Types of eggs. Egg membranes – egg organization – Role of Pituitary and other related endocrines in gametogenesis – Estrous cycle.

UNIT II : FERTILIZATION
Mechanics - Physiology – Theories and development – Experimental works in Fertilization - Biochemical changes during fertilization

UNIT III : CLEAVAGE AND GASTRULATION
General principles – Outlines of Physiology – Comparative account in Frog, Chick and Man

UNIT IV : EMBRYONIC ADAPTATIONS
Embryonic Membranes and their function – Placentation in mammals

UNIT V : PARTHEONOGENESIS AND REGENERATION
Artificial partheonogenesis – Experiments on Artificial Parthenogenesis and their findings – Regeneration in invertebrates and vertebrates – Regeneration studies in Amphibians.
Types of Placenta in Mammals

UNIT VI : HUMAN DEVELOOPEMENT
Puberty and related changes – Menstrual cycle – Menopause – Pregnancy and related problems – Parturition – Lactation – Contraception and family welfare.

UINT VII : REPRODUCTIVE TECHNOLOGY
Super ovulation – Synchronisation of estrous – Artificial insemination – Embryo collection – Semen and Embryo preservation – Embryo transfer – Pregnancy diagnosis – Amniocentesis.

***Reference Books**:*
Balinsky – Text Book of Embryology
Nelson – Comparative vertebrate embryology
Berril – Developmental Biology
Raven – Developmental Physiology
Barrington- Structure and Function of Invertebrates
Subramonium – Developmental Biology
Berril & Berth – Development
McEwven – Comparative Vertebrate Embryology

B.Sc. (vi) - SEMESTER III - PART III a: MAJOR

ENDOCRINOLOGY ***4 Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I - Endocrine glands
Localization – structure – function and secretion.

UNIT II - Hormones
General function – types of hormones – steroids – peptides - second messenger – transport – metabolism.

UNIT III
Receptors and hormones.- Mechanism of action

UNIT IV: Pituitary
Structure – synthesis – release and action

UNIT V Thyroid
Structure – secretion - functions – parathyroid and their role - Pathophysiology

UNIT VI: Adrenal
Structure – secretion – function - Pathophysiology

UNIT VII: Endocrine functions of the ovary and testis
Cyclic events of ovaries - Pathophysiology

UNIT VIII
Pineal, thymus and gastrointestinal hormones and their significance.

UNIT IX
Hormones in invertebrates.

Reference Books*:*

D. Turner, General Endocrinology.
Williams –Endocrinology

B.Sc. (vi) - SEMESTER III – PART IIIc: ALLIED II

BIOCHEMISTRY - I ***4 Hours / week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I

Physicochemical forces acting on the living body:

Definition of pH, its determination, maintenance of pH in blood – water - buffers and electrolytes in the body and their functions, Definition of osmosis (a method of determining osmotic pressure - oedema and dehydration).

UNIT II

Carbohydrates: Classification and structure of monosaccharides (glucose and fructose in detail) disaccharides (sucrose, maltose and lactose in detail), polysaccharides (starch, glycogen and cellulose) - properties.

UNIT III

Proteins: Classification and structure of amino acid – properties. Classification and structure of Protein – primary, secondary and tertiary structures - quarternary structure with Haemoglobin as example – porphyrins.

UNIT IV

Lipids: General classification of lipids – saturated and unsaturated Fatty acids – names and properties - characterization of fats, saponification value, iodine value - compound and derived lipids.

UNIT V

Enzymes: Definition, classification, mechanism of enzyme action, enzyme substrate complex, enzyme inhibitors, Factors affecting enzyme activity.

Reference Books*:*

Lehninger, Albert L. 1970. Biochemistry Worth Publishers, Inc., New York, pp.833.

Jain, L.L. Sunjay Jain & Nitin Jain 2005. Fundamental of biochemistry, S. Chand and Company Ltd., New Delhi, pp.1230.

Ambika Shanmugam 1974. Fundamentals of Biochemistry for Medical Studies. Second Edition (Revised), Aries Agencies, Chennai, pp.647.

Biochemistry – Satya Narayanan

B.Sc. (vi) - SEMESTER III and IV – PART III c : ALLIED II

BIOCHEMISTRY PRACTICAL ***2+2 Hours / week*** ***4 credit***

(for students admitted from 2008-'09 onwards)

1. Preparation of solution with ppm, ppt and percentage concentration.
2. Preparation of different molar solutions.
3. Preparation of different normal solution
4. Principles of titrimetry
5. Preparation of buffers with varying pH.
6. Qualitative analysis of Carbohydrates.
7. Qualitative analysis of Proteins.
8. Qualitative analysis of Lipids.
9. Quantitative estimation of carbohydrates.
10. Quantitative estimation of proteins.
11. Quantitative estimation of triglycerides.
12. Quantitative estimation of moisture
13. Separation of aminoacids by paper chromatography.
14. Colorimetric estimation of Creatinine.
15. Determination of enzyme activity : Salivary Amylase
16. Determination of enzyme activity: Alkaline Phosphatase
17. Principles of colorimetry and centrifugation.

B.Sc. (vi) - SEMESTER III – PART IV b : Inter Disciplinary

WILD LIFE MANAGEMENT ***4 Hours / Week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

Preamble: This paper deals with wild life from an Indian point of view. The objective of this paper is to expose the student to the potential of Indian forestry and wildlife and to equip him/her to undertake minor projects in this area. He/she will also be in a position to attempt questions in this topic in competitive examinations.

UNIT I Introduction

Definitions, ancient history of wild life in India and its present status. Scope fo wild life biology. Governmental and NGO involvement in protection and conservation of wildlife. Relationship between animals and man.

UNIT II : Wildlife ecology

Aquatic, terrestrial, forest and mountain ecosystems. Food chain and food web. Animal populations – natality, mortality, fecundity and growth. Intraspecific and interspecific relationships. Dispersal and factors influencing dispersal. Population analysis and interpretations. Effects of man's involvement on wildlife. Scrub jungle ecology.

UNIT III: Wildlife in India.

Endangered species and economically important fishes. Amphibiology – endangered species and economically important amphibians. Herpetology – endangered species and economically important reptiles; special emphasis on Olive Ridley, Crocodiles and snakes. Ornithology – endangered species and economically important birds; bird migration, nesting, bird watching, birds in relation to humans. Mammalogy – endangered species and economically important mammals, Mammals in human life.

UNIT IV¨ Wildlife management

Concepts and principles; planning and execution. Habitat evaluation – physical and remote sensing. Habitat conservation and protection. Capture and marking technique for census and treatment – bird rings and radio collars.

UNIT V: List & location of Zoos, Sanctuaries, Parks and Biosphere reserves of India.

Role of these in preservation and conservation management. Rehabilitation programmes (eg. Project Tiger). National parks – Khaziranga, Gir, Bandhipur, Kanha, Guindy, Corbett, etc. Marine National Parks – Mannar, Kutch, Point Kalimer, etc. Sanctuaries – Periyar, Mudumalai, Vedanthangal, Bhandipur, etc. Zoos – Mysore, Trivandrum, Vandalur, Hyderabad, etc.

UNIT VI: Forestry and Sylviculture

Major vegetation types in India – classification, characteristics, composition and distribution. Indian Forest Act (1927) – Forest Conservation Act (1985).

UNIT VII: Wildlife conservation and Legislation

Administrative set up – Central, State, Quasigovernmental. Statuary bodies (IBWL, BNHS, ZSI, WWF, etc). Wildlife protection Act (!972), Rules, regulations and punishment, "Red Data Book".

Reference Books*:*

1. The Development of International Principles and Practices of Wildlife Research Management by Stephen H. Berwick and U. B. Sahania
2. Ecology of a changing planet by Mark B. Bush
3. Human import on ecosystem by Trivi and O'Hore
4. National Parks of Madhyapradesh by S. K. Tiwari
5. Endangered Animals of India and their Conservation by S. M. Nair

B.Sc. (vi) - SEMESTER IV- PART III a – MAJOR

MOLECULAR BIOLOGY AND GENETICS 3+3 *Hours / week* *5 Credits*

(for students admitted from 2008-'09 onwards)

Unit I

Nucleic acids: DNA-chemical structure-Purine and Pyrimidines – Chargaff 's rule. Watson and Crick model. RNA: chemical structure. Types of RNA: mRNA, tRNA,rRNA Differences between DNA and RNA.

Unit II

DNA synthesis: DNA replication; origin- fork direction; primer, leading and lagging strand, enzymes.

Unit III

Transcription: andTranslation : RNA polymerase in prokaryote and eukaryote. Initiation – Elongation- Termination. HnRNA.Post –Transcriptional modifications: Splicing: splceosome, intron exon polyadenylation, capping. Reverse transcription –reverse transcriptase-cDNA. Genetic code -Initiation, Elongation and Termination of Translation in prokaryotes and eukaryotes.

Unit IV

Regulatory mechanism; Operon model- Jacob & Monod Lac Operon-positive and negative regulation.

Unit V

Fundamentals of Genetics: Mendel's Law, Monohybrid Inheritance- complete dominance, incomplete dominance, codominance.. Dihybrid Inheritance- Independent assortment-Test Cross. Interaction of alleles- complementary , Supplementary and Epistasis. Multiple alleles: Blood Groups-ABO, MN and Rh Blood Groups, Coat colour in rabbit.

Unit VI

Linkage-Bateson's and Punnett's work on swet pea. Crossing Over- Types, cytological evidence and significance. Mapping of chromosome.

Unit VII

Sex Determination: Various Theories;Types-XX-XY, XX-XO, ZZ-ZW. Sex linked inheritance-colour blindness, haemophilia. Gynandromorphs; Human sex linked anomalies.
Cytoplasmic Inheritance: Kappa particles in *Paramecium*, maternal effect in *Limnaea*

Unit VIII

Mutation: Types Spontaneous – Induced- mutagens-Tautomerizatiom, dimer formation and methylation. Gene mutation –Types-Frameshift, position; addition , Deletion, and substitution. Chromosomal abberration-Numerical: Euploidy, Aneuploidy and Polyploidy. Structural: Inversion, Transversion, Duplication, Deletion.Homologous and Non-homologous Translocation.

UnitI X

Applied Genetics:
Eugenics, Euthenics and Genetic Engineering.

B.Sc. (vi) - SEMESTER IV – PART III a : MAJOR
CYTOGENETICS, DEVELOPMENTAL BIOLOGY + ENDOCRINOLOGY PRACTICAL
2+2 Hours / week 5 Credits

(for students admitted from 2008-'09 onwards)

Cytogenetics

1. Microscopy - dissection and compound microscopes - identifying the different Components.
2. Dermatoglyphics - ulnar, radial loops, whorls and ridge count
3. Karyotypes - Normal male, normal female, Klinefelter, Turner and Down's syndromes.
4. Identification of prepared permanent slide of : Squamous and columnar epithelium, adipose, bone, cartilage and muscle tissues.
5. Blood smear of man.
6. Blood grouping - A,B,AB,O & Rh^+ve and Rh^- ve in human beings.
7. Staining Buccal epithelium (Barr bodies)
8. Mitosis - Preparation, staining and study of different stages in onion root tip.
9. Meiosis - Preparation, staining and study of different stages in grasshopper testis.
10. Study of giant chromosomes in Chironomous larvae.

Developmental Biology

1. Morphometrics of sperm and ovum
2. Preparation of Sperm smear
3. Study of egg types, cleavage, blastula and gastrula stages of Amphioxus & Frog
4. Dissection of Tadpoles to observe structural peculiarities
5. Study of Human foetal stages
6. Study of developmental stages in chick: 24, 36, 48 and 72
7. Study of pig or goat uterus to observe the placentation type.

Endocrinology

1. Observation of histological studies of endocrine organs
   a) ovary b) testis c) thyroid d) adrenal cortex & medula e) pancreas – ilets of langerhans f) thymus e) pituitary
2. Estrous cycle - observation in vaginal smear of mice
3. hCG - based pregnancy test.

B.Sc. (vi) - SEMESTER IV – PART III c – ALLIED II

BIOCHEMISTRY – II ***4 Hours / week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

UNIT VI

Metabolism of Carbohydrates – Glycolysis, Krebs cycle, HMP shunt, Glycogenesis, Glycogenolysis, Gluconeogenesis

Metabolism of Proteins: oxidative deamination, transmination, urea cycle.

(Biosynthesis of proteins – basic pattern)

Lipids: Fatty acid breakdown – formation of ketone bodies (Biosynthesis of fats). Cholesterol biosynthesis.

UNIT VII

Nucleic acids – structure & significance

UNIT VIII

Bioenergetics: I and II Law of Thermodynamics – Free energy, enthalpy of entropy, oxidative phosphorylation, electron transport chain: ATP - Bioenergetics of Glucose fatty acid.

UNIT IX

Vitamins: Fat soluble vitamins (Vitamins A, D, E and K) water soluble vitamins (Vitamin B complex and C) with reference to their occurrence and requirements for humans.

UNIT X

Hormones: Definition, names of various endocrine glands and their secretations – elementary study of the biological functions of insulin, thyroxine and sex hormones, mechanisms of hormone action.

Reference Books*:*

Lehninger, Albert L. 1970. Biochemistry Worth Publishers, Inc., New York, pp.833.

Jain, L.L. Sunjay Jain & Nitin Jain 2005. Fundamental of biochemistry, S. Chand and Company Ltd., New Delhi, pp.1230.

Ambika Shanmugam 1974. Fundamentals of Biochemistry for Medical Studies. Second Edition (Revised), Aries Agencies, Chennai, pp.647.

B.Sc. (vi) - SEMESTER V – PART III a : MAJOR

BIOTECHNOLOGY ***5 Hours / week*** ***4 Credits***

(for students admitted from 2008-'09 onwards)

Unit I: Molecular organization of Cells

Organization of DNA into chromosomes, Histones and DNA – nucleosomal structure –RNA synthesis and RNA processing, RNA processing to form mRNA coding for several proteins – role of nucleolus.

Unit II: Gene Technology

Gene manipulation – basic techniques of cloning, vectors used in cloning, Restriction enzymes, linkers, adapters – expression of cloned genes, PCR- Gene expressionstructures- products and analysis.

Unit III: Enzyme technology

Traditional use of enzyme – immobilization of enzymes and applications.

Unit IV: Bioprocess technology

Exploitation of microorganism – fermentation technology. Immunotechnology – vaccine production, molecular probes, hybridoma technology – monoclonals. bioremediation etc..

Unit V: Environmental biotechnology

Environmenmt and human health; biomonitoring of pollution- waste treatment

Unit VI: Applications.

Animal biotechnology: transgenic animals, high yielding and disease resistant animals; Transferring genes into animal oocytes, eggs, embryos and specific animal tissues. Gene transfer to plants.

Reference Books*:*

Molecualr biology of cell, Bruce Alberts, Weber, et al.
Molecular Biology of Gene, Watson.
Biotechnology, principles and practices, Primrose.
Concepts in biotechnology, Balakrishnan et al.
Fundamentals of Biotechnology, Gupta

B.Sc. (vi) - SEMESTER V – PART III a: MAJOR

BIOPHYSICS, EVOLUTION& ANIMAL BEHAVIOUR ***(2+2+2) Hours / week 4Credits***

(for students admitted from 2008-'09 onwards)

Biophysics

The subject is introduced to Zoology students to know the physical approach of biological system and to have an overall idea about the subject content.

Unit-I: Introduction: Scope of Biophysics; Concept and division of Biophysics; Understanding the physical problems of body; Basic physical laws and its definitions.

Unit-II: Energetics: Energy in different forms; laws of thermodynamics; Energy flow in biological systems.

Unit-III: Molecular Biophysics: Structure of biomolecules – Protein, haemoglobin, myoglobin, actin, tubulin.

Unit-IV: Methods of studying molecules: Principles of Centrifugation, Spectrophotometer, NMR , X-ray diffraction.

Unit-V: Biomembrane: Structure of Phospholipids, hydrophobic effects, self assembly, membrane potentials, flux across membranes, selectivity- Nernst, Na, K and ATPase, Donnan; Ion composition-intracellular fluid and extracellular fluid.

Unit-VI: Electrophysiology: Nerve conduction and Muscle mechanics-contraction.

Unit-VII: Clinical Biophysics: Radiation-radioactive decay, hazards of radiation and radiotherapy; Principles of Ultrasound and CT scan.

Reference:

1. A Text book of Biophysics, R.N. Roy, Central Publication 2005
2. Biophysics and Biophysical Chemistry, Debajyoti Das, Academic Press, 2001
3. Essentials of Biophysics, P.Narayanan, New Age International (P)Ltd., 2007.

Evolution

UNIT I

Origin of life, Growth of evolutionary concepts

UNIT II

Evidences in support of organic evolution.

Evidence from Comparative morphology and Anatomy, Embryology, Palaeontology, Physiology and Biochemistry, Genetics, Taxonomy, Geographic distribution

UNIT III: Theories of Evolution

Abiogenesis – Biogenesis- Cosmozoic theory – Lamarkism – Darwinism – Neolamarkism, Neo Darwinism – Modern synthetic theory of natural selection– Germplasm

UNIT IV: Some general principles

Attavism, Cope's rule – Allen's rule – Allometry – William's rule – Orthogenesis- Extinction, specialization.

UNIT V: Adaptation

Types –Mimicry – Coloration – Adaptive radiation in Darwin finches and mammals– Adaptive convergence.

UNIT VI: Distribution of Animals and Speciation
Barriers – Isolation and related mechanisms.The species concept – types and process.

UNIT VII
Evolution of Man , Cultural evolution of man.
Reference Books*:*
Evolution – process and product, Dodson
Introduction Evolution, Moody.

Animal Behaviour

Unit I : Introduction
Definitions - ethology, instinct, learning, stimulus, drive and motivation, agonistic behaviour, territorial behavior, courtship behavior. Specific Action Potential (SAP), Psycho-hydraulic model of release of Fixed Action Pattern (FAP).

Unit II : Animal Orientation
Tropism, kinesis (definition and classification with examples), taxes (definition and classification with examples). Migration (definition and description of migration in birds).

Unit III : Learning behaviour
Definitions and classification of learning behaviour with examples (habituation, instinct, classical conditioning, trial and error learning, insight learning, imprinting).

Unit IV : Social Behaviour
Communication : Definition and significance of communication. Communication through vision – bee dance, communication through sound - birds, bats (echolocation through ultrasound); communication through chemicals and pheromones.
Courtship: Definition and description with suitable examples from the animal kingdom.
Agonistic behaviour : aggression and appeasement behaviour : definition and description with suitable examples.
Territorial behaviour : Definition and description with suitable examples.

Unit V : Rhythmic Behaviour of Animals
Types of biological rhythms (definitions) – circadian, lunar, tidal, annual; terminologies used (zeitgeber, phase, phase shift, entrainment, free running rhythm,. actogram, masking, arrhythmia). Properties of circadian rhythms. The role of different hormones in the control of behavior, with examples.

Unit VI : Human Behaviour
Actions: Inborn, discovered, absorbed, trained and mixed actions.
Gestures: Primary and secondary gestures , Baton signals, greeting signals.

Reference Books*:*
McFarland, D, Animal Behaviour
Manning, Introduction to Animal Behaviour
Desmond Morris, Manwatching

B.Sc. (vi) - SEMESTER V- PART III a: MAJOR

BIOINFORMATICS & BIOSTATISTICS **5 *Hours / week*** ***4 Credits***

(for students admitted from 2008-'09 onwards)

Bioinformatics

Unit I: Introduction to Bioinformatics

Aims, Tasks and Applications of Bioinformatics. Information Retrieval System. Genomics – Recombinant DNA technology - DNA sequencing. Applications of bioinformatics – Human Genome Project, Sample software in biology.

Unit II: Biological Databases

Sequence, structure and literature databases. Data submission Tools, Data Analysis and Prediction Tools. Nucleic acid and proteins sequence data banks. Databases of patterns, motifs and profiles: Metabolic Pathway Databases. Specialized Software packages.

Unit III: Genomics and Proteomics

Genome sequencing technology, Whole genome analysis, Comparative genomics - Proteomics – protein structure prediction (primary, secondary & tertiary) viewer for protein structure – PDB. Gene to Protein Function: Analysis of Proteomes, Analysis of 2-D gels, Human Genome Project.

***Reference Books**:*

1. Computers and Common Sense (Fourth Edition)- 1997
   Roger Hunt, John Shelley, Prentice Hall of India Private Ltd.
2. Basic Bioinformatics 2005, S.Ignacimuthu, s.j.
   Narosa Publishing House
3. Introduction to Bioinformatics (Fourth Edition) - 2003
   T.K. Attwood & D.J. Parry- Smith, Pearson Education (Singapore) Pvt. Ltd.
4. Introduction to Bioinformatics - 2003
   Arthur M. Lesk , Oxford University Press
5. Bioinformatics- Methods and Applications- Genomics, Proteomics & Drug Discovery- 2005
   S.C. Rastogi, N. Mendiratta & P. Rastogi , Prentice Hall of India Private Ltd.
6. Bioinformatics- Databases and Algoriths - 2006
   N. Gautham - Narosa Publishing House
7. Discovering Genomics, Proteomics & Bioinformatics- 2003
   A.Malcolm Campbell & Laurie J. Heyer, Pearson Education (Singapore) Pvt. Ltd.
8. Bioinformatics- Managing Scientific Data- 2003
   Zoe Lacroix & Terence Critchlow, Morgan Kaufmann Publishers.

Biostatistics

Unit I

Definition – history and development of biostatistics – importance of biostatistics, functions and limitations of biostatistics, data in biology – samples and populations – definitions of variable, variables in biology, accuracy and precision of data, derived variables – Indices, ratios, percentages and rates.

Unit II

Collection of data: primary data – methods of collection, (survey experimental and observation method), secondary data. Sampling and sampling design – law of statistical regulatory and law of inertia of large numbers.

Types of samples – random and non-random samples.

Classification of data – based on differences in kind, quantitative, geographical, chronological and alphabetical classification.

Tabulation of data – components of tables, types of tabulation – simple and complex. General and special purpose tables.

Diagrammatic representation of data – differences between diagrams sand graphs, types of diagrams – one, two and three-dimensional diagrams, pictograms, cartograms.

Graphical representation of data – classification of graphs – graphs of time series and frequency distribution

Unit III

Measures of central tendency – arithmetic mean, other means (weighted, geometric and harmonic), median, mode - measure of dispersion and variability – range, percentile, quartile interquartile range or quartile deviation, mean deviation standard deviation, coefficient of variation – Lorenz curve.

***Reference Books**:*

Biostatistics – Jyothikumar
Statistical methods in bioinformatics - Ewens W J
Statistical methods in biology - Bailey Norman T J

B.Sc. (vi) - SEMESTER V- PART III a: MAJOR
BIOTECHNOLOGY & BIOINFORMATICS PRACTICALS

2+2 Hours / week 4 Credits

(for students admitted from 2008-'09 onwards)

Biotechnology

1. Laboratory organization and GLP
2. Sterilization and Media preparation
3. Culture technique- Basic principles of animal cell culture
4. DNA isolation from bacteria (Demo)
5. Genomic DNA isolation from animal tissues.
6. Separation of DNA by agarose gel electrophoresis
7. Estimation of DNA by Diphenylamine method.
8. Enzyme immobilization.
9. P.C.R.
10. Design of bioreactor.

Bioinformatics

1. Databases: Literature databases Pub Med, Medline.
2. Protein sequence database: Uni Prot
3. Nucleotide sequence database: Genbank.
4. Similarity search tools-Entrez, FASTA and BLAST.
5. EMBOSS – Pair Wise Sequence Analysis
6. CLUSTAL W – Multiple Sequence Analysis
7. DS Visualizer- Protein Visualization
8. RasMol

B.Sc. (vi) - SEMESTER: V and VI – PART III b. ELECTIVE

a. AGRICULTURAL ENTOMOLOGY ***2+3 Hours/week*** ***2+3 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I: Introduction to Entomology**.** Types of damage to plants by insects – insect pests – Causes of insects assuming pest status- Introduction to agronomy.

UNIT II: Insect pests of crops:

Pests of Rice: *Rice leaf folder, Rice stem borer, Rice thrips, Rice gall midge, Rice mealy bug, Green rice leaf hoppers, Brown plant hopper, Rice earhead bug, Rice grass hoppers, Whorl maggot.*

Pests of Sugarcane: *Sugarcane Shoot borer, Stem or internode borer, Top borer, Termites, White grubs, Sugarcane leaf hopper, Sugarcane scale, Mealy bug, Whiteflies.*

Pests of Coconut: *Rhinoceros beetle, Red palm weevil, Black-headed caterpillar, White grub*.

Pests of Vegetables: Brinjal – *Shoot and fruit borer, Stem borer, Spotted leaf beetle, Grey weevil,* Tomato – *Fruit borers, Serpentine leaf miner*, – Pests of lady's finger and gourds.

Pests of Beverages: Coffee – *Coffee white borer, Red borer, Green scale,* Tea – *Tea mosquito bug* – Pests of Cocoa.

Pests of Stored products: *Rice weevil, Sweet potato weevil, Lesser grain borer, Tobacco beetle, Drug store beetle, Pulse beetle, Tamarind beetle, Red flour beetle, Indian meal moth, Fig moth, Rice moth, Khapra beetle.*

UNIT III: Methods of pest control – Natural control – Applied or artificial control – Prophylactic methods – Curative or direct methods – Cultural methods – Mechanical methods – Physical methods – Biological methods – Chemical methods – Insect attractants – Repellents – Anti feedants – Genetically modified crops – Bt cotton – Bt brinjal – Bt maize.

UNIT IV: Pesticides – Classification of Insecticides – Inorganic compounds – Organic compounds – Synthetic organic compounds.

UNIT V: Plant protection appliances – Dusting and dusters – Spraying and sprayers – Aircraft application of pesticides – Other equipments.

UNIT VI: Integrated Pest Management

REFFERENCE:

Elements of Economic Entomology – B. Vasantharaj David

B.Sc. (vi) - SEMESTER: V and VI– PART III b. ELECTIVE

a. SERIBIOTECHNOLOGY **2+3** ***Hours/week*** ***2+3 Credits***

(for students admitted from 2008-'09 onwards)

UNIT 1 INTRODUCTION

Silk producing organisms-tasar silk-muga silkworm-eri silkworm-anaphe silkworm-gonometa silkworm-fagara silkworm-coan silkworm-spiders-mussel-uses of silk-history of sericulture-silk production in the world-sericulture in India-sericulture in pre-british period-sericulture during the british period 10-sericulture after independence-the central silk board-members of CSB-functions of CSB-organizational set-up of CSB-research institutes-CSR&TI,mysore and berhanpore-the national silkworm seed project, Bangalore-the centralsilk technology research institute-the silkworm seed technology laboratory [SSTL]-the seribiotech laboratory-training facilities in sericulture-facilities available for sericulturists-national sericulture projects[NSP]-future scope.

UNIT 2 MORICULTURE

Geographic distribution- optimum conditions for growth- other uses -medicinal value -classification

UNIT3 PACKAGE OF PRACTICES FOR MULBERRY CULTIVATION

Package of practices-planting material-Mulberry varietied recommended-preparation of land-planting direction and season-planting distance-planting system-PIT system-row system-kolar system-strip system-angular system- Irrigation- manuring- harvesting.

UNIT 4 DISEASES OF MULBERRY

Fungal, bacterial and viral diseases- -deficiency diseases.

UNIT 5 PESTS OF MULBERRY

Insect and non-insect pests

UNIT 6 BIOLOGY OF *Bombyx mori*

Taxonomic Position of *Bombyx mori* - life cycle of *Bombyx mori* - Races of *Bombyx mori* - classification based on the number of larval moults – classification based on the voltinism-classification based on place of origin- Indigenous pure races of India- Kashmir race- Borapalu-C. Nichi- Chotopolu- Bulupulu- Nistari- pure Mysore- Nyapolu- Sarupat- Moria- Commercial races of India- multivoltine Races- Bivoltine races- races evolved through mutation breeding-races evolved through line breeding methods- races with sex-limited character.

UNIT 7 GRAINAGE TECHNOLOGY

Breeding stations- P4 and P1 stations- P2 stations- P1 stations- selection of A seed cocoon rearer-grainages- procedures in a grainage- diapausing and non-diapausing egg- diapausing eggs-storage of eggs- incubation constant temperature incubation- raised temperature incubation-embryonic method of incubation- transport of eggs.

UNIT 8 REARING FACILITIES

Rearing house- bed cleaning- spinning larvae- disinfection-maintaining optimum conditions.

UNIT 9 REARING OPERATIONS

Disinfection-physical methods-chemical methods-brushing-brushing from loose eggs in egg

boxes-brushing from egg cards-maintenance of optimum conditions for rearing-temperature-humidity-quantity of feeding-frequency of feeding-quality of leaf-preparation of leaf for feeding-bed cleaning-frequency of bed cleaning-methods of bed cleaning-spacing-frequency of spacing-methods of spacing-care during moulting-mounting-characterstic features of a ripe worm-process of spinning-methods of mounting-population density in mounting-precautions to be taken during mounting-harvesting**.**

UNIT 10 REARING METHODS

Chawki rearing of young age worms in India-paraffin paper rearing-box rearing-new net rearing-co-operative rearing-chawki rearing methods in Japan-single feeding per instar-wet cloth rearing-closed rearing-pack rearing-kasso rearing-showa rearing-co-operative rearing in Japan- rearing of nature larvae-shelf rearing-floor rearing-shoot rearing.

UNIT 11 DISEASES OF *BOMBYX MORI*

Protozoan disease-bacterial disease ["flacherie"]-bacterial flacherie or gastric injury flachers-septicemia-sotto disease-court disease-viral disease-infectious flacherie-gattine-grasserie-fungal disease-disease of the adult moth.

UNIT 12 PESTS OF SILKWORM

Uzi fly-Indian uzi fly-Kuoso or Japanese uzi fly-black uzi fly-tasar uzi fly-dermestid beetles-the straw mite (pedicolus ventricoses)-ants-namatode-lizards,rats,squirrels & birds.

UNIT 13 COCOON MARKETING

Transport of cocoon- physical characters of cocoons considered for commercial purposes-defective cocoons- defects due to heritable racial characters- defects arising from mistakes in rearing and mounting- defects due to parasitic infestation- defects due to moth emergence- cocoon markets.

UNIT 14 SILK REARING

Stifling- sun-drying- steam- stifling- hot- stifling- storage of cocoons- sporting of cocoons-deflossing- cocoon riddling- cocoon mixing or blending- cocoon cooking- boiling for top reeling-boiling for sunken system of reeling- brushing- reeling operations- reeling end formation-intertwining or twisting- drying and distribution of the thread on the reels- reeling appliances-country charkha (traditional charkha)- domestic basin- cottage basin- filatures- re-reeling- lacing, skeining- raw silk testing- visual tests- mechanical tests.

UNIT 15 BY-PRODUCTS OF SERICULTURE

By-products of moriculture-by-products of rearing-use as compost-use as animal feed-use as suturing material-use as feed for biogas plant-use in pharmaceutical industry-by-products of grainage operation-use of pierced cocoons-use of waste moths-by-products of reeling-defective cocoon wastes-pupal waste-reeling wastes-commerical classification of silk thread wastes-filature wastes-charkha wastes-spun silk.

UNIT 16 AN ASSESSMENT OF SERICULTURE IN INDIA AT PRESENT

Productivity in moriculture-productivity of silkworm races-bivoltine rearing-productivity of reeling sector-prospects of sericulture.

B.Sc. (vi) - SEMESTER: V and VI – PART III b. ELECTIVE

b. BIOPROCESS ENGINEERING AND TECHNOLOGY 2+3 *Hours/week 2 + 3 Credits*

(for students admitted from 2008-'09 onwards)

Bioprocess Engineering and Technology

UNIT I

Introduction to bioprocess engineering: Basic principles of bioprocess. Types of fermentation: batch, fed batch and continuous fermentation systems. Microbes in industrial process: Isolation, screening and maintenance of microbes for industrial processes. Strain improvement. Microbial growth kinetics.

UNIT II

Upstream processing: Microbial Nutrition, Media formulation for industrial fermentation. Development of inocula for the industrial fermentations. Scale up.

UNIT III

Bioreactors: batch, fed –batch and continuous bioreactors, biotransformation, stability of microbial reactors, analysis of mixed microbial populations, specialized bioreactors (pulsed, fluidized, photo bioreactors etc.

UNIT IV

Industrial production of chemicals, alcohol(ethanol),acids (citric, acetic and gluconic),solvents (glycerol,acetone,butanol,antibiotics(pencilliin,streptomycin,tetracycline),aminoacids (lysine, glutamic acid),single cell protein. Enzyme and whole cell immobilization and their industrial applications.

UNIT V

Downstream processing: Introduction, removal of microbial cells and solid matter, foam separation, precipitation, filtration, centrifugation, cell disruptions, liquid – liquid extraction chromatography, Membrane process. drying and crystallization. Effluent treatment D.O.C. and C.O.D. treatment and disposal of effluents.

***Reference Books**:*

1. Biochemical Engineering, Aiba,S., Humprey,A.E., and Millis,N.F., Unty. of Tokyo Press, Tokyo.
2. Biochemical Reactors. Atkinson,B., Pion, Ltd., London.
3. Biochemical Engineering Fundamentals. Baily,J.E., and Ollis,D.F., McGraw – Hill Book Co. New York.
4. Bioprocess Technology: Fundamentals and applications, KTH, Stockholm.
5. Process Engineering in Biotechnology, Jackson,A.T., Prentice Hall, Engelwood Cliffs.
6. Bioprocess engineering: Basic Concepts, Shuler,M.L., and Kargi,F., Prentice Hall, Engelwood Cliffs.
7. Principles of Fermentation Technology. Stanbury,P.F., and Whitaker,A., Pergamann Press, Oxford.
8. Bioreaction Engineering Principles , Neilson,J., and Villadsen,J. Plenum Press.
9. Chemical Engineering Problems in Biotechnology, Shuler, M.L.(Ed.), AICHE.
10. Biochemical Engineering, Lee,J.M., Prentice hall Inc.
11. Biochemical Engineering – Kinetics, Mass Transport, Reactors and Gene Expression, Vieth, W.F., John Wiley and Sons, Inc.

B.Sc. (vi) - SEMESTER: V and VI – PART III b. Elective

b. VERMITECHNOLOGY **2+3** ***Hours/week*** ***2 + 3 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I

Concepts of vermitechnology, objectives, scope and application of vermitechnology. Endemic and exotic species of earthworms. Distribution and seasonal dynamics of earthworms. Drilospheres and vermicasts.

UNIT II

Special features of Lumbricidae, Megascolidae and Eudrilidae with suitable examples. Biology and anatomy of earthworms : metamerism, musculature, locomotion, digestive system, nutrition, reproductive system, clitellum and cocoon formation. Classification of earthworms.

UNIT III

Ideal conditions for vermicomposting and maintaining a vermiculture unit. Types of vermicomposting - large scale and small scale vermicomposting. Vermicomposting - raised bed method and pot method.

UNIT IV

Earthworms as bioreactors. Materials required for vermibed preparation. Bioremediation using earthworms - minimizing pollution hazards and application of vermitechnology by recycling of organic wastes.

UNIT V

Diseases caused in earthworms, attack of predators and parasites and suitable remedies. Solutions for problems affecting worm bins. Properties of vermicompost. Collection of vermiwash and methods to obtain vermiwash.

UNIT VI

Economics of vermiculture - cost benefit analysis : establishment of vermiculture unit, infrastructure, raw materials, labour, accessories. Harvesting of vermicompost, packaging and marketing.

Reference books :

1. Invertebrate Zoology - E.L.Jordan P.S.Verma

2. Principles and Practice of Soil Science - Naren Kumar, Dutta

3. Soil Microbiology - N.S.Subba Rao

4. Vermicomposting - P.K.Gupta

5. Vermiculture and Organic Farming - T.V.Sathe

B.Sc. (vi) - SEMESTER: V – PART IV b. SKILL BASED

VERMICULTURE ***4 Hours/week*** ***2 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I :

Introduction: Definitions and concept of vermiculture. Soil:major types (red soil, black soil, alluvial soil). Influence of soil organisms in vermitechnology - bacteria, earthworms, entomofauna, mites etc. Litter degradation and decomposition.

UNIT II :

Types of earthworms : Endemic and exotic species of earthworms. Ecological classification of earthworms - epigeic, anecic and endogeic forms. Physical, chemical and biological changes caused by earthworms in soil - drilospheres and vermicasts.

UNIT III :

Vermicomposting - vermicomposting materials, vermicomposting methods (raised bed method and pot method). Vermicompost - quality, properties and advantages over chemical fertilizers. Problems in vermiculture and remedial solutions.

UNIT IV :

Natural enemies of earthworms - Pests, parasites and pathogens affecting earthworms. Uses of earthworms in food and medicine - ayurvedic and unani medicine. Recycling of food wastes in vermitechnology. Application and scope of vermitechnology.

UNIT V :

Establishment of vermiculture unit: materials required, conditions for maintenance of vermiculture unit, harvesting of vermicompost, packaging and marketing - cost benefit analysis - man power, infrastructure and other raw materials.

Reference books :

1. Invertebrate Zoology - E.L.Jordan P.S.Verma
2. Principles and Practice of Soil Science - Naren Kumar, Dutta
3. Soil Microbiology - N.S.Subba Rao
4. Vermicomposting - P.K.Gupta
5. Vermiculture and Organic Farming - T.V.Sathe

B.Sc. (vi) - SEMESTER: V – PART IV b. SKILL- BASED

COMPUTER BASICS ***2 Hours/week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

Unit I

Introduction : Components of computer – hardware and software, power supply, peripherals. Installation of operating system

Unit II

MS word, MS excel, MS power point– short cut keys, saving documents, printing, scanning.

UNIT III

Internet : LAN, MAN, WAN, types of topology, requirements for internet connections, Integrated Service Digital Networking and its utility, Internet Service Provider (ISP) – IP address, File Tranfer Protocol (FTP).

Unit IV

Internet access : web pages, web browsers, search engines : google, yahoo, Uniform Resource Locator (URL), electronic mail, installation of antivirus.

Reference books :

1. Computers and Common Sense (Fourth Edition), 1997 - Roger Hunt, John Shelley, Prentice Hall of India, Private Ltd.
2. Essentials of Computer Applications - S.Mythili.S.Gopalan

B.Sc. (vi) - SEMESTER VI – PART III a : MAJOR

ANIMAL PHYSIOLOGY AND IMMUNOLOGY **4+3 *Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

Animal Physiology

UNIT I: Respiration

Availability of oxygen. Respiratory organs in animals. Properties and function of respiratory pigments. Regulation of respiration

UNIT II: Circulation

Types of hearts. Composition and functions of blood. Cardiac rhythm, cardiac output, ECG, Blood pressure. Electrical activity and properties of the heart. Regulation of the cardiovascular function

UNIT III: Coordination (Neuromuscular and neuroendocrine)

Nerve impulse conduction. Ultra structure of muscle. Theories of muscle contraction

UNIT IV: Excretion

Structure and functions of different excretory organs in animals. Mechanism of urine formation in man

UNIT V: Homeostasis

Significance. Mechanism of osmo-ion regulation in fresh water, estuarine and marine fishes

Reference Books:

Invertebrates Structure and

Immunology

Unit I Immunity- Definition. Types of immunity-Active and Passive.

Unit II The basis of immunity: Innate Immunity- Natural Barriers, Phagocytosis, Inflammation, Complement system, lectin. Adaptive Immunity- Primary and secondary response, memory, Booster response.

Unit III Antibody: Immunoglobulin; Basic structure, classes and role in immunity. Cellular Immunity Hemopoietic Tissue: Types and functions of B and T cells; cytokines and Interleukines. Antigen: Types and structure. Hapten; Immunogen. Antigen-antibody reaction: Haemagglutination, Precipitation, Immunodiffusion -ELISA

Unit-IV Lymphoid organs: Primary and secondary organs- location, structure and role. Bone marrow, Thymus, Bursa of Fabricius, Lymph node, Spleen, MALT, GALT.. Maturation of Immuno-competent cells.

Unit V Clinical Immunology. Immune response of Infections caused by bacteria and virus. Diseases- Immunodeficiency, Hypersensitivity and autoimmune. Transplantation-Types of Graft-MHC-HLA.

B.Sc. (vi) - SEMESTER VI – PART III a : MAJOR

ENVIRONMENTAL BIOLOGY AND BIODIVERSITY **4+3 *Hours / week*** ***4 Credits***

(for students admitted from 2008-'09 onwards)

Environmental Biology

I. - Abiotic and Biotic factors: Ecosystem concept – Pond as an Ecosystem – Energy flow – Ecological pyramids – Food chain – Significance of food-web. Biogeochemical cycles – Nitrogen – Phosphorous and Carbon cycles.

II. Ecological factors: Water, pH, salinity, temperature and light as factors. Atmospheric pressure – Moisture in the atmosphere – Hydrological cycle – Humidity.

III. Population Ecology: Basic concepts of population ecology – Characteristics of population – Inter and intra specific relations among populations.

IV. Community: Characteristics of a community, Ecological succession – causes of succession, Basic types of succession – General process of succession – Hydrosphere or hydarch; Lithosphere – a xerosphere on rock; climax concept in succession.

V. Freshwater Habitat: Lentic community; Lake zonation, Thermal stratification of a lake; Eutrophication; Lotic community-streams & rivers; Stream zonation and communities.

VI. Marine Habitat: Characteristics of ocean, Structure of ocean; Ocean zones; Biotic communities of oceanic zone; Pelagic life of marine organisms and their adaptations – Plankton as a community – Benthic life and adaptations – Intertidal; rocky, sandy and muddy shores. Marine pollution; control of marine pollution.

VII. Terrestrial Habitat: Biomes – Latitudinal and Altitudinal life zones; Major Biomes; Desert, grassland, Tropical rain forests, Temperate deciduous forests, Taiga and Tundra.

VIII. Environmental Pollution & Public Health:

Air pollution – sources of pollution, Acid rains; Ozone; Prevention and control of air pollution. Water pollution; Sources of Pollution and Pollutants; Prevention and control of water pollution. Land pollution: Solid waste Pollution; Radioactive pollution; noise pollution; pollution control through law.

IX. Natural Resource and their Conservation:

Resources – types of resources; soils of India; Climate of India; climatic regions of India; vegetation of India; Diverse fauna of India; Wild life of India; Endangered flora and fauna of India, Natural parks and sanctuaries. Projects for endangered species, Biosphere reserves. Conservation: soil, land, water conservation; Forest resources; Forest cover; Deforestation, Afforestation.

Reference Books*:*

Fundamental of Ecology – Eugene P. Odum
Elements of Ecology – Clarke
Animal Population – Browning
Concepts of Ecology – Kormandy
Ecology & Environmental Science – H.R.Singh & Neeraj Kumar
Environmental Biology – P.D.Sharma

Biodiversity

Unit I Introduction
Defining biodiversity, convention on biological diversity, its role, goals, functioning and perspectives.
Mega diverse nations protected areas and biosphere reserves in India, IUCN, categories of threats – Marine Park.

Unit II: Biodiversity from taxonomic and evolutionary perspective:
Origin of scientific taxonomy, basics of taxonomic characterization, characterizing, species (the morphological species concept, biological species concept, the phylogenetic species concept). Taxonomic measures of species diversity, modern developments (database and expert identification systems).

Unit III: Types of Diversity
Ecosystem diversity, (variety of habitats), species diversity, genetic diversity. Methods of measuring species diversity, molecular methods of assessing levels of genetic diversity.

Unit IV: Human society and biodiversity, Cultural diversity, values of diversity.

Unit V: Legislation
A review of national and international treaties, conventions and laws, biodiversity and international environmental law, intellectual property rights over biological products.

Unit VI:
Biodiversity conservations and sustainable use.

Reference Books*:*

Ferguson. C. 1980. Biochemical Systematics and Evolution.
Mayor. E. 1994. Principles of Systematic Zoology.
Agarwal. K.C. 2000. Biodiversity.
A.B.Choudhari and D.D.Sarkar 2002. Biodiversity Endangered.
Kumar.V. 2003. Biodiversity Principles and Conservation.
Kotwal P.C. 2003. Biodiversity Conservation in Managed Forests and Protected Area.
Trivedi. P.C. 2004. Biodiversity Assessment and Conservation.
India 2006: Ministry of Information and Broadcasting, Government of India, New Delhi.

B.Sc. (vi) - SEMESTER VI – PART III a: MAJOR

ANIMAL PHYSIOLOGY& IMMUNOLOGY AND ENVIRONMENTAL BIOLOGY & BIODIVERSITY PRACTICALS ***3+3 Hours / week*** ***4 Credits***

(for students admitted from 20014-'15 onwards)

Animal Physiology and Immunology

1. Estimation of oxygen consumption in an aquatic animal (Fish)
2. Blood smear: Total and differential count
3. Qualitative analysis of excretory products of animals
4. Estimation of salt loss or gain in an aquatic animal in heterosmotic media
5. Enzyme activity in relation to pH
6. Microscopic observation of sections of - Bone marrow, Thymus, Spleen and Lymph node
7. Locate primary and secondary lymphoid organ in any vertebrate (Demo)
8. Human blood smear: Observation of white blood corpuscles
9. Agglutination test: Blood groups
10. Visit to research laboratories

Environmental Biology & Biodiversity

1. Estimation of oxygen content in two water samples.
2. Estimation of salinity in two water samples.
3. Estimation of carbondioxide in two water samples.
4. Qualitative analysis of plankton from any one sample.
5. Study of soil organisms-Species richness, abundance, density, frequency, species evenness.
6. Study of physical characteristics (Temperature, colour & texture) of the soil.
7. Identification of fauna of rocky shore.
8. Identification of fauna of sandy shore.
9. Identification of fauna of coral reef.
10. Study of termitarium.

B.Sc. (vi) - SEMESTER: VI – PART III b. Electives

c. ON SITE TRAINING

a) Agricultural Entomology ***2 Hours/week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

1. Land prepation for Paddy and vegetables
2. Survey of Pest in paddy and vegetable fields.
3. Estimation of damage
4. Pest control operations using sprayer and dusters
5. Harvesting
6. Rearing of biocontrol agents and field applications

Sc. (vi) - SEMESTER: VI – PART III b. Electives

a) Seri-biotechnology ***2 Hours/week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

1. Mulberry :- Land preparation – Preparation of cutting and planting – Irrigation – Application of manures – Leaf harvest and preservation – Annual pruning
2. Sericulture:- Brushing – rearing - feeding – bed cleaning – bed spacing – harvesting – marketing.

Sc. (vi) - SEMESTER: VI – PART III b. Electives

b)Bioprocess Engineering & Technology ***2 Hours/week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

1. Fermentation Process
2. Production of alcohol
3. Production of any antibiotics
4. Production of aminoacids

Sc. (vi) - SEMESTER: VI – PART III b. Electives

b) Vermitechnology ***2 Hours/week*** ***3 Credits***

(for students admitted from 2008-'09 onwards)

1. Establishment of a vermiculture unit - an overview - preparation of vermibeds.
2. Culture of earthworms - observation of their burrowing activity, formation of drilospheres and vermicasts.
3. Analysis of soil organisms using Berlese funnel - beetles, millipedes, mites, dermapterans etc.
4. Study of soil termites - termite mounds, caste disintegration and social behaviour.
5. Study of natural enemies of earthworms - attack of vermieries by ants, scorpions, beetles, mites, centipedes, snakes etc.
6. Study of litter degradation and decomposition of farmyard wastes - agricultural and animal wastes.
7. Determination of soil pH.
8. Harvesting of vermicompost and packaging.

B.Sc. (vi) (Voc) - SEMESTER I – PART III b Electives - Vocational

FISH BIOLOGY - THEORY AND PRACTICAL ***4+2 Hours / week 4 Credits***

(for students admitted from 2008-'09 onwards)

Theory

UNIT I

Introduction to taxonomy; Binomial nomenclature; Characters of Elasmobranches and teleosts; Variations in scales, fins, mouth, teeth and other structures used in taxonomic studies

UNIT II

Commercially important orders, families, genera and species of Elasmobranches and teleosts; Internal anatomy of fish – digestive system and associated organs, gills, swim bladder, accessory respiratory organs, heart and circulatory systems, lateral sense organs

UNIT III

Identification of commercially important species of prawns, crabs, lobsters and cephalopods of India – Organization of internal organs of prawn and cephalopod

UNIT IV

Length-weight relationship – Age and growth – Studies on stomach content and its significance – Feeding in relation to age – Index of preponderance

UNIT V

Fish reproduction – Sexual dimorphism – Dichromatism – Hermaphroditism – Types of ovary – Ovarian development – Stages of maturity – Types of spawning in Elasmobranches and teleosts – Fecundity – Gonadosomatic index

Reference Books*:*

Jhingaran Y.G Fish and Fisheries of India.
Bal and Rao.Marine Fisheries of India.
Carl .E. Bond. Biology of Fishes.
Lagler .K.F, J.E Baradack and R.R.Miller.Icthyology.
Munro.Marine and Freshwater fishes of Ceylon.
FAO Fishes identification catalogue Indian Ocean.
Michael King. Fisheries Biology, Assesment and Management

Practicals

1. Study of external morphology of a teleost fish.
2. Study of the anatomy of a teleost fish.
3. Identification of important marine (Shark, ray, skate, mullet, milk fish, seabass, flat fish, bream, goat fish and pompret) and freshwater (catla, rohu, mrighal, tilapia and mystis) fishes.
4. Gut content analysis of fishes.
5. Study of food and feeding habit of a herbivorous fish.
6. Study of food and feeding habit of a carnivorous fish.
7. Study of food and feeding habit of an omnivorous fish.
8. Male and female reproductive organs of fish.
9. Maturity stages of ovary and testis – Gonadosomatic index (GSI).
10. Fecundity of fishes.

B.Sc. (vi) (Voc) - SEMESTER II – PART III b Electives - Vocational

CAPTURE FISHERIES - THEORY AND PRACTICAL ***4+2 Hours / week*** ***4 Credits***

(for students admitted from 2008-'09 onwards)

Theory

UNIT I
Capture fisheries in India; **Freshwater fisheries** – Status and resources of Indian major carps, catfishes and freshwater prawn

UNIT II
Estuarine fisheries – Status and resources of finfishes – Mullet, Milkfish and Seabass; Status and resources of shellfishes – Clam, Mussel and Oyster

UNIT III
Marine fisheries – Status and resources of pelagic fishery – Oil sardines, Mackeral, Tuna and Seerfish; Status and resources of demersal fishery – Elasmobranchs, Flatfishes, Crustaceans (shrimps, crabs and lobsters), Molluscs (bivalves, gastropods and cephalopods)

UNIT IV
Crafts and gears – Different types of nets and traps; traditional, non-mechanised and mechanised gears

UNIT V
Fishery management – Principles and importance of conservation and management of fisheries, Exploitation and management of EEZ, Role of Government organization – CMFRI, FSI, MPEDA and TANUVAS

Reference Books*:*
Srinivastava C.R.L.Fishery Science and Indian Fisheries.
Jhingaran Y.G Fish and Fisheries of India.
B.N.Yadav.Fish and Fisheries.
S.P.Biswas Manual and Methods in Fish Biology.
Narasimhan, Molluscan Fisheries of India.
Santhanam.Fisheries Science

Practicals

1. Visit to Royapuram fish landing centre.
2. Visit to Pulicat fish landing centre.
3. Observation of crafts employed in Pulicat lake.
4. Observation of gears operated in Pulicat Lake.
5. Visit to Sathanur dam.
6. Observation of crafts and gears used in Sathanur.
7. By-catch studies – fish landing sites.
8. Analysis and interpretation of data.
9. Identification of prawns – *Macrobrachium* sp., *Penaeus* sp.; crabs – *Portunus* sps., *Scylla* sp.; lobsters; clams; mussels; oysters; cephalopods – squid, cuttlefish, octopus.
10. Identification of fishes – oil sardine, mackerel, tuna, seer fish and flatfish.

AQUACULTURE – THEORY & PRACTICAL **4+2 *Hours / week*** ***4 Credits***

(for students admitted from 2008-'09 onwards)

Theory

UNIT I : Introduction: Scope and definition, Importance, Origins and growth of aquaculture, Present status of aquaculture.

UNIT II: Selection of sites for aquaculture: Land based farms, Open water farms, Water quantity and quality, Sources of pollution, Environmental impacts,

UNIT III: Pre-requisites of cultivable organisms (sea weeds, sponge, shell fish, prawn, shrimp and crabs, echinoderm and fin fish), Exotic species, Common aquaculture species.

UNIT IV: Farm culture: Extensive, semi-intensive and intensive culture, integrated farming, cage culture, pen culture, raft culture, raceway culture, Sewage fed fish culture. Monoculture and Polyculture.

Unit V: Fresh water aquaculture: Present status, preparation of ponds, Liming and fertilization.
Nutrition and feeds: Feeding habits and food utilization, Energy sources, Brood stock and larval nutrition, Live feed and artificial feed.
Pests , predators, diseases: Control of aquatic insects, and predatory and weed fishes, Methods of weed control i.e., manual, chemical and biological, important fish and shell fish diseases.
Breeding and culture of freshwater prawns, polyculture with finfish, Air breathing fish culture, and cold water fish culture.

UNIT VI: Coastal aquaculture: Introduction, Present status, Brackish water resources, Culture practice in Bherries and Pokkali fields.
Important species of cultivable Penaeid Shrimps. Life history, hatchery production of seed and transportation, Waste water treatment, Stocking, management and harvesting.
Breeding and culture of brackish water fin fish in relation to milk fish and Grey mullets
Mariculture: Culture of edible oysters, mussels, sea cucumbers, pearl oyster and sea weed culture.

UNIT VII: Harvesting:
VII.1 : Harvesting methods- Harvesting drainable ponds, Seining undrainable ponds , harvesting cage and raceway farm, harvesting mollusc.

UNIT VIII: Aquafarm management.

Practicals

a) Identification of cultivable organisms:

1) Fishes 2) shrimps 3) Prawns 4) Molluscs

b) Identification of aquatic insects, weeds and predatory weed fishes

c) Culture of live feed organism- Field training

d) Identification of parasites and diseases of fish/shrimp

e) Soil and water analysis

f) Study of few brands of Artificial feeds

g) Visits to:
1) Fish farm 2) Shrimp farm 3) CIBA 4) CMFRI

h) Training program.

FISH DISEASES AND POST HARVEST TECHNOLOGY-THEORY & PRACTICAL

4+2 *Hours*/Week 4 Credits

(for students admitted from 2008-'09 onwards)

UNIT I: Fish, shrimp diseases and Fish health management–Infectious diseases-Bacterial, fungal, viral, protozoan; Non infectious and nutritional diseases. Disease diagnosis, prevention and control measures. Fish immunization and vaccines.

UNIT II. Fish as food commodity-Biochemical and nutritional value of fish; fish decomposition-Rigor mortis, post rigor, rancidity, Autolysis. Fish Preservation and processing- Principles and methods- Chilling, freezing, sun drying, salt curing, canning, smoking, irradiation.

UNIT III: Fishery products and by-products: Fish liver oil, fish body oil, fish flour sausage, ham, Fish meal, fish silage, fish manure, fish glue, isinglass, fish leather, guano, Shagreen, dried fins, fish roe, Squalene, and chitosan, ambergris, Sea weeds: By-products- Agar, Algin, and Carageenan. Industrial and pharmaceutical uses.

UNIT IV: Sanitation in processing units and quality control of fishery products: Importance and methods; HACCP (hazard analysis and critical control point)principle and quarantine methods: HACCP and Safety of canned foods and unreliability of post process sampling of canned foods to ensure sterilization. Status of a batch of canned foods identifying CCPs and their monitoring by specially trained personnel.

UNIT V: Fishery Economics: Definition and application of economic principles to fisheries. Fishery resource as common property resource. Theory of production and law of diminishing returns. Fish markets economics and valuations. "Fishery cooperatives" and their importance. Planning and financing scheme for fisheries.Extension education- Objectives. Role of extension in fishing villages development. Methodologies of extension.

Reference books:

1. Balachandran, K.K., Fish Canning Principles and Practices. CIFT, Cochin.
2. Gopakumar K., 2002. Text Book of Fish Processing Technology. ICAR, New Delhi .
3. Hall, G.M., 1992. Fish Processing Technology (Ed), Blackie Academic and Professional, London.
4. Hersom, and Hulland, E.D,1980. Canned Foods.Chemical Publishing Company,Inc., New York
5. Larousse, J and Brown, B. E, 1997. Food Canning Technology. Willey VCH New York
6. Venugopal, V. 2006. Seafood Processing. Taylor & Francis Group, London.

Practicals:

1. **Ide**ntification of common fish parasites
2. Field visits to study diagnosis and treatment of fin fish and shell fish diseases
3. Visit to fish processing plants
4. Filleting of fish, packaging and freezing.
5. Processing of Prawns, Lobster, Squid, Cuttle Fish, Crab etc. in different styles.
6. Identification of fresh and spoilt fish. Studies on physical, chemical and sensory changes.
7. Study of socio-economic status of fisher folk by field visits to fishing villages

ENTREPRENEURSHIP DEVELOPMENT - THEORY

Hours / week ***Credits***

(for students admitted from 2008-'09 onwards)

UNIT I

Need, Scope and characteristics – Types of entrepreneurship – Importance of environmental considerations- Municipal by law and insurance coverage.

UNIT II

Special scheme for technical entrepreneurs – Identification of opportunities –Market need, scope and approaches for project formulation.

UNIT III

Criteria for principles of product selection and development – Institutions financing procedures and financing procedures and financial incentives SIPCOT, SISI, TIDCO, TIIC.

UNIT IV

Creativity and innovation-Problem solving approach-Strength weakness opportunity and threat (SWOT) techniques-Techno-Economic feasibility of the project-Licensing-Registration procedures.

UNIT V

Critical path methods (CPM)-Project Evaluation Review Techniques (PERT) as planning tools for establishing-SSI.

BOOKS RECOMMENDED:

Entrepreneurial Development – S.Saravanavel

Entrepreneurial Development – Gupta

AQUARIUM SCIENCE - THEORY & PRACTICAL **4+2 *Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I: Ornamental fish biodiversity of India- History, live bearers and egg layers, common ornamental fishes of India (Fresh water and marine); scope for entrepreneurs in ornamental fish trade.

UNIT II: Construction and maintenance of aquarium: Material required, construction, Glass cover, Hood, Aquarium stand, Installation, setting of Aquarium, Planting of aquarium, tank conditioning and stocking, introduction of fish, Decoration, Aeration, Acclimatization, Maintenance. Aquarium accessories: Air pumps, filters, functions of gravel bed, foam filters, power filters, lighting, aquarium heaters.

UNIT III: Feed and feeding of ornamental fish: Nutritional requirements, types of fish feed, available feeds in market.

UNIT IV: Sexual dimorphism in live bearers and egg layers; Live bearers- Sword tails, white sail fin molly; red platy fish; guppy; Egglayers- Cichlids; Cyprinids; Characins (tetras); Anabantiods (Gourami) loaches and catfish

UNIT V: Breeding techniques of aquarium fish: Sexing, selecting the parent; conditioning the fish to breed; various types of breeding, larval rearing and transportation.

UNIT VI: Disease of ornamental fish and their cure: Bacterial, fungal, protozoan, crustacean, viral

UNIT VII: Aquarium plants and their propagation: Types of aquarium plants; important aquarium plants and their uses.

Reference books:

1. Archana Sinha & Radha C Das . 2004. Ornamental fishes. Dr SC Mukherjee, Director, CIFE, Mumbai (Publisher). PP 54
2. M. Kanthaiyapparaju. Simple guide to Aquarium fish keeping. Kasthuri Publishers. PP 122.
3. Dick Mills. 2004. 101 Essential tips Aquarium fish. Dorling Kindersley Limited, Penguin Group (UK). PP 72.
4. Gerhard Brunner. 1973. Aquarium plants. TFH. Publications, Inc, Ltd. PP 157.

Practicals:

1. Identification of important ornamental fish – Fresh water and marine
2. Hands on training in ornamental fish culture
3. Knowledge on identification of common pathogens of fish
4. Construction of a typical home aquarium
5. Collection of live feed organisms from the water bodies

FISH BIOTECHNOLOGY - THEORY & PRACTICAL **4+2 *Hours / week*** ***5 Credits***

(for students admitted from 2008-'09 onwards)

UNIT I. Fish Breeding: Synthetic hormones for induced breeding- GnRH analogue structure and function.

UNIT II Transgenesis : Methods of gene transfer in fishes, single gene traits, screening for transgenics, site of integration, applications, regulation of GMOs, IPR, Evaluation of GFP transgenics, monosex production.

UNIT III Gene Bank and conservation; Cryopreservation of gametes and embryos.

UNIT IV Feed Technology: Micro encapsulated feeds, micro coated feeds, micro-particulate feeds and bio-encapsulated feeds, mycotoxins and their effects on feeds.

Unit V: Genetic engineering and its application in fisheries: Recombinant DNA technology: DNA modifying enzymes - types of restriction endonucleases (Type I, II and III), DNA/RNA modifying enzymes (alkaline phosphatases, kinases, exonucleases, ligases, terminal transferases); Vectors - plasmids (replication, copy number control and compatibility), phagemids, cosmids, high capacity vectors (eg. BAC), Hosts: prokaryotic (selected E. coli strains) and eukaryotic (selected yeast strains).

Unit VI- PCR – principle, types and applications; Structure and function of DNA polymerase and reverse transcriptase. Genomic DNA library: construction, screening (PFGE-Pulse field gel electrophoresis) and applications.

Reference Books:

1. Reddy. P.V.G.K; Ayyappan et al., (2005) "Text Book Of Fish Genetics and Biotechnology". 218p ICAR publications. ISBN:81- 7164 – 029- X.
2. Lakra.W.S et al.,(2004) "Fisheries Biotechnology" Narendra Publishing house, 240p ,ISBN- 81 – 85375- 86- 0.
3. Sambrook J et al 1989. Molecular Cloning: A laboratory manual. New York: Cold Spring Harbor, Vol 1-3.
4. T.A. Brown. 1998. Recombinant DNA. Academic Press, London.
5. T.A. Brown. (2002) Genomes - 2nd edition. John wiley & sons, Newyork. 572p.
6. Lewin Benjamin. GENES – IX, London; Jones & Bartlet publishers; 2008; 829P; ISBN: 10-0- 7637- 5222.
7. Primrose S.B, Twyman R.M (2006) Principles of Gene Manipulation and Genomics (7th edn). Blackwell Publishing, Oxford UK

Biotechnology Practicals:

1 Field visits to TANUVAS, ornamental fish farms:

a) Induced breeding
b) PCR
c) Diagnosis of WSSV
d) Cryopreservation of gametes
e) Live feed culture
f) HACCP methods