THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

B.Sc. ZOOLOGY

DEGREE COURSE

(With effect from 2020 - 2021)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Invertebrata	25	75	100
	III	Core Practical	Practical-1	4	0	Invertebrata and chordata	0	0	0
4.	III	Allied -1	Paper-1	4	3	(To choose 1 out of 3) 1. Chemistry – I 2. Botany – I 3. Economic Entomology – I	25	75	100
	III	Allied- 1	Practical-1	2	0		0	0	0
5.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II					**CIA**	**Uni. Exam**	**Total**
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	6	4	**Communicative English II**	25	75	100
9.	III	Core Theory	Paper-2	5	4	Chordata	25	75	100
10.	III	Core Practical	Practical-1	3	2	Invertebrata and chordata	25	75	100
11.	III	Allied-1	Paper-2	4	3	(To choose 1 out of 3) 1. Chemistry II 2. Botany II 3. Economic Entomology II	25	75	100
12.	III	Allied Practical - 1	Practical-1	2	2		25	75	100
13.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
14.	IV	Value Education		2	2		25	75	100
15.	IV	Soft Skill		2	1		25	75	100
		Sem. Total		**36**	**25**		**225**	**675**	**900**

		SEMESTER III					CIA	Uni. Exam	Total
16.	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
17.	II	English	Paper-3	6	4	English	25	75	100
18.	III	Core Theory	Paper-3	4	4	Cell and molecular Biology	25	75	100
	III	Core Practical	Practical- II	3	0	Cell and molecular Biology	0	0	0
19.	III	Allied-2	Paper-3	4	3	**(To choose 1 out of 3)** 1. Chemistry - I 2. Botany - I 3. Economic Entomology - I	25	75	100
		Allied Practical - 2	Practical-2	3	0		0	0	0
20.	IV	Skill Based Subject	Paper-1	2	2	**(To choose 1 out of 2)** 1.Vermiculture 2. Single Cell Protein Culture	25	75	100
21.	IV	Non-Major Elective	Paper-1	2	2	**(To choose 1 out of 2)** 1.Public Health and Hygine 2.Poultry Farming	25	75	100
		Sem. Total		**30**	**19**		**150**	**450**	**600**
		SEMESTER IV					**CIA**	**Uni. Exam**	**Total**
22.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
23.	II	English	Paper-4	6	4	English	25	75	100
24.	III	Core Theory	Paper-4	4	4	Genetics and Biotechnology	25	75	100
25.	III	Core Practical	Practical-2	3	3	Cell and molecular Biology and Genetics and Biotechnology	25	75	100
26.	III	Allied-2	Paper-4	4	3	(To choose 1 out of 3) 1. Chemistry II 2. Botany II 3. Economic Entomology II	25	75	100
27.	III	Allied Practical - 2	Practical-2	3	2		25	75	100
28.	**IV**	**NMSDC : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	**25**	**75**	**100**
29.	IV	Non-Major Elective	Paper-2	2	2	**(To choose 1 out of 2)** 1. Bio-Fertilizer Production 2. Aquarium Fish keeping	25	75	100
		Sem. Total		**30**	**24**		**200**	**600**	**800**
		SEMESTER V					**CIA**	**Uni. Exam**	**Total**
30.	III	Core Theory	Paper-5	6	6	Bio-Statistics and Bio-Informatics	25	75	100
	III	Core Practical	Practical-3	3	0	Bio-Statistics and Bio-Informatics Developmental Biology and Immunology Animal Physiology	0	0	0
31.	III	Core Theory	Paper-6	6	6	Developmental Biology and Immunology	25	75	100

		Core Practical	Practical-4	3	0	Environmental Biology Economic Zoology	0	0	0
32.	III	Core Theory	Paper-7	6	5	Animal Physiology	25	75	100
33.	III	Internal Elective	Paper-1	3	3	(To choose 1 out of 2) 1. Nano Technology in Life Sciences 2.Human Endocrinology	25	75	100
34.	IV	Skill Based Subject	Paper-3	3	2	(To choose 1 out of 2) 1. Animal Behavior 2.VegetableMeat Culture	25	75	100
		Sem. Total		**30**	**22**		**125**	**375**	**500**
		SEMESTER VI					**CIA**	**Uni. Exam**	**Total**
35.	III	Core Theory	Paper-8	5	5	Environmental Biology	25	75	100
36.	III	Core Theory	Paper-9	5	5	Economic Zoology	25	75	100
37.	III	Core Practical	Practical-3	3	3	Bio-Statistics and Bio-Informatics Developmental Biology and Immunology Animal Physiology	25	75	100
38.	III	Core Practical	Practical-4	3	3	Environmental Biology Economic Zoology	25	75	100
39.	III	Compulsory Project	Paper-10	5	5	Individual / Group Project	25	75	100
40.	III	Internal Elective	Paper-2	3	3	(To choose 1 out of 2) 1. Evolution 2.Microbiology	25	75	100
41.	III	Internal Elective	Paper-3	3	3	(To choose 1 out of 2) 1. Bio Chemistry 2.Applied Entomology	25	75	100
42.	IV	Skill based Subject	Paper-4	3	2	(To choose 1 out of 2) 1.Medical Lab Technology 2.Industrial Fishery Management	25	75	100
43.	V	Extension Activities		0	1		100	0	100
44.	-	**NMSDC : Employability Readiness**		-	-	**(choose any one)** • **Naandi** • **Unnati** • **Quest** • **Izpay** • **IBM Skills build**	-	-	-
		Sem. Total		**30**	**30**		**300**	**600**	**900**
					140				**4300**

Part	Subject	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Languages	4	4	16	100	400
Part II	Communicative English & English	4	4	16	100	400
Part III	Allied (Odd Semester)	2	3	6	100	200
	Allied (Even Semester)	2	5	10	100	200
	Allied Practical	2	2		100	200
	Electives	3	3	9	100	300
	Core	9	(3-5)	43	100	900
	Core practical	4	(2-3)	11	100	400
	Professional English	2	3	6	100	200
	Compulsory Project (Group/Individual Project)	1	5	5	100	100
Part IV	Environmental Science	1	2	2	100	100
	Soft skill	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others /NME	2	2	4	100	200
	Skill Based	4	2	8	100	400
Part V	Extension Activities	1	1	1	100	100
	Total	**43**		**140**		**4300**

SECOND YEAR

SEMESTER III
Core Paper - 3

CELL AND MOLECULAR BIOLOGY

Objectives:
To learn the cytological techniques, the structure and functions of various cellular components.
To understand the integrated activity of the whole cell as in mitosis, meiosis and protein synthesis.
To understand the molecular basis of cell structure DNA structure and functions.

UNIT - I
History of Cell and Molecular Biology - Principles of microscopes light and electron, Cytological techniques - cell fractionation, Homogenization Centrifugation, Isolation of Sub-cellular components. Biochemical techniques - Electrophoresis and their applications. Cell culture techniques and applications.

UNIT - II
Cell - Cell theory, Ultra structure of animal cell - structure, composition and functions - cell components - Plasma Membrane - Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysomes, Peroxisomes, Centrioles and Mitochondria.

UNIT - III
Cytoplasm - Physical, chemical and biological properties. Nucleus - Ultrastructure, Composition and Function - Chromosomes - Giant chromosomes (Polytene and Lamp brush chromosomes).

UNIT - IV
Cell cycle and cell division - Amitosis, Mitosis and meiosis and their significance. Cancer biology - structure of cancer cell, carcinogenesis. Aging - Cell death and apoptosis.

UNIT - V
Structure and functions of DNA & types of RNA [mRNA, tRNA, rRNA]. Semi conservative replication, mechanism and enzymology of DNA replication. Protein synthesis.

Reference Books:
1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong.
3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philiadelphia, London, Toronto.
4. Powar, C.B.,1989.Essentials of Cytology, Himalaya Publishing House, Bombay.
5. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
6. Rastogi. S.C. Cell and Molecular Biology, 2008 2nd Edition, New Age International (p) Ltd., New Delhi.
7. G.P. Jayanthi 2009 Molecular Biology, M.J P Publ. Chennai.
8. Philip Sheeler, Donald E. Bianchi, 1987.Cell and Molecular Biology - John Wiley and Sons, Inc, 3rd Edition.

9. M. Prakash, C.K. Arora,1998 - Microscopical Methods - Anmol Publications Pvt. Ltd., First Edition.
10. M. Prakash, C.K. Arora, 1998 - Laboratory Instrumentation - Anmol Publications Pvt. Ltd. First edition.

Course Outcome: After completion of the course the student will..

CO 1: Acquire knowledge about the history basic techniques in cytology and molecular biology.
CO 2: Get an in depth knowledge about the cell structure.
CO 3: Learn about the cell organelles and their functions.
CO 4: Understand the cell cycle and learn about cancer biology.
CO 5: Learn about the nucleic acid and protein synthesis.

SKILL BASED SUBJECT-1
PAPER -1
(to choose one out of 2)

A. VERMICULTURE

Objectives:
To acquire knowledge about biofertilizer
To impart training on Earthworm culture technology
To create knowledge on Self - Employment opportunity

UNIT - I

Eathworm types - Morphological and Anatomical characteristics. Biology of *Lampito maruitti.*

UNIT - II

Vermicompost process - Types of Vermicomposting materials. Monoculture and polyculture techniques, factors affecting vermicomposting - pH, Moisture, temperature etc.

UNIT - III

Vermicomposting methods - Small scale and large scale pit method, heap method, Wind row method and bin method. Vermiwash.

UNIT - IV

Vermicomposting: General procedure in Homes. Maintenance of vermicomposting beds. Harvesting the worms. Earthworm Predators, parasites and pathogens.

UNIT - V

Nutrients availability - Application of Vermicomposting in Agriculture and Horticultural practices. Advantages of Vermicompost and marketing.

Reference Books:
1. Edwards, C.A., and Bother, B. 1996: Biology of Earthworms - Chapman Hall Publ. Co., London.
2. Ismail, S.A. 1997: Vermitechnology - the Biology of Earthworms - Orient Longman Publ. - India.
3. Ranganathan, L.S. 2006: Vermibiotechnology from soil health to Human health - Agrobios - India.
4. Talashikar, S.C. 2008: Earthworms in Agriculture - Agrobios - India
5. Gupta, P.K. 2008: Vermicomposting for sustainable agriculture [2nd edition] - Agrobios - India.
6. EIRI Board, 2015: Handbook of Biofertilizers and Vermiculture, New Delhi, India.
7. NIIR Board: The complete technology book on Biofertilizers and organic farming New Delhi, India.
8. Mary Violet Christy, A. 2008: Vermitechnology - MJP Publishers, Chennai , India.
9. Rajeev Prathap Singh. 2012: Organic Fertilizers: Types, Production and Environmental Impact Nova Science Inc. New York.

10. Keshav Singh, 2014: A textbook on Vermicompost, Vermiwash and Biopesticide. Biotech Books, Astral International, New Delhi, India.

Course Outcome: After completion of the course the student will ..

CO 1: Learn about the characteristics and biology of earthworm.
CO 2: Get an in depth knowledge about the culture techniques.
CO 3: Understand about the methods of composting.
CO 4: Learn the factors for proper maintenance of the vermicomposting beds.
CO 5: Learn about the application and marketing of the compost.

SKILL BASED SUBJECT-1
PAPER -1

B. SINGLE CELL PROTEIN CULTURE

Objectives:
To have knowledge and importance of **Single cell protein (SCP)** culture techniques.
To emphasize the importance of integrating new knowledge of Food Biotechnology.
To update the technological innovations of Microbial organisms and its applications in Nutrition.

Course Outcome: After completion of the course the student will ..
CO 1: Acquire knowledge about the scope and organisms used in SCP.
CO 2: Get an in depth knowledge about the Algal SCP.
CO 3: Understand about the culture and extraction of Bacterial SCP.
CO 4: Understand the culture techniques of Fungal SCP.
CO 5: Learn about the application of SCP.

UNIT - I

The scope of food biotechnology - characterization, classification and identification of Microorganisms employed in single cell protein (SCP) cultivation.

UNIT - II

Algal sources of single cell proteins - Culture and extraction of SCP From spirulina Maxima, chlorella species.

UNIT - III

Bacterial sources of single cell proteins - culture and extraction of SCP from Bacillus species and *Methylococcus capsulatus.*

UNIT - IV

Fungal sources of single cell proteins - Culture and extraction from yeasts - Candida species. Extraction from filamentous fungi - Agaricus species

UNIT - V

General account on the production of SCP from Biomass and Waste Materials. Nutritive values of SCP - Dietary supplements for Human, Cattle and Birds.

Reference Books:
1. Arumugam, N. 2006: Microbiology, Saras Publ. Nagercoil - India.
2. Kumarasan, V. 2001: Biotechnology, Saras Publ Nagercoil - india.
3. Agarwal, A.K. and Parihar, P.2006: Industrial microbiology - student edition - India.
4. Dubey, R.C and Maheswari, D.K. 2005: A Text Book of Microbiology - S. Chand & co., New Delhi.

5. Rao, A.S. 1997: Introduction to Microbiology - prentice - Hall, New Delhi, New Delhi- India.
6. Sullia, S.B. and Shantharam, S.2005: General Microbiology, Oxford IBH - Publ.. New Delhi - India.
7. Krishnan, A. 2005: Students Dictionary of Microbiology - Student edition - India.
8. Dubey R.C. 2013.- A textbook of Biotechnology, S.Chand and Company Pvt. Ltd. New Delhi.
9. Israel Goldberg, 1985: Single Cell Protein Springer , New York.
10. Steven R. Tannenbaum and Daniel I-chyau Wang, 1975: Single Cell Protein - II-M I T press, London

Course Outcome: After completion of the course the student will ..

CO 1: Acquire knowledge about the scope and organisms used in SCP.
CO 2: Get an in depth knowledge about the Algal SCP.
CO 3: Understand about the culture and extraction of Bacterial SCP.
CO 4: Understand the culture techniques of Fungal SCP.
CO 5: Learn about the application of SCP.

NON-MAJOR ELECTIVE

PAPER -1

(to choose one out of 2)

A. PUBLIC HEALTH AND HYGINE

Course Objectives

1. To impart awareness on public health, Hygiene and diseases.
2 To educate and emphasize on preventive measures of diseases.
3. To create knowledge on Health Education.

UNIT - I

Scope of Public Health and Hygiene - Nutrition and health - classification of foods - Balanced Diet - malnutrition - Kwashirkor, Marasmus, Obesity, Anaemias, - Vitamin deficiencies. Nutritional requirements of special groups.

UNIT - II

Environment and Health Hazards - Causes and effects of Environmental degradation - pollution and associated health Hazards - Health problems due to industrializations - Hospital waste management.

UNIT - III

Communicable diseases and their control measures such as Cholera, Hepatatis, Measles, Polio, Chikungunya, Rabies, Plauge, Leprosy and AIDS.

UNIT - IV

Non - communicable diseases and their preventive measures such as Cancer, Chronic kidney diseases, Chronic respiratory diseases, Hypertension, Coronary Heart Diseases, Stroke, Diabetes, and Obesity. Alcoholism and drug dependence.

UNIT - V

Health Education and Health programmes in India - WHO programmes - government and voluntary Organizations and their health service - Precautions first Aid and awareness on sporadic diseases.

Text Books

Unit-1: Park and Park, 1995: Text book of preventive and social medicine - Banarsidas Bhanot Publ. jodhpur- India.

Unit-2: Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India

Unit-3: Singh, H.s. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India.

Unit-4: Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology - S. Chand & co. Publ. New Delhi- India.

Unit-5: Park and Park, 1995: Text book of preventive and social medicine - Banarsidas Bhanot Publ. jodhpur- India.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand Scope of Public Health and Hygiene - Nutrition and health - classification of foods.

2. After studied unit-2, the student will be able to understand Environment and Health Hazards

3. After studied unit-3, the student will be able to understand Communicable diseases and their control measures

4. After studied unit-4, To acquire the knowledge about Non - communicable diseases and their preventive measures

5. After studied unit-5, the student to acquire the knowledge Health Education and Health programmes in India and WHO programmes

NON-MAJOR ELECTIVE

PAPER -1

B. POULTRY FARMING

Objective: To understand the poultry industry based on the past, present and emphasis of future growth. To study the statistical data and various functions involved in poultry industry.

UNIT - I

PROSPECTS OF POULTRY INDUSTRY

Introduction - definition of poultry - broiler, layer and breeder - common terms related to poultry - development of poultry industry in India. Past and present scenario of poultry industry - domestication of poultry. Role of government/private agencies in poultry development. Importance of broiler and layer production under Indian scenario - poultry population and other poultry related statistics, per capita meat and egg availability in India.

UNIT - II

POULTRY PRODUCTION SYSTEMS, HOUSING, AUTOMATION AND EQUIPMENTS

Selection of site and location of poultry farm - importance of poultry housing and equipment. Principles of housing - location of poultry houses - basic principles of construction. System of rearing - backyard system, semi-intensive system, intensive system - cage, deep litter and slat system, floor space, watering and feeding space requirements for different age groups and rearing conditions. Advantages and disadvantages. Rearing of Turkeys, Ducks, Japanese Quails, Guinea fowls and Geese for meat and egg production.

UNIT - III

FOOD AND FEEDING OF POULTRY FARMING

Feed ingredients, processing of feed - forms of feed - mash, pellet and crumble feed preparation and feeding methods. Feeding chicks, growers, layers, broiler and breeders - feeding in different seasons - nutritional and metabolic disorders in poultry. Physical and sensory evaluation of feed ingredients - sampling techniques - proximate analysis - poultry feed formulae. Commonly occurring anti nutrients and toxicants in poultry feed ingredients - Mycotoxins and their prevention.

UNIT - IV

INCUBATION AND HATCHERY MANAGEMENT

Layout, design and location of hatchery; Methods of incubation; Physical requirements of incubation - collection, selection, cleaning and sanitation of eggs. Storage of hatching eggs - incubation methods - single and multistage incubators. Hatchery operations - setting, candling, transfer, hatching, pedigree hatching, chicks pull out, grading, packing and chick dispatch - In-ovo and in-hatch vaccinations and medications.

UNIT - V

ENVIRONMENT, POULTRY PRODUCTION AND DISEASES

Climatic differentiation for avian production: micro &macro climate - temperature, temperature zones, air - composition, speed and movement, relative humidity andlight. Climatic factors affecting poultry production in housed conditions. Definition of disease, Classification of poultry diseases - Viral, Bacterial, Fungal and Parasitic. Nutritional deficiency diseases.

Text Books

Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.

Colin G. Scanes., 2015. Sturkie's Avian Physiology. 6th Edition. Academic Press, Elsevier Inc., New York.

Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow

Leeson S., & Summers J. D., 2001. Scott's Nutrition of the Chicken. 4th Edition. University Books, Cananda.

Mahajan Naresh, 2015. Poultry Nutrition and Management. 1st Edition. Anmol Publications Pvt. Ltd., New Delhi.

Mountney J. George and Parkhurst R. Carmen, 2001. Poultry Products Technology. 1st Edition. The Harwoth Press Inc., USA.

Narahari D., and Kumararaj R., 2008. Handbook of Applied Broiler Production. 1st Edition. Poultry Punch Publication (I) Pvt. Ltd., New Delhi, India.

Prasab Sushil, 2012. Handbook of Poultry Production. 1st Edition. Enkay Publishing House, New Delhi.

Reddy Ramasubba V., and Bhosale T. Dinesh, 2004. Handbook of Poultry Nutrition. 1st Edition. International Book Distribution Co., Lucknow, India.

Saif., Y. M., et al., 2013. Diseases of Poultry. 12th Edition. Blackwell Publishing, USA.

Sathapathy S., Singh M. K., and Joshi S. K., 2015. A Handbook on Anatomy & Physiology of Domestic Animals and Birds. Sathish Serial Publishing House, New Delhi, India.

Susan E. Aiello and Michael a. Moses, 2014. Merck Veterinary Manual. 11th Edition. Merck Vet Manual.

Taylor W. Lewts, 2003. Fertility and Hatchability of Chicken & Turkey Eggs. 1st Edition. International book Distributing Co., Lucknow, India.

Vegad J. L., 2004. Poultry Diseases: a guide for farmers and poultry professionals. 2nd Edition. International Book Distributing Co., Lucknow, UP.

References

1. Ensmiger. M. E., 2015. Poultry Science. 3rd Edition. International Book Distribution Co., Lucknow, India.

2. Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.

3. Singh, R. A., 2011. Poultry Production. 3rd Edition. Kalyani Publishers, New Delhi.

1. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi

2. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi.

3. Jadhav N. V., and Siddique M. F., 2007. Handbook of Poultry Production and Management. 2nd Edition. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

1. Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.

2. Wiseman. J, and Garnsworthy. P. C., 1999. Recent Development in Poultry Nutrition.

3. Titus Harry. W, and Fritz James. C, 1971. The Scientific Feeding of Chickens. 5th Edition.

1. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi

2. Rajini Asha R., 2011. Simply….Poultry Science. 1st Edition. Alfa Publications, New Delhi.

3. Suguna Management System: Standard Operating Manual - Feed Lab, 2012. Suguna Foods Pvt. Ltd.

4. Sreenivasaiah., P. V., 2006. Scientific Poultry Production-A unique encyclopedia. International Book Distributing Co., Lucknow, India.

1. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi

2. Jadhav N. V., and Siddique M. F., 2007. Handbook of Poultry Production and Management. 2nd Edition. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

1. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi

2. Thyagarajan. D., 2011. Diseases of Poultry. 1st Edition. Satish Serial Publishing House, New Delhi, India.

3. Narahari D., and Kumararaj R., 2008. Handbook of applied Broiler Production. 1st Edition. Poultry Punch Publication (I) Pvt. Ltd., New Delhi.

Course Outcome

1) The Students will have a Knowledge about the Prospects Of Poultry Industry
2) The Students will have a Knowledge about the poultry production systems, housing, automation and equipments
3) The Students will have a Knowledge about the food and feeding of poultry farming
4) The Students will have a Knowledge about the incubation and hatchery management
5) The Students will have a Knowledge about the environment, poultry production and diseases

SEMESTER IV

Core Paper - 4
GENETICS AND BIOTECHNOLOGY

Course Objectives

Unit - 1: (50 to 100 contents)

- Develop and understanding of genetic interactions, discuss about the supplementary genes complementary genes.
- Enable to understand the difference between dominance and epistasis.
- To acquire the knowledge of lethal genes and genic interactions.

Unit - 2: (50 to 100 contents)

- To understand the linkage and crossing over.
- To know about the cytological evidences.
- To understand the alterations of chromosome number arise during mitosis and meiosis.
- To understand the gene structure, expression and regulation.

Unit - 3: (50 to 100 contents)

- To understand how mutation can affect gene dosage and function**.**
- To understand the animal breeding mechanisms.
- To learn about the population structure interms of genetics variations.
- To evaluating the principles to describe genetic profiles of populations.

Unit - 4: (50 to 100 contents)

- To determining the applicability of different kind of cloning vectors.
- To understand recombinant DNA technology.

Unit - 5: (50 to 100 contents)

- To understand the major trends in genetic analysis**.**
- To understand the genetic research in technology and society

UNIT – I

Introduction to genetics – Basis of Mendelian Inheritance and Mendelian Laws

–Genetic Interaction of Genes – Non-Epistatic Interaction, Epistasis, Meotic drive,

Segregation, distortion and Selfish genes. Multiple Alleles – Blood Groups and their

Inheritance in Human, Tissue Typing.

UNIT – II

Linkage and crossing over – Drosophila – Morgan's Experiments - Cytological Evidence for Crossing Over. Sex determining mechanisms-Genetical, Metabolical, and Environmental. Sex determination in human beings - Cytoplasmic Inheritance–, Fine Structure of Gene – Cistron – Recon, Muton – Gene Regulation – Operon concept – Lac Operon.

UNIT – III

Gene Mutation-Types of mutation-Physical and Chemical mutagens, DNA Repair. Applied Genetics – Animal Breeding – Heterosis, Inbreeding, Out breeding, Out Crossing, Hybrid Vigour. Population Genetics: Hardy weinberg Law –Genetic Polymorphism.

UNIT – IV

Definition – Scope and applications – Molecular tools for gene cloning experiments. Cloning vectors, [plasmids, pBr322, Phage vector, Cosmids and phagemids]. Techniques of Genetic Engineering _ recombinant DNA Technology and gene Cloning in prokaryotes [cDNA and Genomic Library].

UNIT – V

Transgeneic plants and animals – DNA finger printing – gene therapy – biosensors – biochips - Application of Recombinant DNA technology in Medicine & Agriculture –Legal and Ethical issues in Biotechnology.

Text Books

UNIT - I: Verma, P.S. and V.K. Agarwal, 1995 Genectis, 8th edition, S. Chand & Co, New Delhi - 110 055.580pp.
Verma, P.S. and V.K. Agarwal, 2009.9th edition, S. Chand & Co, New Delhi.

S.C. Rastogi Biotechnology, Principles and Applications 2007 Narosa Publishing house, Pvt.Ltd.

Verma.P.S and Agarwal.V.K (2004) Genetics, S.Chand & Co., New Delhi .

Dalela.R.C and Verma.S.R (1970) A Textbook of Genetics,Jaiprakash Nath and Company., Meerut.

Gunther S. Stent, 1986. Molecular Genetics.Macmillan Publishing Co Inc. 773pp.
Higgins II, Best GJ and Jones J [1996] Biotechnology - Principles and application Black well scientific Publication Oxford London.
Gupta P.K. Elements of Biotechnology [2001] Rastogi publication, Meerut.
Dubey 2006 Text Book of Biotechnology S. Chand & co. New Delhi.
Gardener. 1991. Principles of Genetics. 8th edition.John wiley& sons Inc. New York. Chichester,Brisbane, Toronto, Singapore.
Monroe. W. Strick Berger 2004 Genetics.Printice Hall of India New Delhi.
Kumar H. D.1998 A text book of Biotechnology, affiliated East West pvt. Ltd., New Delhi.
Nicholls. 2002 Genetic Engineering, Cambridge University Press. UK.
S. Gladis Helen Hepsyba and CR. Hemalatha 2009 Basic Bioinformatics MJP Publ. Chennai.
Vijayaraman, Chellammal K.S and Manikkili.P 1998.UyiriyaeThozhilnutpam. Chimeeraa, Trichy.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to study effectively, and enable to understand the difference between dominance and epistasis, to enable the students understand types of blood groups in humans.

2. After studied unit-2, the student will be able to describe gene linkage and explain the genetic anomalies caused by changes in chromosome number and structure. To understand the fine structure of genes and gene regulations.

3. After studied unit-3, the student will be able explain DNA mutation and repair mechanisms and different kinds of mutagens and kinds of mutagens. To understand the animal breeding techniques, population structure and genetic polymorphisms.

4. After studied unit-4, the student will be able to determine the applicability of difference kinds of cloning vectors, techniques of genetic engineering, illustrating the use of genomic libraries in gene detection and characterization.

5. After studied unit-5, the student will be able to analyse the function of applied genetic research in technology, nature and society, understanding the applications of rDNA technology, and identifying the ethical issues related to gene manipulation**.**

SKILL BASED SUBJECT

PAPER - 2

(to choose one out of 2)

A. SERICULTURE

OBJECTIVES

To develop sericulture is a need based curriculum, infuse sound knowledge about the silkworm, their economic importance and diseases and to disseminate Sericulture as a need.

UNIT - I

ECONOMIC IMPORTANCE AND SILKWORM BIOLOGY

Introduction to Sericulture - Origin and history of Sericulture - Silk road, spread of Sericulture to Europe, South Korea, Japan, India and other countries. Sericulture map of India and World: Components of Sericulture. Types of silkworms, their food plants - Silk producing species - their distribution - Bombyx mori - life cycle - organization of larvae, pupae and moth - structure of the silk gland. Prospectus of Sericulture in India: Sericulture industry in different states, Employment generation in sericulture-Role of women in sericulture employment, potential in mulberry and non-mulberry sericulture.

UNIT - II

MORICULTURE

Silk production: Importance of soils with reference to mulberry cultivation; soil analysis - soil sampling, soil pH, organic carbon and NPK level. Mulberry and non-mulberry cocoon and yarn - Mulberry species: Classification, distribution and common varieties used in Sericulture in India. Requirement for Mulberry Cultivation - methods of cultivation and preparation - Harvest - Transport and preservation of leaves. Feeding and nutrition - specificity of diet - Factors of nutrition - Diet and growth. Pest and diseases. Vegetative morphology : Characters of root, stem, bud and leaf. Reproductive morphology: Male and female reproductive organs, pollination, fertilization and development of seed, structure of seed and fruit. Leaf storage - Leaf yield: Mulberry management and Economics.

UNIT - III

SILKWORM REPRODUCTION AND GENETICS

Reproduction - Growth and Development of silkworms - Physiology of molting in different varieties (Uni, bi and multivoltine) - factors affecting Growth and Development = Endocrinology of reproduction and development. Genetics - mutation breeding and development of new strains. Mendelism and quantitative genetics - Silkworm heredity and environment - Inheritance and Sex determination.

UNIT - IV

PATHOGENIC DISEASES AND PEST

Pathology: Basic concepts of silkworm diseases - Viral, bacterial, Protozoan, and Fungal Diseases diseases (Etiology, Structure, Symptoms, lessions and Pathogenesis) - control mechanisms. Pests of mulberry (Classification, Biology, Nature of damage and control measures*)* - Uzi fly menace**.** Prospects of sericulture, Biology of silkworm (Nutrition, Genetics, Endocrinology, Reproduction, Pest and Diseases).

UNIT - V

SILKWORM REARING AND SILK REELING

Rearing operations - Selection and construction of rearing house Incubation - Hatching - brooding, Harvesting and storage of cocoons: Harvesting, preservation, assessment, storage - Transportation: Cocoons, record maintenance, cost of cocoon production, leaf-cocoon ratio. Disinfectants and feeding appliances **-** Reeling techniques - lacing skinning. Re-reeling etc.

Reference Books

1. Ganga, G. and Sulochana Chetty, J. 1997.An Introduction to Sericulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. 2003. Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Hisao Aruga. 1994. Principles of Sericulture (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Veda, K., Nagai, I. and Horikomi, M. 1997. Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Otsuki, R. and Sato, S.1997. Silkworm Egg Production (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Eikichi Hiratsuka. 1999. Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., 2000. Mulberry Silk Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Soo-Ho Lim, Young-Taek Kim, Sang-Poong Lee. 1990. Sericulture Training Manual - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
9. Wu Pang-Chuan and Chen Da-Chuang. 1994. Silkworm Rearing - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
10. Lu Yup-Lian and Liu-Fu-an. 1991. Silkworm Diseases - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Course Outcome

The Students will have a Knowledge about the economic importance and silkworm biology
The Students will have a Knowledge about the moriculture
The Students will have a Knowledge about the silkworm reproduction and genetics
The Students will have a Knowledge about the pathogenic diseases and pest
The Students will have a Knowledge about the silkworm rearing and silk reeling

SKILL BASED SUBJECT

PAPER - 2

B. APICULTURE

Objectives:

To acquire knowledge of honey bees and their social values. Entrepreneur motivation for practicing apiculture as cottage industry.

UNIT - I

BASICS OF BEEKEEPING

History - History of bee keeping: Definition, Bee keeping in worldwide, In India. Traditional bee keeping, Modern beekeeping, Urban or backyard beekeeping. Honey bee species and identification - Origin, systematics and distribution; Types of honey bees, Species of honey bees. Bee identification. Social organization of honey bees - Colony life and social organization - Queen, drone, worker. Annual biological cycle op the bee colony. Institute. Biology and classification of honey bee, species of honey bees, Social organization of honey bee colony - Swarming and pheromones

UNIT - II

BEE HIVE

Flora for apiculture - Role of Central Honey Bee Research and Training selection of Bees for apiculture, Method of bee keeping - Indigenous method of extraction of honey. Care and management of honey bee hive. Seasonal management of honey bees: Honey bees on Canola, Spring management of bees, Wintering bees, Apiary management for winter/early spring pollination. Summer management of honey production.

UNIT - III

BEE ENEMIES, DISEASES, PESTICIDE POISONING

Bee enemies and diseases: An introduction, Bee enemies - Wax Moth, Ants, Wasps, Microorganisms, Pests. Diagnosis and Identification. Bacterial, viral, fungal & protozoan diseases: Bacterial disease - American Foulbrood, European Foulbrood, Viral disease - Deformed Wing Virus, Sacbrood Viru, Black Queen Cell Virus, Kashmir Bee Virus, Acute Bee Paralysis Virus; Fungal disease - Chalkbrood, Stonebrood; Protozoan disease - Nosemosis, Nosema cerana **-** appliances for modern method, Diseases of honey bee and control measures.

UNIT - IV

PRODUCTS OF BEE KEEPING

Bee products - An introduction, honey, pollen, royal jelly, bees wax, propolis & venom, Significance of bee products - Bee products - An introduction, honey, pollen, royal jelly, bees wax, propolis & venom, Marketing of bee products: Definition of marketing, Marketing Honey Comb and Honey, Marketing Pollination Services, Marketing Wax, Marketing PropolisHoney - bee wax bee venom - Honey. Production, chemical composition - Economic importance of Honey bee wax.

UNIT - V

ECONOMICS AND MARKETING

Marketing Pollen, Marketing Royal Jelly, Marketing Bee Venom, Marketing Adult and Larval bees, Costing and Financing the Marketing Activities. Significance of bee products. Recent Efforts - Modern method in employing honey bees for cross pollination in horticultural gardens. Role of Central Honey Bee Research & Training

Reference Books:

M.S. Nalina Sundari 2006, Entomology M.J.P Publications, Chennai
Sardar singh, Bee keeping in India.
Sharma.P.L., & Singh S. Hand Book of Bee Keeping.
Honey - A Comprehensive survey - International Bee Research Association for House - CNRC [England]
Roger. A. Morse,1990. The ABC & XYZ of Bee culture, 40th ed., A.I Root & Co, Medina, Ohio 44256.516pp 19

Course Outcome

The students will be able to understand the Basics of beekeeping
The students will be able to understand the role of Bee hive
The students will be able to understand the Bee enemies, diseases, pesticide poisoning
The students will be able to understand the Products of bee keeping
The students will be able to understand the Economics and Marketing

NON-MAJOR ELECTIVE

PAPER – 2

(to choose one out of 2)

A. BIOFERTILLIZER PRODUCTION

Objectives :
1.To impart awareness on Bio fertilizer Technology
2.To create knowledge on Environmental degradation.

UNIT - I

Scope of Bio fertilizers - Types of soil - Physical and Chemical composition of Soil. Types of microorganisms in soil.

Course Outcome
To facilitate the students to understand basics of biofertilizers .
They get the knowledge of Introduction to Biofertilizers Scope ,Necessity and Benefits, Types of soil- Physical and Chemical composition of Soil. Types of microorganisms in the soil.
They could understand that Biofertilizers gives supplement to the plants with all nutrients than any fertilizers and do not replace them.

UNIT - II

Production of Bacterial bio fertilizers - Mass production and utilization of different strains of Cyanobacteria. Mass cultivation of Azolla and its utilization.

Course Outcome
They could learn the use of biofertilizers is being emphasized along with chemical fertilizers and organic manures.
They could understands that Biofertilizers are live products (or latent cells of microbes) and require care in storage, transport, application and maintaining field conditions.
They can get the knowledge about Development of integrated management for best results uses both nitrogenous and phosphatic biofertilizers.
They could be aware of Applied to seed/seed material/seedlings/soil/waste matter/crop residues in order to increase the population.
They can accelerate some biochemical processes.

UNIT - III
Isolation and identification of Endophytic nitrogen fixers. Rhizobium and Legume root nodulation and nitrification process.

Course Outcome
To make the students Familiar with culturing techniques, handling of biofertilizer microbes and characteristic attributes such as PGP traits ,Specialized biofertilizer ,bioreactors etc.
They could learn about Microbial scale-up, Bench scale, pilot scale and industrial scale

Biofertilizer Production: Media preparation, sterilization, microbial propagation, mass-scale production, fermentation, formulation ,Preparation of carrier based biofertilizers and field application.

UNIT - IV

Production of Micorrhizal bio fertilizer - Phosphate solublising microorganisms - VAM - Vesicular Arbuscular Mycorrhizal Fungi and its applications as bio fertilzers.

Course Outcome

To promote organic farming in the region through technical capacity building of all stakeholders.
Ability to distinguish the types of biofertilizers.

UNIT - V

Use of Composite Bio fertilizers - Methods for enhancing soil fertility. Renewable properties of bio fertilizers. The cost / benefit analysis of production and application of bio fertilizers. .

Text Books:

1. Singh,T. and Purohit,S.S. 2008: Bio fertilizer technology, Agrobio - India
2. Sharma,A.K. 2007 : Bio fertilizer for sustainable Agriculture - Agrobios-India.

Reference Books :

1.Pandiyarajan,P. 2008 : Techniques in Agricultural Microbiology- Agrobios-India
2. Purohit, S.S. 2005 : Microbiology - Fundamentals and Applications (6th Edition) Student Edition - Jodhpur - India.
3. Dubey,R.C., and Maheswari, D.K. 2007 : A Text Book of Microbiology - S. Chand & Co., New Delhi, India.

Course Outcome

To make students ready for industry as entrepreneurs.
To improve the professional competencies and upgrade the knowledge and develop technical skills of biofertilizer production
Use of Composite Bio fertilizers with different Methods for enhancing soil fertility.
The Renewable properties of bio fertilizers.
The cost and benefit analysis of production and application of bio fertilizers.

NON-MAJOR ELECTIVE

PAPER – 2

B. AQUARIUM FISH KEEPING

Objectives;
To impart training on Aquarium fish keeping technology.
To create knowledge on self employment opportunity.

UNIT - I

Fish Aquarium - Introduction - Types of aquarium - Importance of aquarium - Accessories of aquarium - Aquarium fabrication- Setting of aquarium.

UNIT - II

Care and maintenance of aquarium - Aquarium water quality and management - Aquarium plants - Food for Aquarium fishes.

UNIT - III

Study of ornamental fishes (Taxonomy general characters, food and feeding and breeding habits) A. Egg Layers i) Gold fish ii) Zebra fish iii) Koi carp vi) Angel fish v) Gourami B. Live Bearers i) Guppy ii) Mollies iii)Sword tail iv) Platies - Breeding and rearing of ornamental fishes: i) Identification of brooders ii) Breeding behaviour iii) Induced breeding iv) Management of water quality In breeding and rearing of fishes. v) Transportation of ornamental fishes.

UNIT - IV

Disease management of ornamental fishes (Symptoms, life cycle, and control measures) i. protozon disease ii. Bacterial disease iii. Crustacian disease iv. Fungal disease and v. Helminth disesase.

UNIT - V

Food and feeding of Aquarium fishes - use of live fish feed organisms. Preparation and composition of formulated fish feeds- Live fish transport - fish handling, packing and forwarding techniques - General aquarium maintenance - budget for setting up an aquarium fish as a cottage industry.

Reference Books:
Jingran V.G., 1991: Fish and fisheries in India - Hindustan Publ. co New Delhi - India.
Shanmugam K. 1992, Fishery Biology and Aqua Culture - Leo Pathipagam - Chennai- India.
Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York -USA
Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi - India
Hall, C.B. 2005: Ponds and Fish culture - Agrobios - Jodhpur - India.
Day,F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.

Outcomes

The student will be able to understand the basic knowledge of Aquarium fish keeping.

The students will be able to know how to maintain an aquarium .

The student will be able get knowledge about different varieties of ornamental fish.

The student will be able to acquire knowledge about disease management in aquarium fish culture.

The students will acquire knowledge about the feeding techniques of aquarium fishes.

CORE PRACTICAL – II

CELL AND MOLECULAR BIOLOGY, GENETICS AND BIOTECHNOLOGY

CELL AND MOLECULAR BIOLOGY

Cytometry
Compound microscope, camera Lucida, Stage ad Ocular Micrometers

Blood Smear Preparation - Differential count of W.B.C.
Total count of RBC using Haemocytometer.
Total count of WBC using Haemocytometer.

Slide Preparation
Mounting of Buccal Epithelium.
Mitosis in onion root tip squash.
Squash preparation of Grass hopper testes.

Study of prepared slides of histology.
Columnar Epithelium, Ciliated epithelium, Glandular Epithelium. Cartilage T.S., Bone T.S., Cardiac Muscle, Striated muscle, Non Striated muscle, Neuron, Male germ cell, Female germ cell.

GENETICS
Squash preparation of Salivary glands of chironomous larva.
Male & Female identification.
Observation of common Mutants of Drosophila.
Human Blood Grouping analysis.

BIOTECHNOLOGY
Study of prepared slides, Models or specimen.
Escherichia coli, Bacteriophage, Plasmid.
Demonstration of P.C.R technique: Southern blot, Electrophoresis.
Visit to Biotechnology lab and Report - compulsory.

THIRD YEAR
SEMESTER V
Core Paper - 5

BIOSTATISTICS AND BIOINFORMATICS

Objectives :

1.To get a basic knowledge of statistical methods and computations in biology.
2.To study the application of information sciences (mathematics, statistics and computer sciences) in biology.
3.To study the application of information technology to the management and analysis of biological data.

UNIT - I

Biostatistics - Definition and Scope - Census and sampling methods - collection and presentation of Data. Diagrams and graphs; bar, pie Histogram, line graph - Concept of Statistical population and sample characteristics of frequency distribution sampling.

UNIT - II

Measures of Central tendency: mean, median mode and Measures of Dispersion, Range, Quartile deviation, Mean deviation & Standard deviation.

BIOINFORMATICS

UNIT - III

MS-WORD: File Operations New, Save & Print - Editing: Cut, copy, Paste, Find and Replace - Insert: Page numbers and Pictures - Format: Font, Bullet & Numbering, Paragraph and Background Tools: Spelling and Grammar - Data: Sort - MS. EXCEL: Presentation of Bio statistical data using Excel: Auto sum, Paste function, Chart wizard, sort function and Drawing - Use of Internet, Messenger and e-mail-Basic knowledge of Medical transcription and Bio-informatics.

UNIT - IV

Bioinformatics - Definition - Literature databases - NCBI-Pubmed, Medline, Protein and nucleic sequence databases - PIR, Swiss-prot, GeneBank, DDBJ - structure databases - PDB, SCOP, CATH, structure visualization Tools, RasMol, Swiss PDB viewer.

UNIT - V

Pairwise sequence Alignment - Scoring Matrice - PAM and BLOSUM - Statistics of alignment scored Dot plot - local and global alignment - Database Searching - FASTA and BLAST multiple sequence alignment clustal W-Phylogenetic trees-PHYLIP.

Text Books:

1. Biostatistics P. Ramakrishnan Saras Publications 1996 A.R.P. Camp Road, Kottar, Nagarkoil, Kanyakumari District.
2. Elements of Biostatistics by Gurumani ,Nithi Publishers 1998.
3. Developing Bioinformatics Computer Skills Cynthia Gibbs, Sheoff Publishers & Distribtors Pvt. Ltd., Mumbai.

Arthur. M. Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.

Reference Books:

1. Statistics - SP Gupta 1996 S. Chand and Co., New Delhi.
2. Jerold H. Zar Bio statistical analysis [2nd Edition] Printice Hall of International edition, 1984 [Relevant portions]
3. Goutham Roy. Introduction to Computing and Computing lab and Cad[2002] Books and allied [pvt] Ltd. Kolkata
4. MS. OFFICE for Win-Microsoft office press.
5. Developing Application with MS. OFFICE - Christine. Solomon- Microsoft Office Press.
8.Arthur. M.Lesk, Introduction to Protein Structures Oxford University Press, New Delhi, 2000
9. Baxevanis, A and Outllette. Bioinformatics a practical guide to the analysis of genes and proteins, Wily - Interscience, Hoboken, NJ. USA 2005.

Course Outcome:

On completion of the course the students will able

To Define Biostatistics and list out the Scopes of Biostatistics

To determine the value of mean, the median, the mode of grouped data, identifying the relationship among the three measures of central tendency for systematical and skewed distributions, advantages and disadvantages of the three measures.

They could be able to do File Operations New, Save & Print - Editing: Cut, copy, Paste, Find and Replace - Insert: Page numbers and Pictures - Format: Font, Bullet & Numbering etc.

To get introduced to the basic concepts of Bioinformatics

They could able to outline the application areas for multiple sequence Pair wise sequence Alignment

Core Paper - 6

DEVELOPMENTAL BIOLOGY & IMMUNOLOGY

Course Objectives

UNIT - I: (50 to 100 contents)

- To understand the mechanisms of reproduction and types of eggs.
- To understand Physiology of parthenogenesis.
- To understand the difference between complete and incomplete parthenogenesis.

UNIT - II: (50 to 100 contents)

- To learn the patterns and molecular changes, in cleavage.
- To understand the metabolism of embryonic cells during gastrulation.
- To understand the development of organogenesis of brain and eye in chick and frog.

UNIT - III: (50 to 100 contents)

- To understand the embryonic membrances placentations in chick and mammals.
- To acquire knowledge family welfare reproductive technology and applied genetic engineering in developmental genetics.
- To understand the bioethics in embryo transfer.

UNIT - IV: (50 to 100 contents)

- To understand the structure of lymphoid organs.
- To understand the role immune response.
- To acquire knowledge in immunity against bacterial and viral infections.

UNIT - V: (50 to 100 contents)

- To learn types of immunoglobulins and prevention of diseases.
- To learn the deficiency disorders .
- To acquire knowledge of immuno techniques.

DEVELOPMENTAL BIOLOGY

UNIT – I

Gametogenesis – Fertilization - polarity & symmetry of eggs – types of eggs – Fertilization Mechanism, Physiology & theories – parthenogenesis –Natural – artificial – Experiments on Artificial Parthenogenesis.

UNIT – II

Cleavage – Factors influencing cleavage – fate map – blastulation and gastrulation in amphioxus, morphogenetic movements in frog and chick – Experimental works of speeman and Mangold- Development of brain and eye in frog.

UNIT – III

Embryonic adaptations; Embryonic membranes and their functions in chick – placentation in mammals. Puberty – Menstrual cycle-contraception – family welfare reproductive technology; Artificial insemination - cryopreservation - IVF - Embryotransfer – Test tube babies – Bioethics.

IMMUNOLOGY

UNIT- IV

Introduction - Lymphoid organs, cells of immune system – their role in immune response –Antigen – Antibody reaction. Types of immunity –immunity to infections, Transplantation Immunology.

UNIT – V

Immunoglobulin – types, structure, Physico chemical and biological properties – Immunoprophylaxis – Immunization schedule of children. Immuno deficiency – AIDS, Immunotechniques

Text Books

- Balinsky, B.L., 1981. Introduction to embryology Saundeers, Philadelphia. Berril& Corp Developmental Biology. McGraw Hill Book Company, MC.,New York.
- M.S.JayarajAn Introduction to embryology Veer BalaRastogi Publication.
- Verma, P.S., V.K. Agarwal and Tyagi, 1995.Chordate embryology. S. Chand & co., New Delhi.
- Nandhini shetty 2003 published by K.K. Gupta for new age international publiocation.
- MadhaveeLatha. P, 2012.Text book of Immunology, S. Chand & Company.

Reference Items: books, Journal

Balinsky, B.L., 1981. Introduction to embryology Saundeers, Philadelphia.

Berril& Corp Developmental Biology. McGraw Hill Book Company, MC.,New York.
M.S.JayarajAn Introduction to embryology Veer BalaRastogi Publication.
Verma, P.S., V.K. Agarwal and Tyagi, 1995.Chordate embryology. S. Chand & co., New Delhi.
Majumdar, N.N. 1990. Text Book of Vertebrate embryology. Tata McGraw - hill Publishing company Ltd. New Delhi.
McEwen, R.S., 1969.Vertebrate Embryology. Oxford and IBH Publishing Co., New Delhi.
Jain, P.C 1998, Elements of Developmental Biology. Vishal Publication, New Delhi.
Dubey 2006 Text book of Biotechnology S. Chand and Co., New Delhi.
Roitt.I.M 2000 Essential Immunology, Blackwell Scientific Publishers.
Paul, W.E.M. 1989,Fundamental Immunology, Raven Press, New York.
Kuby.J.1999, Immunology.W. H. Free man and Co. New York.
Current protocols in Immunology - 3 Volumes 1994 Wiley Publications.
Roitt.I, Brostoff, J. and Male. D. 2002. Immunology, Mosby, New York.
Richard, A. Golds, Thomas I, Kindt& Barbara A. Osborne 2000 Kuby Immunology, Freeman and Co.New York.

Course Out Comes (five outcomes for each units should be mentioned)

1. The student will be able to study ontogenesis, the development of animals including parthenogenesis.
2. The student will be able to study embryonic adaptations, human reproduction and reproductive technology in man.
3. The student will be able to study the process of immune response and mechanism.
4. The student will be able to understand the advances in Immunology.
5. The student will be able to understand the role of development in defining biological process.

Core Paper – 7

ANIMAL PHYSIOLOGY

Objectives:

To emphasize the basic needs of macromolecules of food and their importance.
To study the basic principles of animal Physiology.
To understand the physiology of various organs and organ systems.

UNIT - I

NUTRITION AND DIGESTION

Introduction - Definition of food, Classification of food constituents - Carbohydrates, proteins, fats, minerals, water and vitamins. Types of nutrition, Ingestion, Feeding mechanisms, Digestion, Enzymes, Physiology of digestion - absorption, assimilation, egestion or defaecation. Metabolism - Definition of metabolism - Carbohydrate metabolism

UNIT - II

RESPIRATION AND CIRCULATION

Definition of Respiration, Respiratory Pigments and functions. Respiratory mechanism - inspiration, Expiration. Transport of gases [Co2 and O2] - Respiratory quotient.
Circulation Types of hearts - Myogenic heart, Neurogenic heart, Composition, Properties and Function of Blood - Coagulation of Blood, Human - Cardiac Cycle - Cardiac Rhythm - Origin of heart Beat - Regulation of heart Beat - ECG - Blood Pressure - Factors Contributing to heart Problems - Coronary circulation.

UNIT - III

EXCRETION AND OSMOIONOREGULATION

Definition of Excretion - kinds of excretory products - Ammonotelism, Ureotelism, Uricotelism, Environmental influence on Excretion. Kidney of man, Nephron structure and formation of urine in mammals - ultrafiltration, reabsorption, secretion hormonal regulation of excretion. Kidney failure and Transplantation. **Osmoionoregulation** Definition: Types of medium, Osmosis, Osmoregulation in fishes and mammals.

UNIT - IV

NEUROMUSCULAR CO-ORDINATION

Nervous tissue - Neuron - Structure, types of neurons. Nerve impulse - Synapse - Synaptic transmission, neuromuscular junction, Reflex actions transmission of impulses - Neurotransmitters. Muscles - Types of muscles -Chemistry of Muscles - Ultrastructure of muscle fibre, Types of muscle contraction - Physical and chemical changes of muscle contraction - Theories of muscle contraction.

UNIT - V

RECEPTORS AND ENDOCRINE SYSTEM

Receptors - Photoreceptor - mammalian eye - structure of retina - visual pigments - physiology of vision - phonoreceptors - mammalian ear - Organ of Corti - working mechanism - phonoreception in bat.

Endocrine glands - structure, secretions and functions of endocrine glands of vertebrates - Pituitary-Hormones of the Adenohypophysis, Hormones of the Neurohypophysis and disorders, Hypothalamus, - Thyroid - Hormones of the thyroid gland and disorders - Parathyroid - Hormones of the parathyroid gland and disorders, Adrenal- Hormones of the adrenal gland and disorders, Thymus, Islets of Langherhans - Hormones of the Islets of langherhans and disorders, Sex organs - testis, ovary.

Reference Books:

Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi - 110 055.

Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology, S. Viswanathan [printers & Publishers] Pvt. Ltd.

William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.

Wood.D.W, 1983, Principles of Animal Physiology 3rd Ed.,

Prosser,C.L. Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003.

Course Out Comes

1. After studied unit-1, the student will be able to understand macromolecules of food and their importance, understand the digestion and metabolism.
2. After studied unit-2, the student will be able to understand important and mechanism-respiration,
3. After studied unit-3, the student will be able to understand Excretion and Osmoionoregulation
4. After studied unit-4, To acquire the knowledge about nervous system muscles and muscle contraction
5. After studied unit-5, the student to acquire the knowledge about Receptors Endocrine system and disorders,

INTERNAL ELECTIVE

PAPER – 1

(to choose one out of 2)

A. NANOTECHNOLOGY IN LIFE SCIENCE

Objectives:
To impart current knowledge in Nanotechnology.
To create fundamental understanding of usage of Nanometerial in life science.

UNIT - I

Scope - Fundamental Understanding of concepts and Methods of Nanotechnology - overview on Nanotechnology and Interdisciplinary field.

UNIT - II

Basic and structural Nanotechnology. Molecular and Macromolecular Levels - Nanoscales - devices and systems developed in Nanotechnology.

UNIT - III

Nanotechnology adopted in DNA computing, Molecular Nanotechnology, Quantum Nanotechnology, Optical and Particles used in Nanotechnology.

UNIT - IV

Use of carbon nanotubules, Better and cheaper nanomaterials - Evaluation of nanomaterials and nanosystems by using conventional materials.

UNIT - V

Application of nanotechnology in the fields of Agriculture, Medicine. Future perspectives of Nanotechnology in life Sciences.

Reference Books:
1. Shanmugam, S.2009 : Nanotechnology, MJP-Publ. Chennai - India.
2. Kumar,U, 2008 : Nanotechnology - A Fundamental Approach - Agrobios - India.
3. Ratner, 2008 : Nanotechnology-A Gentle Introduction to next big idea Tamilnadu Book House, Chennai - India.
4. Goodshell, D.S, 2004 - Biotechnology : Lessons from Nature - John Wiley & Sons (Asia) Publ.Ltd, Singapore.
5. Jeremy Ramsden, 2016: Nanotechnology 2nd edition, William Andrew, Cranfield University
6. Murty, B.S., Shankar, P., Raj, B., Rath, B.B., Murday, J, 2012: .Textbook of Nanoscience and Nanotechnology, Orient Blackswan Private Limited - New Delhi.
7. T. Pradeep A, 2017: Textbook of Nanoscience and Nanotechnology- McGraw Hill Education; 1 edition.

8. Gabor L Hornyak., Harry F. Tibbals., Joydeep Dutta and John J. Moore.,2011: Introduction to Nanoscience and Nanotechnology CRC Press Taylor And Francis Group Boca Raton, New York.
9. Guozhong Cao, 2004: Nanostructures and Nanomaterials Synthesis, Properties and Applications, Imperial College Press, London.
10. Michael S Ashby, Paulo J.Ferreira., Daniel L. Schodek, 2009: Nanomaterials, Nanotechnologies and Design. An Introduction for Engineers and Architects. Elsevier, Oxford, UK.

Course Outcome: After completion of the course the student will ..
CO 1: Understand the basics of nanotechnology.
CO 2: Get knowledge about the levels and devices in nanotechnology.
CO 3: Acquire knowledge about nanotechniques at molecular level.
CO 4: Learn the evaluation of nanomaterials.
CO 5: Learn about the application of nanomaterials in various fields.

INTERNAL ELECTIVE

PAPER – 1

B. HUMAN ENDOCRINOLOGY

Objectives:

To understand the structure and functions of endocrine glands in human.
To learn about the hormonal regulation and their defects in human.

UNIT - I

Pituitary Gland: Classification and characteristic features of hormones. Structure of hypothalamus and pituitary Gland - Hormones of Adenohypophysis, Pars intermedia and Neurohypophysis. Effects of hypo and hyper secretions - Hypothalamic regulation for release of pituitary hormones.

UNIT - II

Thyroid and Parathyroid: Structure of thyroid Gland - Biosynthesis of thyroid hormones. Biological functions of Thyroxine, Regulation of Thyroid secretion-Thyroid Dysfunction - Parathyroid Glands- Biological Action of parathyroid Hormones - Parathyroid Dysfunction

UNIT - III

Adrenal gland: Structural features- hormones of Adrenal medulla and Cortex and their functions - Biological Action of Adrenaline and Noradrenalin - Emergency Hormones.

UNIT - IV

Islets of Langerhans: Histology - hormones Insulin and Glucagon - Biosynthesis of Insulin-Regulation and Mechanism of Action.

UNIT - V

Testes and ovaries: Male reproductive system - Hormonal control of testes Chemistry and Biosynthesis of Testosterone - functions of testosterone Female reproduction system - role of Hormones in Female sexual Cycle Placental hormones - parturition - Lactation.

Reference Books:

1. Mac E Hadley, 1992 Endocrinology, Third edition, prentice Hall, New Delhi.
2. Matsumoto A. and Ishi S., 1992. Atlas of endocrine organs, vertebrates and invertebrates Springier Verlag, Germany.
3. Wilson J.D and Foster D.W 1992, William's textbook of endocrinology, 8th edition, WB saunders company, Philadelphia.
4. World health organization Technical report series, 1992, Oral contraceptives and Neoplasia WHO, Geneva.
5. Turnerm C.D and Bagnarr, J.T., 1994, General Endocrinology, 6th edition, WB saunder's company, Philadelphia [saunder's international students edition]
6. Lamming, G.E. 1984. Marshll,s Physiology of Reproduction; Reproductive cycles of vertebrates. Churchill livingstone, Edinburgh.
7. Prakash S Lohar Endocrinology, Hormones and Human Health.
8. Parameswaran, Anantakrishnan and Ananta Subramanian, 1975- Outlines of Animal Physiology - S. Viswanathan (Printers and Publishers) Pvt. Ltd.,
9. William S.Hoar,1976- General and Comparative Physiology - Prentice Hall of India Pvt., Ltd., New Delhi.
10. Guyton, A. 2001. Textbook of Medical physiology, Tenth Edition, W.B. Saunders, London.

Course Outcome: After completion of the course the student will ..

CO 1: Learn about the structure and function of Pituitary.
CO 2: Understand the biological actions of the thyroid and parathyroid.
CO 3: Know about the emergency hormones.
CO 4: Learn the Mechanism of action and regulation of pancreatic hormones.
CO 5: Understand about the function of the male and female reproductive hormones.

SKILL BASED SUBJECT
PAPER -3
(to choose one out of 2)

A. ANIMAL BEHAVIOUR

UNIT - I

Introduction and mechanisms of behaviour - origin and history of Ethology - types of behaviour - proximate and ultimate behaviour - objective of behaviour- behaviour as a basis of evolution - behaviour as a discipline of science.

UNIT - II

Patterns of behaviour reflexes - reflex path, characteristics of reflexes latency, after discharge, summation, fatigue, inhibition and it comparion with complex behaviour- orientation- primary and secondary orientation - learning - associative learning, classical and conditioning, habituation and imprinting.

UNIT - III

Social behaviour with reference to insect society, Honey bee - society organization, polyethism foraging, round dance - waggle dance - experinment to prove distance and direction compound of dance, learning ability in honey bee -formation of new hive/queen, supersedure, reciprocal altruism, Hamiltons rule and include fitness with suitable example .

UNIT - IV

Sexual behaviour, asymmetry of sex, sexual dimorphism-intra sexual selection (male rivalry) intersexual selection (female choice) infanticide, consequence of mate choice for female fitness, sexual conflict for male versus female - parental care and courtship behaviour in three spine stickleback.

UNIT - V

Biology rhythm - types and characteristics of biological rhythms - short and long term rhythms - circardian rhythm - lunar rhythms- circannual rhythm- photoperiod and regulation seasonal reproduction of vertebrates - biological adaptic significance of biological clock.

Reference Book:

1. Animal behavior - an evolutionary approach by JOHN ALCOCK - Ninth edition.
2. Animal behaviour (ETHOLOGY) V.K. Agarwal - S. Chand publishers.
3. Animal behaviour - a very short introduction - wyatt Tristram D - oxford publishers.

Outcomes:

- Student should be capable of understanding and identify behaviour in a variety of taxa.
- Competently discuss the evolutionary origins of various behaviours.
- Designing and implementing experiment to test hypothesis relating to animal behaviour.
- To demonstrate knowledge of key concepts in animal behaviour.
- To exhibit quantitative research skills.

SKILL BASED SUBJECT
PAPER -3

B. VEGETABLE MEAT CULTURE

Objectives
To emphasize the importance of integrating new knowledge on food biotechnology
To update the technological innovations of edible mushrooms and their application in Nutrition.

UNIT - I

Introduction, history and scope of mushroom cultivation; biology of mushrooms; Nutritional value: (Proteins, amino acids, mineral elements, carbohydrates, fibers, vitamins); Medicinal value of mushrooms; Poisonous mushrooms and mushroom poisoning; edible mushrooms and cultivation in India and world

UNIT - II

Structure and key for identification of edible mushrooms - Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajorcaju) and paddy straw mushroom (Volvariella volvcea). Structure and key for identification of poisonous mushrooms-Truffles (Tuber elanosporum), Ammanita sp, Galerina marginata, and Chlorophyllum molybdites.

UNIT - III

Cultivation Technology: Infrastructure, equipments and substrates in mushroom cultivation: Polythene bags, vessels, inoculation hook, inoculation loop, culture racks, mushroom unit or mushroom house, water sprayer, tray, boilers, driers, pure culture, Spawn: types of spawn, preparation of spawn, mushroom bed preparation and factors affecting mushroom bed preparation; Compost: materials used for compost preparation, compost technology in mushroom production

UNIT - IV

Nutrient Profile of Mushroom: Protein, aminoacids, calorific values, carbohydrates, fats, vitamins & minerals- Nutrient supplements for human consumption as vegetable meat. Nature, Medicinal and nutritional value, Health benefits: Microbicidal effects. Therapeutic Aspects: Antitumour effect.

UNIT - V

Factors influence contamination, diseases in mushrooms in mushroom cultivation- Environmental, fungal, bacterial, viral, insect pests, Nematode diseases, and competitor moulds. National level and regional level, Marketing of mushrooms in India and world.

Reference

1.Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

2.Marimuthu, T. et al. (1991). Oster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
3.Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
4.Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5.Kannaiyan,S. Ramasamy,K. (1980). A hand book of edible mushroom, Today & Tomorrows Printers &Publishers, New Delhi.
6.Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
7. Mushroom Production and Processing Technology, PathakYadavGour (2010) Published by Agrobios (India).

Outcomes

1) Students will understand the principles of mushroom cultivation,
2) acquire the practical knowledge to grow several species of fungi,
3) will have the confidence to approach the mushroom industry for potential employment opportunities.
4) The Student will be able to procure knowledge about the nutritive values of mushroom.
5) The student will be able understand the medicinal values of mushrooms

SEMESTER VI

Core paper - 8

ENVIRONMENTAL BIOLOGY

Objectives:
To create awareness towards recent changes in the environment and preventive measures.
To realize the importance of inter relationship between every organism and environment.
To study the impact of eco factors on the morphology & distribution of organisms.

UNIT - I

Definition of Ecology, Derivation of the term ,Scope - concept - Branches in ecology - **Environmental factors - Soil** -Types, soil formation, Soil group of India, Soil components, Soil chemistry, soil pH, Soil air, Soil organisms. **Light -** Spectrum, Light on land, Light in water, Biological effects of light. **Temperature -** Range of temperature Homeiothermic and poikilothermic organism, Methods of meeting temperature extremes, Effect of temperature. **Water:** Properties of water, Soft and hard water, Composition of natural waters, Water problem in different habitats, Effects of humidity on growth and distribution of animals, Precipitation. **Air** composition - properties

UNIT - II

Definition of ecosystem, Abiotic substances, Producer, Consumers, Decomposers, Transformers, Tropic levels in an ecosystem, Food chain, Food web, Ecological pyramids, pyramid of numbers, pyramid of biomass, **Habitat ecology -** Freshwater Habitats, Types of freshwater Habitats - Lentic habitats, Lotic habitats, freshwater adaptations. Marine habitats - Types of marine water habitats, Pelagic adaptations, adaptations of deep sea.

UNIT - III

Biogeochemical cycles - gaseous cycle [Carban cycle, Nitrogen cycle] sedimentary cycle, [phosphates]. **Animal association** - Intra specific and inter specific - colony formation, social organization, predation, parasitism, commensalisms, mutualism, inter specific competition - competitive principle or Gause's principle.

UNIT - IV

Population: Definition - characteristics - Natality, Mortality, age distribution of Population growth forms, population fluctuation. Community Ecotone and edge effects - ecological succession - **Wild life Conservation -** aims of wild life conservation, methods of conservation, endangered species - sanctuaries and National parks. **Natural resources -** types of resources, forest resources.

UNIT - V

Environmental degradation - deforestation, urbanization, population explosion and other environmental hazards - Environmental ethics and laws - Earth summits - role of governmental agencies for environmental monitoring. **Space ecology -** environmental problems of space travel.

Reference Books:

Kotpal. R.L, and N.P. Bali, 1986. Concepts of Ecology, Vishal Publications, New Delhi - 7
Rastogi V.B, and M.S. Jayaraji, 1988 - 1989. Animal Ecology and Distribution of animals, Kedar nath, Ram Nath Meerut - 250 001.
Clark, G.L. 1954, Elements of Eology, John wiley & Sons Inc., New York, London.
Ananthakrishnan, T.N, and S. Viswanathan, Principles of Animal Ecology.
Eugene P. Odum, 1971. Fundamentals of ecology, Saunders International Student Edition, W.B. Saunders Company, Philadelphia London, Toronto.
Verma, P.S and Agarwal 1986, Environmental Biology, S. Chand & Co Ltd.
Richard, Manual of wild life conservation.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand Scope, concept, Branches in ecology and Environmental factors (soil, light, temperature, water and air).
2. After studied unit-2, the student will be able to understand fundamental units of ecosystem, Tropic levels of ecosystem and Food chain.
3. After studied unit-3, the student will be able to understand Bio geochemical cycles and importance of inter relationship between every organism and environment
4. After studied unit-4, to acquire the knowledge about population and community ecology, ecological succession, aims of wild life conservation and Natural resources.
5. After studied unit-5, the student to acquire the knowledge environmental hazards, Environmental ethics and laws.

Core paper - 9

ECONOMIC ZOOLOGY

ECONOMIC ZOOLOGY

Objectives :
1.To encourage young learners to take up the small scale industries
2.To generate motivation for Self-Employment
3.To disseminate information on economic aspects of Zoology
4.To inculcate knowledge on useful animals to Mankind
5.To satisfy the learners with modern techniques of Animal culture

UNIT - I

A) Vermiculture and Composting
Economic Entomology: Useful Insects of commercial values,
B) A piculture - Species of Honeybees - Honey extraction - Economics of Apiculture and management.
C) Sericulture - Nature and economic importance of Sericulture in India

UNIT - II

Economics of aquaculture-
A] Pisciculture - Techniques of induced breeding Commercial culture of catla & cat fish By-Products of Fishing and its commercial values.
B] Prawn culture -Culture techniques of fresh water (Macrobrachium rosembergii) & Marine water (Penaeus monodon) preservation - processing and export techniques adopted in Prawn fishiery.
C] Pearl culture: Formation and nature of Pearls - Commercial importance of Pearl Culture in India.

UNIT - III

Economics of Poultry keeping: Morphology of different breeds of Chicken - Brooding and Rearing of Chicks-Processing of Egg, Meat and By-Products of Poultry.

UNIT - IV:

A]: Dairy farm management, Milch breeds. Draught breeds, Dual purpose breeds and New Cross breeds of Cows and Buffaloes in India.
B]: Sheep farming: Indigenous and Exotic breeds of Sheep.

UNIT - V

Future strategies for Livestock Development - Transgenic Animal Technology - Genetic Improvement for best breeds - Economic importance of Dairy, Leather, Wool, Fur and Pharmaceutical Industries in India.

Text Books:

1. Sukla, G.S. and Upadhyay, V.B., 2000
Economic Zoology - ISBN - 81-7133-137-8
Rastogi Publications, Meerut, India.
2. Jawaid Ahsan and Subhas Prasad Sinha, 2000
A Handbook on Economic Zoology-ISBN-81-219-0876-O
S. Chand & Co., Ltd., New Delhi.

Reference Books:

1. Ashok Kumar and Prem mohan Nigam, 1991
Economic and Applied Entomology
Emkay Publications, New Delhi.
2. Shammi, Q.J. and Bhatnagar, S., 2002
Applied Fisheries: ISBN-81-7754-114-5
Agrobios (India), Jodhpur - India.
3. Major Hall, C.B. 2005
Ponds and Fish culture - ISBN-81-7754-146-3
Agrobios (India), Jodhpur - India.
4. Keith Wilson, N.D.P., 2005
A Handbook of Poultry Practice - ISBN-81-7754-O-69-6
Agrobios (India), Jodhpur - India.
5. Banerjee, G.C. 1992
Poultry - III- Edition - ISBN-81-204-008-4
Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Banerjee, 1988
A Text Book of Animal husbandry-VIII-Edition-ISBN-81-204-1260-5
Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Kaushish, S.K., 2001
Trends in Livestock Research - ISBN-81-7754-112-9
Agrobios (India), Jodhpur - India.
8.Ismail, S.A. 1997. Vermicology the Biology of Earth worm Orient
Longman, India
9. A. Mary violet Christy 2008 vermy technology MJP Publ. Chennai

Course Outcome

1) Understanding the role of worm farming in modern farming,potential of vermicompost,maintaining health of the soil,economic importance of Vermiculture and role of Vermiculture in protecting the environment.

2) They could able to understand Techniques of induced breeding,Commercial culture of catla & cat fish
3) They could understand about area of poultry production including nutrition,health welfare and product quality
4) To provide basic input to students about production, planning and management of diary farms Milch breeds. Draught breeds, Dual purpose breeds and New Cross breeds of Cows and Buffaloes in India.
5) The students could able to learn the Future strategies for Livestock Development

Internal Elective
Paper -2
(to choose one out of 2)

A. EVOLUTION

Objectives:

To provide comprehensive overview of Concept of Evolution.

To comprehend the scientific concepts of animal evolution through theories and evidences.

To impart detailed understanding of Analogy, Homology, Paleontological Evidences, Embryological Evidences and Molecular Phylogeny

To develop comprehensive knowledge regarding various Sources of Variations and their role in evolution.

To provide adequate knowledge about Micro-evolutionary changes, Speciation and Adaptive Radiation.

To impart descriptive knowledge regarding Origin and Evolution of Man.

UNIT – I

Evidences: The need of evidences for the fact of evolution – Morphological, anatomical, Embryological,Physiological and Biochemical evidences.

UNIT – II

Theories: Lamarckism, Neolamarckism, Darwinism, NeoDarwinism, Devries concept of Mutation.

Modern version of Mutation theory.

UNIT – III

Natural selection: Types, stabilizing and diversifying directional selection. Variation: Types of variation.

UNIT-IV

Mimicry – Batesian and mullerian mimicry and evolution, living fossils. Distribution of animals.

UNIT – V

Isolation – Premating and post mating isolating mechanism, speciation. Evolution of man

– Biological and cultural.

Course Outcome

The students will understand the basic concepts of evolution

The students will understand various theories of evolution

The students will have a comprehensive knowledge regarding various Sources of Variations and their role in evolution

The students will have an adequate knowledge about Micro-evolutionary changes, Speciation and Adaptive Radiation.

The students will have a descriptive knowledge regarding Origin and Evolution of Man.

Reference Books:

Agarwal, V.K and Usha Gupta – Evolution and animal distribution, Chand and Co.,

Dodson,E.O. 1990. Evolution, Reinhold, Newyork.

Francisco.J.Ayla – Evolution, Surject publication.

Gopalakrishnan.T.S. Itta Sambasivaiah and A.P.Kamalakara Rao. Principles of organic

Evolution,

Himalaya publishing house.

T.K.Ranganathan, Evolution. 1994 Rainbow Printers, Palayankottai.

Veer Bala Rastogi. Organic Evolution, Meerut Publications.

Arumugam.N. Organic Evolution, 2009 Saras. Publ. Nagarcoil, Kanyakumar Dt.

Internal Elective
Paper -2
(to choose one out of 2)

B. MICROBIOLOGY

Objectives:

To emphasize the importance of integrating new knowledge on Microorganisms.

To update the Technology innovations of Microbial genetics and its Application.

To understand the general morphology of micro organism

To understand the epidemology of various infectious diseases

To understand the role of micro organisms in Agriculture,Industry and environment

UNIT – I

The scope of microbiology – characterization, classification and identification of Microorganisms.

UNIT – II

Bacteria – General morphology, and physiology – pathogenic and non – pathogenic bacteria, economic importance.

UNIT – III

Micro organisms – general morphology of Fungi – Moulds and yeasts, Algae, Protozoa and Viruses.

UNIT – IV

Epidemiology of infectious diseases with reference to Human – such as Bacterial [Tuberculosis], Viral [Hepatitis], protozoan [Amoebiasis] and Fungal [any one] diseases - Host. Microbe interaction – immune responses – Antibiotics and other Chemotherapeutic agents.

UNIT – V

Applied Microbiology in the fields of food, Agriculture, Industry and environment.

Course Outcome

The students will understand the importance of Microorganisms.

The students will understand the Technology innovations of Microbial genetics and its Application.

The students will understand the general morphology of micro organism

The students will understand the epidemology of various infectious diseases

The students will understand the role of micro organisms in Agriculture,Industry and environment

Reference Books:

Mani, A., Selvaraj, A.M, Narayanan, L.M & Arumugam, N. 1996 : Microbiology – saras

publicagtions – Nagercoil – India.

Sharma,P.D 1998 : Microbiology – Rastogi Publ. Meerut, India.

Subba Rao, N.S, 1999 : Soil Microbiology, Oxford IBH Co. New Delhi, India.

Sullia, S.B. & Santharam, S. 2004 – GeneralMicrobiology, Oxford IBH, India.

Meenakumari,S. Microbial Physiology, MJB-Publ. – Chennai, India.

Purushotam Kaushik, 2005 : Microbiology – S.Chand & Co., New Delhi, India.

Vijaya Ramesh, 2005 : Environmental Microbiology, MJP.publ, Chennai, India.

Vijaya Ramesh, 2007 : Food Microbiology, MJP.Publ. Chennai, India.

Rajan,S 2007 : Medical Microbiology – MJP.Publ. Chennai, India.

Mosharaffudin, Ahmed & Basumatary 2006 : Applied Microbiology – MJP Publ. India.

Purohit, S.S.2007 : Microbiogy – Agrobios Publ. India.

Trivedi, P.C.2008 : Applied Microbiology – Agrobios Publ. India.

Prescott, 2009 : Industrial Micobiology – Agrobios Publ. India.

Parihar, L. 2008 : Advances in Applied Microbiology – Agrobios Publ. India.

Agarwal, A.K 2008 : Industrial Microbiology, AgrobiosPubl.India.

Bohra, A.2006 : Fod Microbiology, Agrobios Publ. India

INTERNAL ELECTIVE
Paper -3
(to choose one out of 2)

A. BIOCHEMISTRY

Objectives:
To study the structure of biomolecules and their importance in the life process.
To define and explain the basic principles of biochemistry.

UNIT - I

Aqueous solutions - properties of water - hydrogen ion concentration, acids bases and their concept - buffers and electrolytes and functions - acidity, alkalinity and pH determination.

UNIT - II

Bioenergetics - energy and its forms - free energy - laws of thermodynamics - enthalpy and entropy - redox coupling and ATP bioenergetics.

UNIT - III

Classification, **metabolism** and biological significance of carbohydrates, lipids, protein - primary, secondary, tertiary and quaternary structure and characteristics of proteins, vitamin types - source & deficiency.

Classification, structure and biological significance of carbohydrates, lipids, protein.
Metabolism of carbohydrate

UNIT - IV

Enzymes: classification and nomenclature - Physico-chemical - properties of enzymes - enzyme kinetics - mechanism of enzyme action - factors affecting enzyme activity.

UNIT - V

A brief account on the **biochemistry of antibiotics** & their mode of action. Fractionation of Biological materials by chromatography [PC, TLC] electrophoresis [Principle & types] centrifugation [Principle & Types].

Reference Books:
L. stryer, 1999 Biochemistry IV Edition. Freeman Company, New York
Lehninger, 1992 Biochemistry worth publication Inc., CBS Publication New Delhi.
H.S. Srivastava Elements of Bio Chemistry, Rastogi Publications.
Outline of Biochemistry, Corn & Stump.
Veerakumari.L, 2004, Bio Chemistry, MJP Publications.
G.P. Talwar & L.M. Srivastava, 2003 Text Book of Bio Chemistry and Human Biology Eastern Economy Edition, Prentice Hall of India. New Delhi.

Course Outcome

- To learn and understands the various properties of water
- To understand the bioenergetics
- To know about classification, metabolism and biological significance of carbohydrate, protein and lipids
- To learn properties, classification, nomenclature and action of enzymes
- To learn biochemistry of antibiotics
- To learn about principles and application of instruments

INTERNAL ELECTIVE
Paper -3

B. APPLIED ENTOMOLOGY

Objectives:
To create awareness towards insect borne diseases.
To study the insect species causing damage to the crops in the field as well as under storage condition and the effective control measure against them.
To study Household pests effective control measure against them.

UNIT - I

Introduction - Morphology of insects - Economic importance of insects**-** beneficial insects and harmful insects- Types of pests - types of damage caused by pests in crops - causes for insects assuming pest status - outbreak of pests.

UNIT - II

Types of insect development - ametabola and metabola (hemimetabola, holometabole) - Pests of agricultural importance, their bionomics, life cycle and control measures of paddy, ground nut, cotton, tomato, coffee & Banana.

UNIT - III

Pests of stored products and their control - Household pests - cockroach and termities - and their control - pest in relation to public health - Houseflies diseases and their control measures, Lice diseases and their control measures. Mosquitoes borne diseases and their control measures.

UNIT- IV

Pest control methods and application: cultural, mechanical, biological and chemical methods - classification of pesticides - LC 50 and LD 50 values - First Aid & precautions in handling pesticides -Plant protection appliances, duster-hand operated duster, wet duster, sprayers-hand syringe, knapsack sprayer, power-operated sprayer, miscellaneous appliances-mist bower, fog generator .

UNIT - V

Insect vectors of virus disease in crop plants - Recent trends in pest control - pheromones, attractants, repellants, antifeedants and chemosterilants, Integrated pest management, its importance &applications.

Reference Books: Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.

P.G. Fenemore, Alka Prakash 1997 Allied Entomology, Wiley Eastern Ltd., New York.
Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
Temphare D.B., 1984 A. Text Book of Insects Morphology, Physiology and Endocrinology. S. Chand and Co., New Delhi.

Course Out Comes

1. After studied unit-1, the student will be able to understand the insect morphology and types of pest.
2. After studied unit-2, the student will be able to understand insect species causing damage to the crops in the field as well as under storage condition and the effective control measure against them.
3. After studied unit-3, the student will be able to understand the awareness of pest in relation to public health-Houseflies diseases and their control measures,
4. After studied unit-4, To acquire the knowledge about the effective control measure against insect pest.
5. After studied unit-5, the student to acquire the knowledge Recent trends in pest control and Integrated pest management, its importance &applications

SKILL BASED SUBJECT
Paper - 4
(to choose one out of 2)

A. MEDICAL LABORATORY TECHNOLOGY

Objectives

1) To impart awareness on clinical lab-technology
2) To create knowledge on self- employment opportunity

UNIT - I

Medical Laboratory scope- general procedures- Laboratory requirements, Sterilization, Dry heat (Hot air oven),Moist heat (Autoclave, Pressure cooker),Laboratory equipments - Spectrophotometer, Incubator Refrigerator, Auto analyzer, Micro centrifuge, Automatic pipettes.

UNIT - II

Collection of blood samples, Packed cell volume (PVC), Erythrocyte sedimentation Rate (ESR),RBC Count, WBC Count, Reticulocyte count, Total count, Differential Count, Pulse rate, Use of blood pressure Apparatus, Electrocardiogram, Echocardiogram, Estimation of Haemoglobin, Artificial pacemaker.

UNIT - III

Blood cross matching - Hepatitis test - Haemolytic jaundice, ELISA, Estimation of blood glucose fasting two hour post prandial - Diabetes mellitus, Estimation of blood Cholesterol, Blood Urea, Blood Uric Acid.

UNIT - IV

Analysis of urine - Physical examination, Blood cells, Urine glucose, Urine albumin, Bile salts, Ketone bodies, Urine culture - Antibiotic susceptibility test. Pregnancy Test (Detection of HCG). Analysis of faeces - Components of faeces their characteristics, factors affecting faeces.composition. Analysis of sputum - Pathological conditions that can be detected in sputum - their causes - Detection of Group A - Streptococcus.

UNIT - V

Cerebrospinal fluid - Formation, Composition function, Conditions altering its composition - their causes. Seminal fluid - Composition of seminal fluid, Sperm count, Abnormal sperms, Common pathological conditions detected in semen - their causes. Aminotic fluid - Sex determination, Diagnosis of pathological conditions of developing foetusthrough analysis of amniotic fluid.

Reference books:

1. Biswajit Mohanty and Sharbari Basu - Fundamentals of Practical Clinical Biochemistry, B.I. Publications PVT., LTD.,54, Janpath, New Delhi - 110001.
2. Estridge B.H. Raynold A.P and Walters N.J. Basic Medical Laboratory Techniques,4th edition, Thomson Delmar Learning, Eastern press (Bangalore)Pvt., Ltd., Boommasandra Industrial Area, Hosur Road, Bangalore - 562158.
3. Kannai, L. Mukherjee, Medical Laboratory Technology Vol - I, Vol - II and Vol - III. Tata MC Graw Hill Publishing Company Limited,No:444/1,Sri Ekambara Naicker Industrial Estate, Alapakkam, Porur, Chennai - 600116.
4. Ramnik Sood, Medical Laboratory Technology, Methods and Interpretations. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
5. Venkadesan, O. Essential of Medical Laboratory technology, Bicobas P.G and Research Department of Zoology, Loyola College, Madras - 60003

Outcome

1.The student will be able to understand the sterilization techniques .
2.The student will be able to apply and analyse the haematalogical parameters.
3. The student Will be able to diagnose different diseases.
4. The student will be able to analyse the physical examination of urine and faeces.
5. The student will be able to get a thorough knowledge about cerebro-spinal fluid.

SKILL BASED SUBJECT
Paper - 4
B. INDUSTRIAL FISHERY MANAGEMENT

Objectives:

1.To introduce basic knowledge of industrial fishery management and export practices.
2.To realize the need augmenting food production from aquatic resource.
3.To give the students a holistic understanding of the subject giving substantial weight age to both the core content and techniques used in Industrial Fish and Fisheries.
4.To acquire knowledge about various fisheries institutions of India

UNIT - I

Definition and History of Aquaculture, Scope and importance with reference to Marine, Freshwater and estuarine fishes - Status of aquaculture in India - in Tamilnadu - Hatchery technology, important hatcheries, river-rine seed collection - Different stages of seed - spawn, fry and fingerlings.

UNIT - II

Principles of site selection in fish farm construction - Quality and productivity of water, soil character and other parameters - Nursery and rearing ponds Management

UNIT - III

Harvesting of fry and fingerlings - Transportation of fish seed and brood fish (Various methods of transportation) - Induced breeding techniques - Different systems of Aquaculture - Monoculture, polyculture, Cage culture - Integrated fish culture. Extensive, Semi-intensive and intensive fish culture Raceway culture, culture in re-circulatory systems Warm, water and cold water aquaculture, sewage-fed fish culture.

UNIT - IV

Feed resources - Nutritional value of feed ingredients and live feed - importance of natural food to nutrient requirement of fish - feed additives - attractants - growth stimulant and probiotics and binders - supplementary feed - feeding methods and scheduling.

UNIT - V

Disease management of culturable fishes - protozoan - Bacterial - crustacians - fungal - helminths disease and their control measures -fish marketing- quality management - Role of MPEDA and IIP - fisheries institutions of India - CMFRI - CIFT - CIFE -CIFA- FSI - NIO - FFDA.

References

1. V. G. Jhingran, (1991). Fish and fisheries of India. Edition-3, Hindustan Pub. Corp. (India), 727.
2. S. Ayyappan, J. K. Jena, A. Gopalakrishnan, Dr. A. K. Pandey, (2011). Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, New Delhi, 755.

3. FAO Technical Paper No.361. Manual on production and use of live food in aquaculture.
4. Pronob Das, Sagar C. Mandal, S. K. Bhagabati, M. S. Akhtar and S. K. Singh (2012). Important Live Food Organisms And Their Role In Aquaculture, Frontiers in Aquaculture, 2012: 69-86.
5. Handbook of Aquafarming: Aquaculture Feed, MPEDA.

Outcomes:

- The students will get the basic information about the scope of aquacultures in India.
- The student will acquire knowledge about fish farming.
- The students will acquire knowledge about various culture techniques.
- The students will acquire knowledge about feed formulations
- The students will acquire knowledge about disease management in fish farming.

CORE PRACTIC AL - III

BIOSTATISTICS AND BIOINFORMATICS, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY AND ANIMAL PHYSIOLOGY,

BIOSTATISTICS:

Biological data - calculation of mean, median, mode, Mean and standard deviation.
Graphical representation - Bar, Pie, frequency distribution.
Demonstration of MS- word, MS-Excel and MS-PPT.

DEVELOPMENT BIOLOGY:

Study of the following prepared slides / museum specimens.
Section of testis and Ovary [Mammalian].
Slides of Mammalian sperm and ovum.
Study of Egg types - Frog's Egg, Hen's Egg.
Study of cleavage stages 2 Cell, 4Cell, 8Cell - Blastula and gastrula of Frog.
Slides of different stages of chick embryo - 18 hours [primitive streak stage], 24 hours, 48 hours 72 hours and 96 hours.
Placenta of Sheep, Pig and Man.

IMMUNOLOGY:

Study of Antigen - Antibody reaction - Human Blood grouping [ABO and Rh].
Study of prepared slides of histology: Thymus, Spleen, Bone marrow, Lymph node.

ANIMAL PHYSIOLOGY:

Activity of human salivary amylase in relation to Ph, Enzyme concentrate and Temperature.
Estimation of Oxygen consumption in a fish with reference to body weight.
Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine/ Kidney.
Use of Kymograph Unit, B.P. apparatus, stethoscope.

CORE PRACTICAL - IV

ENVIRONMENTAL BIOLOGY, ECONOMIC ZOOLOGY AND EVOLUTION

ENVIRONMENTAL BIOLOGY:

Estimation of Dissolved oxygen, salinity, pH, Free Co2, Carbonate and Bicarbonates in water samples.
Use of rain gauge, Maximum and Minimum thermometer, Hygrometer and Anemometer.
Plankton study - fresh water and Marine plankton.
Study of natural ecosystem and field report.

ECONOMIC ZOOLOGY:

Study of the following prepared slides / specimens.

Earthworm types [any two] - [vermiculture].
Megacolex mauritii - south Indian species - surface crawlers.
Drawida modesta - Redsoil with calciferous gland.
Pheretima posthuma - North Indian - Large specimen.
Eudrilus eugenia - Redworm, Exotic.
Fish parasites [Lernea, Argulus].

Larvivorous fishes :
Poecelia reticulate - Guppy.
Gambusia Affinis - Gambusi.
Colisa labia - Dwarf gowrami.
Different stage of **Silk worm.**
Types of **Bees.**
Common **Pests.**

EVOLUTION

Fossils - ammonite.
Living fossils - Limulus, sphenodon.
Conneting link - peripatus, archaeopteryx.
Evolutionary significance - exocoetus, draco, hippocampus.
Mimicry - monarch butterfly.
Camouflage - chameleon.

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