

**AP STATE COUNCIL OF HIGHER EDUCATION**  
**REVISED UG SYLLABUS UNDER CBCS**  
**(Implemented from Academic Year 2020-21)**  
**PROGRAMME: FOUR YEAR B.Sc. (Hons)**

**Domain Subject: ZOOLOGY**

***Courses for Semesters VII & VIII***

*(Syllabus with Learning Outcomes, References, & Co-curricular Activities)*

**Higher Order Courses for semester-VII**

**(To choose any three of the following courses)**

	Course no	Course Title (Theory + Lab)	Marks	Credits
<b>Choose any THREE Courses</b>	8A	ENDOCRINOLOGY	100+50	4+1
	8B	DEVELOPMENTAL BIOLOGY AND REPRODUCTIVE TECHNOLOGIES	100+50	4+1
	8C	PARASITOLOGY	100+50	4+1
	8D	HUMAN HEALTH AND INFECTIOUS DISEASES	100+50	4+1
	8E	BIODIVERSITY AND SYSTEMATICS	100+50	4+1
	8F	WILDLIFE AND CONSERVATION BIOLOGY	100+50	4+1

**Skill Enhancement Courses for Semester-VII**

**(To choose one pair from the four alternate pairs of SECs)**

Course no	Course Title (Theory + Lab)	Marks	Credits
9A	HATCHERY TECHNOLOGY IN AQUATIC ORGANISMS	100+50	4+1
9B	FISH NUTRITION AND FEED TECHNOLOGY	100+50	4+1
	(OR)		
10A	MILK AND MILK PRODUCTS TECHNOLOGY	100+50	4+1
10B	MILK AND MEAT HYGIENE, FOOD SAFETY AND PUBLIC HEALTH	100+50	4+1
	(OR)		
11A	POULTRY PRODUCTS AND MANAGEMENT	100+50	4+1
11 B	POULTRY WASTE MANAGEMENT	100+50	4+1
	(OR)		
12 A	MULBERRY PHYSIOLOGY AND MULBERRY BREEDING & GENETICS	100+50	4+1
12 B	SILKWORM PHYSIOLOGY AND SILKWORM BREEDING & GENETICS	100+50	4+1

<b>13</b>	<b>ONE ONLINE COURSE FROM ANY DISCIPLINE</b>	<b>5</b>
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Of the 6 courses in Semesters VII, 5 courses(3+2)are Subject related and 1 course shall mandatorily be OPEN Online course in any discipline, encouraging trans disciplinary

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***Courses for Semesters VII & VIII***

*(Syllabus with Learning Outcomes, References, & Co-curricular Activities)*

**Higher Order Courses for semester-VIII**  
**(To choose any three of the following combination)**

Choose any <b>THREE</b> Courses	Course no	Course Title (Theory + Lab)	Marks	Credits
	14 A	TOOLS AND TECHNIQUES IN BIOLOGY	100+50	4+1
	14 B	TOXICOLOGY AND BIostatISTICS	100+50	4+1
	14 C	ENVIRONMENT BIOLOGY AND ENVIRONMENT PHYSIOLOGY	100+50	4+1
	14 D	ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	100+50	4+1
	14 E	MOLECULAR AND HUMAN GENETICS	100+50	4+1
	14 F	BIOSYSTEMATICS & TAXONOMY	100+50	4+1

**Skill Enhancement Courses for Semester-VIII**  
**(To choose **one pair** from the four alternate pairs of SECs)**

Course no.	Course Title (Theory + Lab)	Marks	Credits
15 A	MARICUTLURE	100+50	4+1
15 B	ORNAMENTAL FISHERY	100+50	4+1
	(OR)		
16 A	LIVESTOCK ECONOMICS, MARKETING AND BUSINESS MANAGEMENT	100+50	4+1
16 B	LIVESTOCK ENTREPRENEURSHIP	100+50	4+1
	(OR)		
17 A	POULTRY ECONOMICS, MARKETING AND INTEGRATION	100+50	4+1
17 B	POULTRY ENTERPRENUERSHIP	100+50	4+1
	(OR)		
18 A	SERICULTURE MARKETING	100+50	4+1
18 B	SERICULTURE ENTREPRENUERSHIP	100+50	4+1
	HUMAN RESOURCE DEVELOPMENT		
19	<b>ONE ONLINE COURSE FROM ANY DISCIPLINE</b>		5

Of the 6 courses in Semesters VIII, 5 courses(3+2) are Subject related and 1 course shall mandatorily be OPEN Online course in any discipline, encouraging trans disciplinary learning.

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**Semester-wise Revised Syllabus under CBCS 2020-21**  
**Four Year – B.Sc. (Hons), Semester – VII**  
**Domain Subject: ZOOLOGY**  
**COURSE –8. A**

**ENDOCRINOLOGY**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning Outcomes:**

This course will provide students with a deep knowledge in endocrinology by the successful completion of the course the graduate shall able to –

- Acquire a comprehensive picture of scope in endocrinology and morphology of endocrine tissues
- Know the synthesis release of hormones and functions
- Understand the mechanism of hormone action
- Understand the the interrelationship between endocrine and nervous system
- Understand the hormone regulation mechanism

**II. Syllabus:**

**Unit 1**

1.1 Aim and scope of endocrinology-Types of chemical messengers, Discovery of hormones, Classification of endocrine glands and hormones.

1.2 Comparative morphology of Endocrine tissue-Hypothalamus, Gastrointestinal tract, Juxta-glomerular apparatus (kidney), Heart

**Unit 2**

2.1 Life history of hormones: Biosynthesis of hormones, Biosynthesis of simple peptide hormone, Biosynthesis of amino acid derived small size hormone (T3, T4), Biosynthesis of steroid hormone, (cortisol, progesterone)

2.2 Release of hormone from endocrine gland-Releasing mechanism.

2.3 Concentration and transport of hormone in the blood

**Unit 3**

3.1 General mechanism of hormone action - Feedback mechanism.

3.2 Plasma membrane hormone receptor and its action, Cytosolic hormone receptor and its action,

3.3 Termination of hormone action.

**Unit 4**

4.1 Neuroendocrine system - The hypothalamo- hypophyseal axis. Hypothalamo- vascular system. 4.2 Hormones from hypothalamus: chemistry and physiology of releasing and release inhibiting hormones;

4.3 Regulation of hypothalamic hormone secretion

**Unit-5**

5.1 Hormonal regulation and its metabolic activity- Role of hormone in – Carbohydrate

metabolism, Protein metabolism, Fat metabolism, and Calcium metabolism.

5.2 Role of hormone in fasting, Hormone & behavior, Role of hormone in growth & development

### III. Recommended Text books

1. General & comparative endocrinology: E.J.W. Barrington, oxford, Clarendon Press
2. Text book of Endocrinology: R.H. Williams, W.B Saunders
3. Endocrinology: Hadley
4. Endocrinology: Negi

### IV. References Books

1. Endocrine Physiology: C.R Martin, Oxford Univ. Press
2. Comparative endocrinology: A. Gorbman et al, John Wiley and sons
3. Medical Physiology: W.F. Ganong (1981) :10th edition Lange Medical Publications
4. Principles of anatomy and physiology: Torota Grabowski, 9th edition, John Wiley & sons
5. Reproductive Physiology of vertebrates: Van Tienhoven, A,(1983) 2nd edition Cornell Univ. Press, NY
6. The pituitary gland: Imura. H(1994)2nd edition Comprehensive Endocrinology revised series Raven, NY
7. Comparative vertebrate endocrinology: Bentley, P.J(1976) Cambridge Univ. press, Cambridge
8. Invertebrate endocrinology: D.B. Temblare, Himalaya Publishing house
9. J. Larry Jameson, editor. (2010). Harrison's Endocrinology. 2nd Edition. McGraw-Hill Press: New York.
10. Turner, D.C. and Bagnara, J.T. (Editor) (1976). General Endocrinology. W. B. Saunders Company, Philadelphia, Pennsylvania.
11. Hall, J.E. (2011). Guyton and Hall Textbook of Medical Physiology (Guyton Physiology).

### V. Activities recommended

- Preparation of charts with models of the prescribed endocrine structures mentioned in Unit-I
- Preparation of podcast by the students on the topics mentioned in Unit – II
- Preparation of working model of hormone action by any biodegradable material.
- Observation of neuro endocrine integration in the pet animals in the vicinity of the college or houses highlighting the behavioral changes (milking of buffaloes)
- Observation of individuals under fasting for their behavioral change, recording hormone growth relation.
- Visit to near by medical diagnostic lab to know about various hormone based tests (Ex thyroid test , Pregnancy Test(HCG hormone.) ...Growth hormone test.or any other hormone test
- To conduct Health Survey in a village/town to know about how many people suffer with various hormonal problems like Thyroid, Diabetes, Dwarfism, Adrenal
- Collect various paper clippings related to Hormonal disorders,diabetis,thyroid..etc and organize Group Discussion

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**COURSE – 8A**

**ENDOCRINOLOGY LAB**

**Hours : 30**

**Max. Marks: 50**

**I. Learning Out comes**

This course will provide students with a deep knowledge in acquiring laboratory skills, by completion of the course the graduate shall able to –

- Acquire a skill to demonstrate the endocrine glands of model animals
- Know the anatomy of endocrine glands
- Understand the mechanism of hormone action
- Understand the interrelationship between endocrine and nervous system
- Understand the hormone regulation mechanism

**II. Syllabus**

1. Demonstration of various endocrine glands in fish/fowl
2. Endocrine glands Morphology and Anatomy:  
Whole gland morphology, T.S/L. S to be explained with model or slide)
  - A. Pituitary gland
  - B. Pancreas,
  - C. Thyroid,
  - D. Parathyroid,
  - E. Thymus,
  - F. Adrenal gland,
  - G. Testis,
  - H. Ovary.
3. Hormone assay protocols/virtual lab/Video - T3, T4, TSH (Any commercial kit)
4. Survey on the thyroid patients in the college/Community – Preparation of the Report with observation and specific comments (Details from clinical laboratories nearby PHC's may obtained by visits) 6 Hours
5. Optional- Demonstration/Virtual lab demo/video of synthetic hormone ova prim/ova tide on any model animal. (fish)

**III. Web resources for Laboratory**

- [https://www.cdc.gov/nchs/data/nhanes/nhanes\\_01\\_02/118t4\\_b\\_met\\_b\\_tsh.pdf](https://www.cdc.gov/nchs/data/nhanes/nhanes_01_02/118t4_b_met_b_tsh.pdf)
- <https://www.redlandsusd.net/site/handlers/filedownload.ashx?moduleinstanceid=19872&dataid=19726&FileName=Endocrine%20System%20Rat%20Lab.pdf>
- <https://www.healthline.com/health/thyroid-function-tests#What-are-thyroid-function-tests>
- <https://pixabay.com/images/search/endocrine/>

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**COURSE –8. B**

**DEVELOPMENTAL BIOLOGY AND REPRODUCTIVE TECHNOLOGIES**  
**Hours- 60+30** **Max. Marks-T100+P50**

**I. Learning Outcomes:**

This course will provide students with a deep knowledge in Developmental biology by the successful completion of the course the graduate shall able to –

- Acquire knowledge on the Developmental Biology
- Know the composition and biochemistry of semen
- Understand the growth and differentiation of ovarian follicle
- Understand the Biochemistry of Fertilization
- Understand the Assisted reproduction technologies
- Understand Immuno contraception

**II. Syllabus**

**Unit – 1 :**

- 1.1. Heterogamy in eukaryotes
- 1.2. Comparative account of differentiation of gonads in a mammal and an invertebrate
- 1.3. Biochemistry of semen
  - 1.3.1. Semen composition and formation
  - 1.3.2. Assessment of sperm functions

**Unit – 2:**

Ovarian follicular growth and differentiation

- 2.1. Morphology
- 2.2. Endocrinology
- 2.3. Molecular Biology
- 2.4. Vitellogenesis
- 2.5. Ovulation and ovum transport in mammals

**Unit-3**

Fertilization

- 3.1. Pre-fertilization
- 3.2. Biochemistry of fertilization
- 3.3. Post-fertilization
- 3.4. Collection and cryopreservation of gametes and embryos

**Unit –4:**

Assisted reproduction technologies

- 4.1. Embryo sexing and cloning
- 4.2. Screening for genetic disorders
- 4.3. ICSI, GIFT etc.
- 4.4. Cloning of animals by nuclear transfer

**Unit –5 :**

Immuno contraception

- 5.1. Gamete specific antigens

- 5.2. Surgical methods
- 5.3. Hormonal methods
- 5.4. Physical methods
- 5.5. IUCD

### **III. Recommended Text books**

1. Textbook of Human Development" by Rani K Sudha and Srivastava Sushila
2. Developmental Biology (Developmental Biology Developmental Biology)" by Scott F Gilbert and Susan R Singer

### **IV. References Books**

- Austen, C.R. and Short, R.V. Reproduction in animals
- Schatten and Schatten. Molecular biology of fertilization
- F.T. Longo. Fertilization, Chapman & Hall
- R.G. Edwards. Human Reproduction
- Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Carlson, R. F. Patten's Foundations of Embryology
- Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers
- Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press

### **V. Recommended Activities:**

- Visit to community for survey on the Reproductive health
- Visit to Any Veterinary center for observation of various mechanisms
- Collection of paper clippings related to Reproductive Techniques

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**COURSE –8. B LAB**

**DEVELOPMENTAL BIOLOGY AND REPRODUCTIVE TECHNOLOGIES**

**Periods: 30**

**Max. Marks: 50**

**I. Learning Out comes**

This course will provide students with a deep knowledge in acquiring laboratory skills, by completion of the course the graduate shall able to –

- Acquire a skill to observe the different embryonic developmental stages
- Know the basic embryonic development of chick
- Know the protocol of pregnancy test with kits

**II. Lab Syllabus:**

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of different sections of placenta (photomicrograph/ slides)
4. Types of eggs
5. Testis Section Human
6. Ovary Section Human
7. Mounting spermatozoa – Grasshopper/Frog/Chick/Rat
8. Demonstration: Pregnancy test using commercial kit

**Web resources for Lab Work:**

- <https://www.youtube.com/watch?v=4Y9jiwOWIHA>- Chick Lab
- [https://www.youtube.com/watch?v=-Oay7q\\_xw9U](https://www.youtube.com/watch?v=-Oay7q_xw9U)
- <https://www.youtube.com/watch?v=25nyZd7gbj4>
- [https://virtuallabs.merlot.org/vl\\_biology.html#blol](https://virtuallabs.merlot.org/vl_biology.html#blol)



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**COURSE –8. C**

**PARASITOLOGY**

**Hours- 60+30**

**Max. Marks-T100+P50**

**I. Learning Outcomes:**

This course will provide students with a deep knowledge in Parasitology by the successful completion of the course the graduate shall able to –

- Acquire knowledge on the General parasitology
- Know the parasitic adaptations and learn about Sampling techniques
- Understand the morphology, lifecycle, epidemiology and diagnosis of certain parasites
- Understand the Evolution of parasitism
- Know the parasitic vertebrates

**II. Syllabus**

**Unit -1**

- 1.1 General Parasitology: History and scope of parasitology.
- 1.2 Evolution of parasites. Zoogeography of parasites. Niches, habitats and environments. Parasitism. Phoresis. Hyperparasitism. Parasitoides.
- 1.3 Ecology of parasitism - Relation of parasite fauna with food, age and migration of the host and seasons of the year.

**Unit-2**

- 2.1 Host specificity.
- 2.2 Biological Adaptations of Parasitism
- 2.3 Diagnostic parasitology: Sampling techniques (blood, stool, urine, sputum)
- 2.4 Diagnostic parasitology Sampling techniques (biopsy, skin scrapping, swabs, ectoparasites, soil)
- 2.5 Parasitic Sample preservation, processing, observation and identification of various parasitic forms.

**Unit-3**

- 3.1 Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Giardia intestinalis*,
- 3.2 Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Trypanosoma gambiense*
- 3.3 Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Leishmania donovani*

**Unit-4**

- 4.1 Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Schistosoma haematobium*
- 4.2 Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Wuchereria bancrofti*
- 4.3 Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Trichinella spiralis*.

**Unit-5**

- 5.1 Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body

louse), *Xenopsylla cheopis* and *Cimex lectularius*

5.2 A brief account of parasitic vertebrates; Cooki cutter Shark, Candiru, Hood Mockingbird and Vampire bat

### III. Recommended Text Books:

1. Parasitology Protozoology And Helminthology 13Ed 2019, by Chatterjee KD (Author)
2. Parasitology 2019 Edition by C P Baveja, V Baveja, Arya Publications

### IV. Reference Books

- Cheng, T.C. General parasitology Academic Press, Inc. (1986)
- Noble, E.R. and Noble, G.A: Parasitology, The biology of Animal parasites Lea and Fabiger
- Andeson, D.R.: Comparative Protozoology, Cambridge Uni. Press.
- Chandler, A.C. and Read, C.P.; Introduction of Parasitology, Willy Eastern,
- Belding, D.A. A text book of Prasitology, Meredith pub. Co.
- Baker, J.R. Parasitic Protozoa, Academic Press
- Grell, K.G. Protozoology, Springer Verlag
- Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors
- Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group
- Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi
- Rattan Lal Ichhpujani and Rajesh Bhatia. Medical Parasitology, III Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
- Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers
- K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd.

### V. Recommended Activities:

- Observation of parasites in the fish gut and fish gills
- Observation of parasites in the stomach of Fowl/ Sheep/ Goat
- Podcast on the Parasitic adaptations
- Visit to near by Medical diagnostic Lab and learn about sampling techniques(Ex .blood,biopsy,skin scrapping)
- Visit to Veterinary Center and to collect parasites(Ex. Flukes, Tapewoms, Round worms, ticks and mites) from various animals.
- Visit to fish market to observe parasites from the gills
- Visit to PHC and know about different treatment methods followed for filaria,giardiasis and also know about diagnostic methods

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**COURSE –8. C**

**PARASITOLOGY LAB**

**Hours- 30**

**Max. Marks-P50**

**I. Learning Out comes**

This course will provide students with a deep knowledge in Parasitology by the successful completion of the course the graduate shall able to –

- Acquire knowledge on the different stages of different parasites
- Know the parasites on the fish gills
- Know the different parasites in the intestine of fowl

**II. Syllabus**

1. Study of life stages of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani* and through permanent slides/micro photographs
2. Study of adult and life stages of *Schistosoma haematobium*, and *Hymenolepis nana* through permanent slides/micro photographs
3. Study of adult and life stages of *Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/micro photographs
4. Study of *Pediculus humans* (Head louse and Body louse), *Xenopsylla cheopis* and *Cimex lectularius* through permanent slides/ photographs
5. Study of monogenean from the gills of fresh/marine fish  
[Gills can be procured from fish market as by product of the industry]
6. Study of nematode/cestode parasites from the intestines of Poultry bird  
[Intestine can be procured from poultry/market as a byproduct]

**III. Web resources for Lab Work:**

- <http://parasitology.dmu.ac.uk/learn/laboratory.htm>- Parasitology virtual lab
- <https://www.youtube.com/watch?v=gd04x4pj9eQ>

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**COURSE –8. D**

**HUMAN HEALTH AND INFECTIOUS DISEASES**

**Hours- 60+30**

**Max. Marks-T100+P50**

**I. Learning Outcomes:**

While studying the Human Health and Infectious Diseases course, the student shall be able to:

- Introduce the basic concepts of pathophysiology of infectious diseases
- Study the major infectious diseases transmission to humans and response of immunity
- Understand the Pathogenesis, mechanisms of pathogenesis; transmission and epidemiology of various bacterial, viral, fungal and protozoan diseases.
- Study the Sexually transmitted diseases.
- Study the prevention and control measures of infectious diseases

**II. Syllabus**

**Unit-1.**

1.1 Introduction to Infectious Diseases:

1.2 Basic concepts in pathophysiology of infectious diseases

1.3 Outline of physiological mechanisms leading to diseased state, Infectious disease transmission, Infection and immunity, Acute and Chronic Infections Major infectious diseases of humans.

**Unit-2.**

**Bacterial Infections:**

2.1 Pathogenesis, mechanisms of pathogenesis; transmission, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major human infections -**Tuberculosis**

2.2 Pathogenesis, mechanisms of pathogenesis; transmission, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major human infections- **Cholera**

2.3 Pathogenesis, mechanisms of pathogenesis; transmission, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major human infections - **Typhoid.**

**Unit-3.**

**Viral Diseases:**

3.1 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and anti-retroviral therapy of Human immunodeficiency virus (HIV/AIDS)

3.2 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and anti-retroviral therapy of Sexually transmitted diseases

#### **Unit-4.**

##### **Fungal Diseases:**

4.1 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major Fungal human pathogens- Dermatophytes

4.2 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major Fungal human pathogens: - Candida

4.3 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of major Fungal human pathogens: - Aspergillus

#### **Unit-5.**

##### **Protozoan Diseases:**

5.1 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of Protozoan human pathogen- *Trypanosoma*.

5.2 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of Protozoan human pathogen- *Giardia intestinalis*,

5.3 Pathogenesis, mechanisms of pathogenesis; transmission, life cycle, epidemiology, public health implications, diagnosis, prophylaxis and treatment of Protozoan human pathogen- *Leishmania donovani*

### **III. Reference Books**

1. Environmental Microbiology, Pepper, I. L., Gerba, C. P. and Gentry, T. J. (2015), 3rd edition, Academia Press, Elsevier
5. Textbook of Environmental Microbiology, Mohapatra, P. K. (2008), I.K. International (P)Ltd.
6. Basic Biotechnology, Ratledge, C. and Kristiansen, B. (2003), 2nd edition, Cambridge University Press
7. Pocket Guide to Bacterial Infections – K. Balamurugan and Prithika Udayakumar (2019). CRC Press.

### **IV. Recommended activities**

- Report preparation on community health
- Awareness on Viral diseases in the Student Community
- Collect paper clippings related to human health and discuss in the class
- Visit to PHC and know about TB treatment and HIV treatment and collect pamphlets and charts

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**COURSE –8 D**

**HUMAN HEALTH AND INFECTIOUS DISEASES LAB**

Hours- 30

Max. Marks-P50

**I. LEARNING OUTCOMES**

While studying the Human Health and Infectious Diseases Lab course, the student shall be able to:

- Know the infectious diseases in the community
- Know the diseases transmission to humans
- Understand epidemiology of various bacterial, viral, fungal and protozoan diseases.
- Study the prevention and control measures of infectious diseases

**II. Syllabus**

Epidemiology of following infectious diseases with the images/photographs:

1. Tuberculosis
2. Cholera
3. Typhoid.
4. Human immunodeficiency virus (HIV/AIDS)
5. Sexually transmitted diseases.
6. Dermatophytes
7. Candida
8. Aspergillus
9. *Trypanosoma*.
10. *Giardia intestinalis*,
11. *Leishmania donovani*

**III. Web resources for Lab**

- <https://pubmed.ncbi.nlm.nih.gov/15520481/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9279679/>

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**COURSE – 8 E**

**BIODIVERSITY AND SYSTEMATICS**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning Outcomes:**

While studying the biodiversity and systematics course, the student shall be able to:

- Understand the Concept and significance of Biodiversity at Global level & National level
- Understand the threats to biodiversity
- Know the conservation strategies of wild life
- Understand the concepts of systematics

**II. Syllabus**

**UNIT-1**

- 1.1 Biodiversity: Definition and significance; biodiversity at global, national and local levels; magnitude and distribution of biodiversity.
- 1.2 Patterns of biodiversity: Latitudinal and altitudinal gradients; species area relationship.
- 1.3 Biogeographic realms of the world.

**UNIT-2**

- 2.1 Biogeographic zones of India and faunal diversity; Hotspots in the world and in India.
- 2.2 Hierarchical components of biodiversity: Species diversity, genetic diversity and ecosystem diversity.
- 2.3 Biodiversity values: Direct values and indirect values.

**UNIT-3**

- 3.1 Biodiversity in peril: Causes of biodiversity losses and extinction; anthropogenic impact on biodiversity.
- 3.2 Biodiversity and biotechnology: DNA based wildlife forensics; genetically modified organisms and Bioremediation.
- 3.3 Biodiversity management and conservation

**UNIT – 4**

- 4.1 IUCN classification of wildlife.
- 4.2 Biodiversity threats; In-situ conservation and Ex-situ conservation. Gene banks; conservation of genetic resource; cryopreservation.
- 4.3 Wildlife protection acts; organizations involved in protection of Biodiversity.

## UNIT – 5

4.1 Systematics: Species concept. Taxonomy and its components –classification and phylogeny, cladistic classification.

4.2 Identification: Keys, biodiversity documentation, species identification and identification tools. Nomenclature: International Code of Zoological Nomenclature (ICZN);

4.3 Types: Holotype, Paratype, Neotype, Lectotype, Syntype, Homonymy and Synonymy. Molecular taxonomy: DNA fingerprinting.

### III. Text Books

- Prabodh K. Maiti and Paulami Maiti. 2011. Biodiversity: Perception, Peril and Preservation.
- Saharia VV. 1982. Wildlife in India. Natraco Publishers, Dehradun.
- Tandon RK. 1999. Biodiversity, Taxonomy & Ecology. Prithipal Singh Scientific Publishers, Jodhpur.

### IV. Reference Books

- Agarwal KC. 1998. Biodiversity. India.
- International Code of Zoological Nomenclature. 1985. Third edition adopted by XX General assembly of the International Union of Biological Sciences, University of California Press, Berkeley and Los Angeles Edition.
- Kormondy EJ. 1996. Concepts of Ecology. Eastern Economy Edition.
- Oliver S & Owen Mc. Natural Resource Conservation: An Ecological Approach. Macmillan Publ. Co. New York.
- Peggy I. Fieldler and Perer M. Kareiva. 1997. Conservation Biology.

### V. Recommended Activities

- Preparation of Biodiversity chart of India
- Preparation of Local area Biodiversity chart
- Visit to BMC at village level
- Acquittance/Awareness on Peoples Biodiversity Register of the local area
- Visit to near by Zoo/ Sanctuary/National park/wetland/Mangrove/sea shore/river and observe fauna and take photos
- Take photos of birds/butterflies/moths/insects/fish..etc of your area.
- Prepare Fauna book of your village
- Celebrate World Biodiversity Day May 22



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**Domain Subject: ZOOLOGY**  
**COURSE – 8 E**

**BIODIVERSITY AND SYSTEMATICS LAB**

Hours- 30

Max. Marks- 50

**I. Learning Outcomes:**

While studying the biodiversity and systematics Lab course, the student shall be able to:

- Understand the Concept Biodiversity Map
- Understand the local biodiversity
- Know the wild life Fauna in the local community

**II. Syllabus**

1. Biodiversity- Map Preparation
2. List of local fauna (invertebrates and vertebrates).
3. Faunal diversity of man-made ecosystem.
4. Report preparation on the BMC Activities
5. Preparation of Peoples Biodiversity Register at a given site
6. Using photographs / paintings / coloured drawings identify and study distribution and ecological role of common bivalves and gastropods that occur along a sea-shore.

**III. Web resources for the Lab**

- <http://biodiversitylab.ncbs.res.in/home>

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**COURSE – 8 F**

**WILD LIFE AND CONSERVATION BIOLOGY**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning Outcomes**

This course will provide students with a deep knowledge in acquiring laboratory skills, by completion of the course the graduate shall able to –

- Know the Concept of wild life and reasons for their depletion
- Know the wild life management strategies
- Know the Importance of ecologically sensitive areas
- Know the human Impact on environmental resources
- Understand the human wild life interaction

**II. Syllabus**

**Unit 1**

1.1 Wildlife in India- Wildlife wealth of India & threatened wildlife.

1.2 Reasons for wildlife depletion in India. Wildlife conservation approaches and limitations. National and State mammals and birds of India.

1.3 Wild life Habitat- Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and corridors. Community Reserve and conservation Reserves

**Unit 2**

2.1 Management of Wildlife- Red Data Book and Conservation status (endangered, vulnerable, rare, threatened and near threatened species)-definitions.

2.2 Distribution, status. Habitat utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle.

2.3 Wild life Trade & legislation- Assessment, documentation, Prevention of trade. Policies and laws in Wild life management (national) and ethics.

**Unit 3**

3.1 Biodiversity extinction and conservation approaches- Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.

3.2 Theory and analysis of Conservation of populations- Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity.

3.3 Population viability analysis-conceptual foundation, uses of PVA models.

**Unit 4**

4.1 National and International efforts for conservation- Information on CITES, IUCN, CBD

4.2 International agreements for conserving marine life. Convention on wetlands of International Importance (Ramsar convention). Important projects for the conservation of endangered species in India.

4.3 Human impact on Terrestrial and Aquatic resources. Conservation of invertebrates with special reference to corals and butterflies. Overview of conservation of Forest & Grassland resources

### **Unit 5**

5.1 Human – wildlife interactions

5.2 Strategies to reduce human-wildlife interactions

5.3 Role of Government and NGOs in controlling human-wildlife interactions Socio-economic issues related to human-wildlife interactions

### **III. Reference Books**

- M.Kato. The Biology of Biodiversity, Springer.
- J.C. Avise. Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.
- E.O. Wilson. Biodiversity, Academic Press, Washington.
- G.G. Simpson. Principle of animal taxonomy, Oxford IBH Publishing Company.
- E. Mayer. Elements of Taxonomy.
- E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northem & Co.
- B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.

### **IV. Suggested activities:**

Visit to nearby biosphere reserve/Sanctuary/National Park/ Sea Shore/Zoo

Visit to local Ramsar site and report preparation with pics

Celebrate World wetland Day February 2<sup>nd</sup>

Celebrate World Wildlife Day March 3<sup>rd</sup>

Celebrate World Sparrow Day March 20<sup>th</sup>

Celebrate Wildlife week from October 1<sup>st</sup> to October 7- Conduct Quiz, photoexhibition, essay writing competitions ..to create awareness among students and public

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**COURSE – 8 F**

**WILD LIFE AND CONSERVATION BIOLOGY- LAB**

Hours- 30

Max. Marks- P50

**I. LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the importance of various biomes
- Understand and gain knowledge of animal architecture

**II. Syllabus**

1. Using photographs / paintings / coloured drawings identify and study ecological role of characteristic animal species (major representative species only) of various Biomes.
2. Study of animal architecture (photographs / diagram / abandoned specimen) ; Hive of honey bee, nest of COURSE wasp, nest of potter wasp, Mount of termite, Nests of Weaver Bird and tailor bird.
3. Endangered species of Indian sub-continent
4. Compare and interpret given sonograms of bird calls (any two e.g. Courtship calls, Alarm calls)
5. On a phytogeographic map of India locate & demarcate major sanctuaries / national parks

**III. Web resources for lab**

[https://www.naturepl.com/pictures/pdfs/NPL\\_Architecture.pdf](https://www.naturepl.com/pictures/pdfs/NPL_Architecture.pdf)

<https://youtu.be/31PWjb7Do1s>

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**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**

**(AQUACUTLURE)**

**THEORY COURSE – 9A**

**HATCHERY TECHNOLOGY IN AQUATIC ORGANISMS**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the importance of hatchery technology and types of hatcheries
- Understand and gain knowledge in fishes hatchery establishment and management
- Understand and gain knowledge in shrimp hatchery establishment and management
- Understand and gain knowledge in seed production of crustaceans and molluscs
- Evaluate emerging trends and future directions in hatchery technology.

**II. SYLLABUS**

**UNIT-1: INTRODUCTION TO HATCHERY TECHNOLOGY**

- 1.1 Importance of hatchery technology in aquaculture
- 1.2 History and development of hatchery technology
- 1.3 Types of fish hatcheries.

**UNIT-2 FISHES HATCHERY ESTABLISHMENT AND MANAGEMENT**

- 2.1 Site selection, Facility design and construction
- 2.2 Broodstock management, Spawning induction-methods
- 2.3 Egg incubation, Larval rearing, Fry rearing, Grow-out production
- 2.4 Disease prevention and management, Record keeping

**UNIT-3: SHRIMP HATCHERY ESTABLISHMENT AND MANAGEMENT**

- 4.1. Site selection; Operation and management of maturation section.
- 4.2. Operation and management of larval section; Operation and management of post larval section.
- 4.3. Live feed culture system, Hatchery seawater treatment.

**UNIT-4: SEED PRODUCTION OF CRUSTACEANS AND MOLLUSCS**

- 3.1. Seed production and nursery rearing of *Penaeus indicus*, *Penaeus monodon* and *Macrobrachium rosenbergii*.
- 3.2 Hatchery operations of pearl oysters, clams,
- 3.3 Hatchery operations of crabs, lobster.

**UNIT-5 ADVANCES IN HATCHERY TECHNOLOGY**

- 5.1 Automated and computer-controlled systems in aquaculture hatcheries
- 5.2 Biotechnology and genetics in hatcheries- breeding, disease management, feed development
- 5.3 Emerging trends and future directions of hatcheries- Sustainable practices,

Alternative species and systems, Traceability and transparency, collaboration and partnerships

### **III. REFERENCE BOOKS**

- Hatchery Management by B. C. Rath
- Aquaculture: Farming Aquatic Animals and Plants by John S. Lucas and Paul C. Southgate
- Fish Hatchery Management by Frank W. Wheaton and David L. Keller
- Principles of Fishery Science by R. J. Welcomme
- Hatchery Technology for Tropical Species by Patrick Lavens and Patrick Sorgeloos
- Fish Hatchery Management, Second Edition by Gary Wedemeyer
- Aquaculture Engineering by Odd-Ivar Lekang
- Introduction to Aquaculture by J. R. Tomasso

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**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**

**(AQUACULTURE)**

**PRACTICAL COURSE – 9A**

**HATCHERY TECHNOLOGY IN AQUATIC ORGANISMS**

Hours- 30

Max. Marks- P50

**LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Demonstrate proficiency in larval rearing, including water quality management, feeding and nutrition, and disease prevention and management.
- Demonstrate proficiency in juvenile rearing, including nursery systems, feeding and nutrition, and disease prevention and management.
- Produce high-quality seed and stock them in aquatic environments.
- Demonstrate proficiency in broodstock management, including selection, breeding

**SYLLABUS**

1. Culture of Rotifers
2. Culture of Artemia
3. Estimation of ammonia levels using a water testing kit.
4. Study on different types of tanks and raceways used in fish/shrimp hatchery.
5. Study on types of pumps, filters and aeration systems used in fish/shrimp hatchery
6. Study on biosecurity measures and waste management in the hatchery at your vicinity

**REFERENCE BOOKS**

- Aquaculture Principles and Practices: Fishing News Books Series by T. V. R. Pillay and M. N. Kutty
- Hatchery Culture of Marine Finfishes: A Practical Guide by K. Nagabhusanam
- Manual of Fish Culture: Hatchery Methods and Management by P. V. Dehadrai
- Aquaculture Engineering by Odd-Ivar Lekang
- Introduction to Aquaculture by J. R. Tomasso
- Hatchery Management Guide for Fish and Shellfish Producers by J. A. Hargreaves
- Aquaculture: Farming Aquatic Animals and Plants by John S. Lucas and Paul C. Southgate
- Fish Hatchery Management by Frank W. Wheaton and David L. Keller

**CO-CURRICULAR ACTIVITIES**

- Visit to local hatcheries to gain practical experience on different techniques and methods used in hatchery technology.
- Inviting guest speakers who are experts in the field of hatchery technology
- Workshops to teach students how to handle fish, water quality monitoring, feed preparation.
- Competitions related to hatchery technology, such as fish breeding competitions or aquaponics competitions.
- Internships in hatcheries can provide students with hands-on experience

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**SKILL ENHANCEMENT COURSES**  
**(AQUACULTURE)**  
**THEORY COURSE – 9B**  
**FISH NUTRITION AND FEED TECHNOLOGY**

Hours- 60+30

Max. Marks-T100+P50

**LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand nutritional requirements for different stages of cultivable fish and prawns.
- Understand about different forms of feeds and feeding methods of cultivable fish and prawns.
- Understand about different ingredients used for feed manufacturing.
- Understand about Feed formulation and storage methods
- Analyze about different feed additives & non-nutrient ingredients used in feed preparation.
- Understand about different nutritional deficiency in cultivable fish

**SYLLABUS**

**UNIT-1: NUTRITIONAL REQUIREMENTS OF CULTIVABLE FISH**

- 1.1 Requirements for energy, proteins, carbohydrates, lipids, fiber, micronutrients for different stages of cultivable fish and prawns
- 1.2 Essential amino acids and fatty acids, protein to energy ratio, nutrient interactions and protein sparing effect
- 1.3 Dietary sources of energy, effect of ration on growth, determination of feeding rate, check tray
- 1.4 Factors affecting energy partitioning and feeding

**UNIT-2: FORMS OF FEEDS & FEEDING METHODS**

- 2.1 Feed conversion efficiency, feed conversion ratio and protein efficiency ratio
- 2.2 Wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets, advantages of pelletization
- 2.3 Manual feeding, demand feeders, automatic feeders, surface spraying, bag feeding and tray feeding
- 2.4 Frequency of feeding

**UNIT-3: FEED MANUFACTURE & STORAGE**

- 3.1 Feed ingredients and their selection, nutrient composition and nutrient availability of feed ingredients
- 3.2 Feed formulation – extrusion processing and steam pelleting, grinding, mixing and drying, pelletization, and packing
- 3.3 Water stability of feeds, farm made aqua feeds, micro-coated feeds, micro-encapsulated feeds and micro-bound diets
- 3.4 Microbial, insect and rodent damage of feed, chemical spoilage during storage period and proper storage methods



#### UNIT-4: FEED ADDITIVES & NON-NUTRIENT INGREDIENTS

- 4.1 Binders, anti-oxidants, probiotics
- 4.2 Feed attractants and feed stimulants
- 4.3 Enzymes, hormones, growth promoters and pigments
- 4.4 Anti-metabolites, aflatoxins and fiber

#### UNIT-5 NUTRITIONAL DEFICIENCY IN CULTIVABLE FISH

- 5.1 Protein deficiency, vitamin and mineral deficiency symptoms
- 5.2 Nutritional pathology and ant-nutrients
- 5.3 Importance of natural and supplementary feeds, balanced diet

#### REFERENCE BOOKS

1. Fish Nutrition, Third Edition by John E. Halver and Ronald W. Hardy
2. Fish Feeding in Aquaculture by David G. Allan
3. Aquafeed Formulation by Sergio F. Nates
4. Nutrient Requirements and Feeding of Finfish for Aquaculture by Carl D. Webster and Chhorn Lim
5. Fish Nutrition by Chhorn Lim and Carl D. Webster
6. Fish Feed Technology, Second Edition by C. Venkataramanaiah
7. Fish Nutrition and Feed Technology by A.K. Datta, N. Gupta, and D.K. De
8. Aquafeed Technology by N. Rajendran and N. Gopalakrishnan
9. Aquaculture Nutrition: Gut Health, Probiotics and Prebiotics by S.K. Nayak, J. Mukherjee, and S. Prusty
10. Fish Feed Preparation and Management by K. Santhanam and S. Viswanathan
11. Fish Nutrition and Feed Technology: A Practical Approach by K. Gopakumar and R. Shankar
12. Aquatic Animal Nutrition: Principles and Practices by N. Gupta and D.K. De

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**SKILL ENHANCEMENT COURSES**  
**(AQUACULTURE)**  
**PRACTICAL COURSE – 9B**  
**FISH NUTRITION AND FEED TECHNOLOGY**

Hours- 30

Max. Marks- P50

**LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Skill in estimation of different ingredients in the aqua feeds.
- Skill in estimation of ash content in aquaculture feed
- Hands on experience in preparation feed in lab and produce nutritionally balanced and safe fish feed using different feed ingredients and processing techniques.
- Analyze and evaluate different binders used in feed preparation.
- Understand the need and care for storage of aqua feed.
- Skill in identification of physical characteristics of floating and sinking feeds

**SYLLABUS**

1. Estimation of protein content in aquaculture feeds
2. Estimation of carbohydrate content in aquaculture feeds
3. Estimation of lipid content in aquaculture feeds
4. Estimation of ash in aquaculture feed
5. Study of water stability of pellet feeds
6. Feed formulation and preparation in the lab
7. Study of binders used in aquaculture feeds
8. Study of feed packing materials
9. Study of physical and chemical change during storage
10. Study on physical characteristics of floating and sinking feeds

**REFERENCE BOOKS**

1. Fish nutrition. Academic press, San diego, Halver Jr 1989
2. Nutrition and feeding of fishes, Chapman & Hall, New York Lovell rt 1998.
3. Fish Nutrition and Feed Technology by A.K. Datta, N. Gupta, and D.K. De
4. Aquafeed Technology by N. Rajendran and N. Gopalakrishnan
5. Aquaculture Nutrition: Gut Health, Probiotics and Prebiotics by S.K. Nayak, J. Mukherjee, and S. Prusty
6. Fish Feed Preparation and Management by K. Santhanam and S. Viswanathan
7. Fish Nutrition and Feed Technology: A Practical Approach by K. Gopakumar and R. Shankar
8. Aquatic Animal Nutrition: Principles and Practices by N. Gupta and D.K. De

**CO-CURRICULAR ACTIVITIES**

- Field visits to nearest feed production plant.
- Visit to a farm for studying feeding practices
- Guest lectures by industry experts and researchers in the field
- Formulating and producing their own fish feed
- Evaluating and analyzing different types of fish feed and supplements.

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**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**

**(DAIRY)**

**THEORY COURSE – 10A**

**MILK AND MILK PRODUCTS TECHNOLOGY**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the basics of milk and milk products
- Know the composition, processing, and packaging of milk and milk products
- Understand the reasons for deterioration of milk and milk products
- Understand the process in preparation of different milk products
- Gain knowledge about different organic milk products
- Understanding the regulations and standards related to milk and milk products.

**II. SYLLABUS**

**UNIT-1:**

- 1.1 Definition of milk and milk products
- 1.2 Composition of milk and factors affecting composition
- 1.3 Nutritional value of milk and milk products
- 1.4 Types of milk products

**UNIT-2**

- 2.1 Collection and transportation of milk
- 2.2 Processing of milk  
(Chilling, standardization, pasteurization, UHT treatment, homogenization, bacto-fugation)

**UNIT-3**

- 3.1 Packaging, storage and distribution of milk and milk products.
- 3.2 Microbiological deterioration of milk and milk products.
- 3.3 Common defects of milk products and their remedial measures.

**UNIT-4:**

- 4.1 Preparation of cream, butter, paneer or channa, ghee,
- 4.2 Preparation of khoa, lassi, dahi, ice-cream, mozzarella
- 4.3 Preparation of cheese, Yogurt, Butter and Ghee

**UNIT-5:**

- 5.1 Organic milk products.
  - 5.2 Pesticides residues in milk and milk products
- Legal and BIS standards of milk and milk products

**REFERENCE BOOKS**

1. Dairy Science and Technology Handbook by P. Walstra, J.T.M. Wouters, and T.J. Geurts
2. Dairy Processing and Quality Assurance by Ramesh C. Chandan, Arun Kilara, and Nagendra Shah
3. Principles of Dairy Science by W.J. Hurst, R.W. Griffiths, and T.P. Toulouse

4. Dairy Processing: Improving Quality by M. K. Hailu and G. K. Kebede
5. Cheese: Chemistry, Physics and Microbiology by P.F. Fox, T.P. Guinee, T.M. Cogan, and P.L.H. McSweeney
6. Yogurt: Science and Technology by A.Y. Tamime and R.K. Robinson
7. Butter: Chemistry, Technology and Microbiology by P.F. Fox and T.A. McSweeney
8. Handbook of Milk Composition by R.G. Jensen
9. Dairy Plant Engineering and Management by Tufail Ahmad and N.P. Pandey
10. Dairy Microbiology by Marth and Steele
11. Milk and Milk Products Technology by Sunita Mann and Y.C. Gupta
12. Milk Processing and Milk Products Handbook by NPCS Board of Consultants & Engineers

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**SKILL ENHANCEMENT COURSES**  
**(DAIRY)**  
**PRACTICAL COURSE – 10A**  
**MILK AND MILK PRODUCTS TECHNOLOGY**

Hours-30

Max. Marks- P50

**LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Develop skill in estimation of fat content in milk
- Develop skill in estimation of SNF content in milk
- Gain knowledge about various platform tests at milk reception sites
- Develop practical skills in milk testing, quality control and assurance
- Develop practical skills in determination of specific gravity of milk
- Develop practical skills in analysis of butter and cream content.

**PRACTICAL SYLLABUS**

1. Estimation of Fat Content in milk
2. Estimation of SNF Content in Milk
3. Various Platform Tests at milk reception sites
4. Tests For Adulteration in Milk
5. Determination of Specific Gravity by Lactometer
6. Analysis of Butter by Khoman Method
7. Estimation of Fat in Cream by Fat Method
8. Estimation of Acidity in Cream

**LAB REFERENCE BOOKS**

1. Dairy Processing and Quality Assurance by Ramesh C. Chandan, Arun Kilara, and Nagendra Shah
2. Practical Manual for Quality Assurance in Milk and Milk Products by M.S. Grewal and S. Chavan
3. Manual of Methods of Analysis of Milk and Milk Products by BIS (Bureau of Indian Standards)
4. Dairy Plant Management and Pollution Control by S. Ranganathan and K.K. Srivastava

**CO-CURRICULAR ACTIVITIES**

- Conduct a milk quality and safety awareness campaign to promote safe and healthy consumption of milk and milk products.
- Organize an industrial visit to a dairy plant to provide hands-on experience to students on milk and milk products technology.
- Organize a dairy product exhibition or fair to showcase and market student-made dairy products.
- Conduct a milk testing competition to test the knowledge and practical skills of students
- Organize a cheese, yogurt, butter, or ghee making competition to encourage creativity and innovation among students

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**SKILL ENHANCEMENT COURSES**  
**(DAIRY)**

**THEORY COURSE – 10B**

**MILK AND MEAT HYGIENE, FOOD SAFETY AND PUBLIC HEALTH**

Hours- 60+30

Max. Marks-T100+P50

**I.LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the importance of Milk and Meat Hygiene in public health
- Identify sources of milk and meat contamination
- Describe methods for milk and meat quality control and inspection
- Identify and control milk and meat-borne pathogens
- Understand about hazards of milk and meat
- Understand food safety regulations and laws
- Implement HACCP principles in food safety evaluation
- Evaluate food preservation techniques

**II.SYLLABUS**

**UNIT-1: INTRODUCTION OF MILK AND MEAT HYGIENE**

- 1.1 Definition and scope of Milk and Meat Hygiene
- 1.2 Historical development and importance of Milk and Meat Hygiene
- 1.3. Public health aspects of Milk and Meat Hygiene

**UNIT-2: MILK HYGIENE**

- 2.1 Sources of milk contamination
- 2.2 Pasteurization and sterilization of milk
- 2.3 Milk-borne diseases
- 2.4 Milk quality control and inspection

**UNIT-3: MEAT HYGIENE**

- 3.1 Sources of meat contamination
- 3.2 Slaughtering and dressing of animals
- 3.3 Meat-borne diseases
- 3.4 Meat quality control and inspection

**UNIT-4: HAZARDS FOR MILK AND MEAT**

- 4.1 Chemical and microbial toxicities associated with milk, meat and aquatic foods.
- 4.2 Toxic residues: pesticides, antibiotics, metals and hormones in food and their health hazards.
- 4.3 Microbial toxins in food and their health hazards.
- 4.4 Sanitary and phytosanitary measures in relation to foods of animal origin and aquatic foods.

**UNIT-5: FOOD SAFETY AND PUBLIC HEALTH**

- 5.1 Hazard Analysis and Critical Control Points (HACCP)
- 5.2 Food safety regulations and laws
- 5.3 Food preservation techniques
- 5.4 Emerging issues in food safety and public health

## **REFERENCE BOOKS**

1. Food Safety: Principles and Practices by Ronald Schmidt and Gary Rodrick
2. Food Safety and Quality Systems in Developing Countries, Volume One: Export Challenges and Implementation Strategies by Jeffrey Hoorfar, Sibel Roller, and Jorgen Schlundt
3. Meat Hygiene by K. Singh and R. K. Sharma
4. Milk and Dairy Products: Technology, Chemistry and Microbiology by Nivedita Datta and Dattatreya Mukhopadhyay
5. Handbook of Food Safety Engineering by Da-Wen Sun
6. Food Safety and Toxicity by Debasis Bagchi and Sreejayan Nair
7. Handbook of Food Preservation by M. Shafiur Rahman
8. Food Safety: The Science of Keeping Food Safe by Ian C. Shaw
9. Milk Processing and Quality Management edited by Adnan Y. Tamime
10. Meat Hygiene by J.F. Gracey, D.S. Collins, and R.J. Huey
11. Handbook of Food Science, Technology, and Engineering edited by Y.H. Hui
12. Principles of Food Sanitation by Norman G. Marriott and Robert B. Gravani

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**AP STATE COUNCIL OF HIGHER EDUCATION  
B.Sc (Hons) ZOOLOGY SYLLABUS  
SKILL ENHANCEMENT COURSES  
SEMESTER –VII  
(DAIRY)**

**PRACTICAL PAPER – 10B**

**MILK AND MEAT HYGIENE, FOOD SAFETY AND PUBLIC HEALTH**

Hours- 30

Max. Marks-50

**I. LEARNING OUTCOMES**

1. Demonstrate skills Microbiological analysis of raw milk and meat samples
2. Skill in grading of milk by MBR test process
3. Skill development in Ante-mortem inspection of food animals.
4. Skill development in Post mortem inspection of food animals.
5. Understand Food safety and hygiene practices among consumers, food handlers, and food processors.

**II. SYLLABUS**

1. Microbiological examination of raw milk and meat samples
2. Grading of milk by MBR test.
3. Ante-mortem inspection of food animals.
4. Post mortem inspection of food animals.
5. Food safety and hygiene practices among consumers, food handlers, and food processors.
6. Study the role of the Andhra Pradesh Public Health and Municipal Engineering Department (PHMED) in food safety and hygiene

**III. REFERENCE BOOKS**

1. Practical Meat Hygiene by J. J. Vogel and S. G. Tindall
2. Practical Dairy Chemistry: Methods of Analysis by T. Varadarajan and B. S. Narang
3. Food Safety and Quality Management: A Practical Approach by Hal King and Joyce Igoe
4. Meat Processing Technology: For Small- to Medium-Scale Producers by Fidel Toldrá and Leo M.L. Nollet
5. Dairy Processing Handbook by Tetra Pak Processing Systems AB
6. Food Microbiology: Fundamentals and Frontiers by Michael Doyle and Robert Buchanan

**IV. CO-CURRICULAR ACTIVITIES**

1. Visit to local dairy and meat processing facilities
2. Guest lectures by industry professionals and government regulators
3. Research and presentation on a specific food safety issue or outbreak
4. Food safety training for local community members or organizations
5. Participation in food safety competitions or events.

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**AP STATE COUNCIL OF HIGHER EDUCATION**  
**Semester-wise Revised Syllabus under CBCS 2020-21**  
**Four Year – B.Sc. (Hons), Semester – VII**  
**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**THEORY COURSE – 11A**  
**POULTRY PRODUCTS AND MANAGEMENT**

Hours- 60+30

Max. Marks-T100+P50

### **I.LEARNING OUTCOMES**

This course will provide students with a deep knowledge in endocrinology by the successful completion of the course the graduate shall able to –

- Understand about various poultry products and their management
- Analyze the different types of poultry products and their nutritional value
- Knowledge in poultry product processing and preservation
- Skill in poultry products evaluation
- Understand the importance of quality of egg and sanitation
- Understand Sources of contamination of Eggs and prevention methods.
- Knowledge in grading of poultry meat
- Develop skills in poultry product processing and preservation techniques

### **II.SYLLABUS**

#### **UNIT-1: INTRODUCTION TO POULTRY PRODUCTS**

- 1.1 Types of poultry products
- 1.2 Nutritional value of poultry products
- 1.3 Factors affecting the quality and safety of poultry products
- 1.4 Value-added poultry products

#### **UNIT-2: POULTRY PRODUCT PROCESSING AND PRESERVATION**

- 2.1 Principles of poultry product processing
- 2.2 Processing techniques for various poultry products
- 2.3 Preservation techniques for poultry products
- 2.4 Packaging and labelling of poultry products

#### **UNIT-3: POULTRY PRODUCTS EVALUATION**

- 3.1 Sensory evaluation of poultry products
- 3.2 Quality control and assurance of poultry products
- 3.3 Factors affecting the shelf life of poultry products

#### **UNIT-4: QUALITY OF EGG AND SANITATION**

- 4.1 Methods of cooking of Eggs
- 4.2 The Nutritive value of Egg before cooking after cooking, other advantages of Egg.
- 4.3 Selection of types of Detergents and Sanitizers for controlling Egg Quality and Poultry Products
- 4.4 Sources of contamination of Eggs and its Products and prevention methods.

## UNIT-5: GRADING OF POULTRY MEAT

5.1 Grade - I, Grade - II

5.2 Abnormalities in Processed Broiler Meat

5.3 Preservation of Meat

### REFERENCE BOOKS

1. Poultry Science by Colin G. Scanes
2. Handbook of Poultry Science and Technology, Volume 1 by Isabel Guerrero-Legarreta
3. Commercial Chicken Meat and Egg Production by Donald D. Bell
4. Poultry Products Processing: An Industry Guide by Simeon Oladele Fasina
5. The Poultry Health Handbook by Dr. M. K. Jain

### WEB LINKS

<https://cari.icar.gov.in/pht.php>

<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=63725>

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**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**PRACTICAL PAPER – 11A**  
**POULTRY PRODUCTS AND MANAGEMENT**

Hours- 30

Max. Marks-50

**I. LEARNING OUTCOMES**

1. Develop skills in Estimation of External Quality of Chicken Egg
2. Develop skills in Estimation of Internal Quality of Chicken
3. Skill in sensory evaluation tests assess the quality of poultry products
4. Develop practical skills in poultry product processing and preservation techniques
5. Skill in estimation of percentage of losses in Processing of Broilers
6. Knowledge about different Government agencies that provide hands-on experience related to poultry products

**II. SYLLABUS**

1. Estimation of External Quality of Chicken Egg
2. Estimation of Internal Quality of Chicken
3. Study on sensory evaluation tests to assess the quality of poultry products- appearance, flavor, texture, juiciness, and aroma.
4. Study on steps involved in processing and preserving poultry products
5. Estimation of Percentage of Losses in Processing of Broilers
6. Data collection about different Government agencies that provide hands-on experience related to poultry products.

**III. REFERENCE BOOKS**

1. Poultry Products Processing: An Industry Guide by Thomas J. Roach
2. Poultry Meat and Egg Processing, Second Edition by Richard J. Stier
3. Technology of Chicken Meat and Poultry Products by Dr. V.K. Singh
4. The Science of Poultry and Meat Processing by Dr. Shai Barbut
5. Sensory Evaluation of Food: Statistical Methods and Procedures by Michael O'Mahony
6. Handbook of Food Preservation by M. Shafiur Rahman

**IV. CO-CURRICULAR ACTIVITIES**

1. Visit a poultry farm to learn about the various poultry products
2. Participation in trade shows, conferences, and workshops related to poultry products and technologies.
3. Collection and display of articles related to poultry industry
4. Working on internship or apprenticeship programs with poultry processing

plants

5. Conducting research projects on topics related to poultry products, such as processing, quality, or safety,
6. Visit Restaurants, KFC, Bekary. And identify different value added Products sold in the market .
7. Collect recipe s of different Value added products and try to prepare them in the college or at home
8. Conduct “Chicken fest “ in the college and prepare different value added products of egg and meat and sell the products to others

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**Four Year – B.Sc. (Hons), Semester – VII**  
**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**THEORY COURSE – 12B**  
**POULTRY WASTE MANAGEMENT**

Hours- 60+30

Max. Marks-T100+P50

### **I.LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the basic principles of poultry waste management
- Understand the sources and types of poultry waste.
- Evaluate and select appropriate poultry waste treatment technologies
- Understand the importance of poultry litter and its value addition
- Understand about poultry litter management
- Gain knowledge about the methods and types of poultry litter disposal and uses

### **II.SYLLABUS**

#### **UNIT-1: INTRODUCTION TO POULTRY WASTE MANAGEMENT**

Definition, Types, Importance of poultry waste management  
Environmental and health concerns associated with poultry waste  
Basic principles of poultry waste management

#### **UNIT-2.: POULTRY WASTE TREATMENT TECHNOLOGIES**

Conventional treatment methods (composting, land application, anaerobic digestion)  
Innovative treatment methods (wetland systems, bioreactors, thermal treatment)  
Selection of appropriate treatment methods based on waste characteristics and local conditions

#### **UNIT-3.: POULTRY LITTER**

Poultry Litter - Bedding Material  
Importance of Poultry Farm Pollution  
Value of Poultry Manure

#### **UNIT-4.: POULTRY LITTER MANAGEMENT**

Moisture management methods.  
Litter Re-utilization methods  
Litter Amendments  
Acidifiers and other Amendments

#### **UNIT-5: POULTRY LITTER DISPOSAL AND USES**

Methods of disposal of faecal material  
Types of uses of faecal material  
Environmental advantages due to use of poultry litter

## **REFERENCE BOOKS**

1. Poultry Waste Management: Agricultural and Environmental Issues edited by B. P. Singh and T. A. El-Masry
2. Poultry Waste Management: Towards a Sustainable Future by G. T. Patel and B. V. Changela
3. Poultry Production and Management by N. G. Das (available on Amazon)
4. Livestock Waste Facilities Handbook by G. L. Riskowski
5. Handbook of Poultry Science and Technology, Volume 2: Secondary Processing by Y. H. Hui and S. C. Dai

## **WEBLINKS**

<https://www.pashudhanpraharee.com/poultry-waste-management/>

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**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**PRACTICAL COURSE – 11B**  
**POULTRY WASTE MANAGEMENT**

Hours- 30

Max. Marks-P50

### **I.LEARNING OUTCOMES**

This course will provide students with a deep knowledge in endocrinology by the successful completion of the course the graduate shall able to –

- Skill in sampling techniques for poultry waste
- Skill in preparation of manure from poultry waste
- Analyze the composition of litter
- Skill in preparing fuel from faecal material
- Skill in preparing of fertilizer from poultry litter
- Awareness about litter collection from cage rearing systems
- Awareness on site selection and preparation for poultry waste management
- Skill development in poultry waste treatment techniques

### **II SYLLABUS**

1. Study of different types of sampling techniques for poultry waste
2. Preparation of manure from poultry waste and spreading on cropland or green land
3. Composition of litter
4. Preparing fuel from faecal material
5. Preparing fertilizer from poultry litter
6. Steps to be considered for site selection and preparation for poultry waste management
7. Study of some common poultry waste treatment techniques
8. Data collection of different methods on disposal of chicken skin waste and carcass waste from chicken shops.

### **III.REFERENCE BOOKS**

1. Handbook of Poultry Science and Technology, Volume 2: Secondary Processing by Y. H. Hui and S. C. Dai (available on Amazon.in)
2. Livestock Waste Facilities Handbook by G. L. Riskowski (available on Amazon.in)
3. Poultry Science and Practice by J. L. Shelton and N. B. Anthony (available on Amazon.in)
4. Reference Books:
5. Poultry Diseases by H. V. Narasimha Murthy (available on Amazon.in)
6. Poultry Nutrition by T. Kotaiah (available on Amazon.in)
7. Handbook of Poultry Feed from Waste: Processing and Use by P. B. Patil and S. K. Sahoo (available on Amazon.in)

#### **IV. CO-CURRICULAR ACTIVITIES**

- Field trips to poultry farms and waste management facilities
- Guest lectures by industry professionals and government regulators
- Group projects on poultry waste management planning and implementation
- Case studies of successful and unsuccessful poultry waste management systems
- Participation in conferences and workshops related to poultry waste management
- Visit to all the chicken shops in your village/town and know the approximate quantity of chicken waste generated per day/per month and calculate amount of waste produced in your town/village

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**AP STATE COUNCIL OF HIGHER EDUCATION**  
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**Four Year – B.Sc. (Hons), Semester – VII**

**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**  
**(SERICUTLURE)**

**THEORY COURSE – 12A**

**MULBERRY PHYSIOLOGY AND MULBERRY BREEDING & GENETICS**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the importance of mulberry as a crop plant and its historical significance in the production of silk.
- Gain knowledge of the anatomy and morphology of mulberry plants, including their growth and development, and photosynthetic processes.
- Understand the principles and techniques of mulberry breeding, including hybridization techniques and breeding objectives.
- Gain a fundamental understanding of the genetics of mulberry plants, including the inheritance of traits and the application of molecular genetics techniques.
- Understand the potential applications of genetic engineering and biotechnology in mulberry research and production.

**II. SYLLABUS**

UNIT-1: Introduction to Mulberry

- 1.1 Importance of mulberry
- 1.2 History and distribution of mulberry
- 1.3 Mulberry species and their characteristics

UNIT-2: Mulberry Physiology

- 2.1 Growth and development of mulberry
- 2.2 Anatomy and morphology of mulberry
- 2.3 Photosynthesis and carbon fixation in mulberry

UNIT-3: Mulberry Breeding

- 3.1 Breeding objectives and methods
- 3.2 Hybridization technique and Selection
- 3.3 Breeding for draught and disease resistance varieties

UNIT-4: Mulberry Genetics

- 4.1 Mendelian genetics and inheritance in mulberry
- 4.2 Molecular genetics of mulberry
- 4.3 Genetic engineering and biotechnology in mulberry

UNIT-5: Germplasm bank

- 5.1 Importance and collection
- 5.2 Characterization and maintenance.
- 5.3 Plant introduction, acclimatization and quarantine

## REFERENCE BOOKS

- Mulberry: The Silkworm Food Plant by H.T. Chan and Keiko Nakatani
- Mulberry Cultivation by S. Nagarajan and V.V. Krishnamurthy
- Genetics, Genomics and Breeding of Mulberry by Anathbandhu Das
- Mulberry: The Silkworm Food Plant by H.T. Chan and Keiko Nakatani
- Mulberry Cultivation by S. Nagarajan and V. V. Krishnamurthy
- Genetics, Genomics and Breeding of Mulberry by Anathbandhu Das
- Mulberry: The Mulberry Plant and Silk Production by Prakash Chandra Kapoor and Hari Shankar Sharma
- Genetics and Breeding of Mulberry and Silkworm by G. N. Ramachandra Rao and Ananthakrishnan T. N.
- Molecular Biology and Biotechnology of Mulberry: Basic Research and Biotechnology by Anantharamanan Rajasekaran and Sivakumar Swaminathan

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**Four Year – B.Sc. (Hons), Semester – VII**

**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**

**(SERICUTLURE)**

**PRACTICAL COURSE – 12A**

**MULBERRY PHYSIOLOGY AND MULBERRY BREEDING & GENETICS**

Hours- 30

Max. Marks-P50

**LEARNING OUTCOMES**

This course will provide students with a deep knowledge in endocrinology by the successful completion of the course the graduate shall able to –

- Develop practical skills in mulberry propagation techniques, including seed germination, cuttings, and grafting.
- Be able to identify and classify different mulberry species based on their characteristics.
- Gain experience in the evaluation of mulberry germplasm, including selecting superior traits for breeding programs.
- Develop skills in hybridization techniques for mulberry breeding and have experience in analyzing the offspring.
- Gain practical experience in molecular techniques for mulberry genetic analysis.

**SYLLABUS**

1. Identification and classification of mulberry species
2. Study of mulberry plant anatomy and morphology
3. Techniques of mulberry propagation (seeds, cuttings, grafting)
4. Evaluation of mulberry germplasm
5. Hybridization techniques
6. Molecular techniques for mulberry genetic analysis

**REFERENCE BOOKS**

1. Handbook of Mulberry Research: Volume 2: Cultivation Practices and Agronomy by T.N. Ananthkrishnan
2. Handbook of Mulberry Research: Volume 3: Sericulture Technology by T.N. Ananthkrishnan
3. Genetics and Breeding of Mulberry and Silkworm by G.N. Ramachandra Rao and Ananthkrishnan T.N.
4. Molecular Biology and Biotechnology of Mulberry: Basic Research and Biotechnology by Anantharaman Rajasekaran and Sivakumar Swaminathan
5. Mulberry: The Mulberry Plant and Silk Production by Prakash Chandra Kapoor and Hari Shankar Sharma

**CO-CURRICULAR ACTIVITIES**

- Field visits to mulberry farms and research centres'
- Guest lectures by experts in the field
- Seminars and presentations on current research in mulberry physiology, breeding, and genetics
- Conduct a research project on a topic related to mulberry physiology, breeding, or genetics
- Present a seminar or poster on a mulberry-related topic at a conference or symposium.

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**Four Year – B.Sc. (Hons), Semester – VII**

**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**  
**(SERICUTLURE)**

**THEORY COURSE – 12B**

**SILKWORM PHYSIOLOGY AND SILKWORM BREEDING & GENETICS**

Hours- 60+30

Max. Marks-T100+P50

### **I.LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the physiology of Digestion and Respiration in silkworm.
- Understand the physiology of Excretion and Nervous system in silkworm.
- Gain knowledge about the sense organs in silk worm.
- Understand the physiology of circulation and reproductive systems in silkworm.
- Understand the mechanism of metamorphosis and its types in silk worm.
- Understand the methods of breeding and genetics involved in silk worm.

### **II.SYLLABUS**

#### **UNIT-1:**

Digestion: Artificial diets, feeding apparatus, feeding behaviour. Structure and function of digestive system, digestive enzyme, process of digestion

Respiration: tracheal systems, spiracles, mechanism of respiration, factor affecting respiration

#### **UNIT-2:**

Excretion: Structure and function of excretory system.

Nervous system.

Sense organ: Photoreceptor, Chemoreceptor and Mechanoreceptor

#### **UNIT-3:**

3.1 Circulation systems. Haemolymph

3.2 Male and female reproductive system;

3.3 Metamorphosis and types.

#### **UNIT-4:**

4.1 Silkworm germplasm bank. Sex determination mechanism in silkworm: importance of ZZ and ZW chromosome; Parthenogenesis in silkworm.

4.2 Genetics and inheritance of cocoon color. Linkage group in Bombyx mori;

4.3 Method of selection, fixation of character.

#### **UNIT-5:**

5.1 Evolution of new breeds – race authorization. Heterosis/Hybrid Vigor;

5.2 Exploitation of heterosis in silkworm – concept of single double and poly hybrids.

### **REFERENCE BOOKS**

1. Silkworm Breeding and Genetics. Central Silk Board, Bangalore. Basavaraja, H.K., Aswath, S.K., Suresh Kumar, N., Mal Reddy, N. And Kalpana, G.V. (2005)
2. The Silkworm – Biology, Genetics and Breeding. Vikas Publishing House Pvt. Ltd.,

- New Delhi., Dilip De Sarkar (1998)
3. Genetics of Silkworm. Academic Press, London, Tazima, Y. (1964)
  4. Experimental Physiology. Oxford & Ibh Publishing Co. Pvt. Ltd., New Delhi and Calcutta. Ather H. Siddiqi (1982)
  5. Silkworm Breeding. Oxford & Ibh Publications, New Delhi. Eikichi Hiratsuka (2000)
  6. Marker-Assisted Selection, Fao, Rome Elcio P. Guimaraes, John Ruane, Beate D. Scherf, Andrea Sonnino and James D. Dargie (2007)
  7. Insect Physiology. 5th Edn. Rev. Methuen, London. Wigglesworth, V.B. (1956)
  8. Mulberry Breeding. Kalyani Publishers. Amitabha Sarkar (2009).
  9. Plant Breeding Principles & Methods. B.D. Singh (2015).
  10. Quantitative Genetics and Biometrical Techniques in Plant Breeding. N. Nadarajan & Lt. M. Gunasekaran (2012).
  11. A Textbook on Mulberry Breeding and Genetics. Kalyani Publishers, S. Roy Chowdhuri, B.B. Bindroo S.P. Chakraborti (2013).
  12. Silkworms: Biology and Biotechnology by K. Murugesh Babu and G. Padmaja
  13. Molecular Model System in Lepidoptera. Cambridge Press, London. Goldsmith, M And Wilkinson, A.S. (1996)
  14. Development and Physiology of Silkworm. Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi. Morohoshi, S (2000)
  15. Silkworm Breeding. IBM Publishers, New Delhi. Sreeramreddy (Ed), G. (1998).

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**SKILL ENHANCEMENT COURSES**  
**(SERICULTURE)**  
**PRACTICAL COURSE – 12B**  
**SILKWORM PHYSIOLOGY AND SILKWORM BREEDING & GENETICS**  
Hours- 30 Max. Marks-50

**LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Demonstrate the ability to estimate the proteins form body / egg
- Demonstrate the ability to estimate the glycogen from fat body/ ovary
- Demonstrate the ability to identify different races of silk worms.
- Demonstrate the ability to select and maintain high-quality silkworm strains for breeding purposes.
- Demonstrate the ability to perform basic genetic crosses and hybridizations to improve silkworm quality.
- Demonstrate the ability to collect and analyze data related to silkworm rearing and breeding.

**SYLLABUS**

1. Estimation of proteins in hemolymph/egg
2. Estimation of glycogen in fat body/ovary of silkworm
3. Identification of different races of silkworm – NB4D2, PM, C. Nichi, KA, CSR2 and CSR4 race/breed characters.
4. Collection and maintenance of breeding stock, selection of the best mating pairs, and management of the breeding process.
5. Comparative assessment of the hybrids and pure race cocoon.
6. Estimation of heterosis and inbreeding depression.

**REFERENCE BOOKS**

Practical Manual on Silkworm Rearing by V. Anitha  
Handbook of Sericulture Technologies by T.S. A. Shantha and V. D. Devasahayam  
Silkworm Rearing by D.N. Srivastava and B.P. Sinha  
Silkworm Seed Production and Management by D.N. Srivastava and B.P. Sinha  
Silkworm Breeding and Genetics by D.N. Srivastava and B.P. Sinha  
Silkworm Diseases and Pest Management by D.N. Srivastava and B.P. Sinha

**CO-CURRICULAR ACTIVITIES**

Visit to a Sericulture Research Center or a Silk Production Unit to understand the practical aspects of sericulture.  
Conducting surveys and research on the different types of silkworms, their habitat, and their importance in sericulture.  
Developing and presenting research COURSE s on different aspects of sericulture and silk production.  
Activities for Students-Rearing silkworms in the laboratory and studying their growth

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**AP STATE COUNCIL OF HIGHER EDUCATION**  
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**Four Year – B.Sc. (Hons), Semester – VIII**  
**Domain Subject: ZOOLOGY**  
**TOOLS AND TECHNIQUES IN BIOLOGY**  
**COURSE 14-A**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning out comes**

After the successful completion of this course the student should be able to

- Acquire knowledge on usage of tools in biological labs
- Understand the handling of Instruments in the Laboratory
- Carryout certain assays
- Stain the biological samples

**II. Syllabus**

**UNIT-1**

- 1.1 Principles and application of Ultracentrifugation, Electrophoresis
- 1.2 Chromatography (various types)
- 1.3 Lambert-Beers Law and colorimetry and spectrophotometry, Flow cytometry.

**UNIT-2**

- 2.1 Principles and Application of Light Microscopy and micrometry
- 2.2 Phase Contrast microscopy, Interference microscopy, Fluorescence microscopy
- 2.3 Transmission Electron microscopy.
- 2.4 Scanning Electron microscopy.

**UNIT-3**

- 3.1 Chemical assays
- 3.2 Biological assays-in vivo and in vitro
- 3.3 Principles of cytological and cyto chemical techniques

**UNIT 4**

- 4.1 Fixation: chemical basis of fixation by formaldehyde, glutaraldehyde, chromium salts, mercury salts, osmium salts, alcohol and acetone
- 4.2 Chemical basis of staining of carbohydrate, protein lipids and nucleic acids.

**UNIT-5**

- 5.1 Principle and techniques of Nucleic acid hybridization and cot curve
- 5.2 Sequencing of proteins and nucleic acids
- 5.3 Media preparation and sterilization, Inoculation and growth monitoring

**III. SUGGESTED READING MATERIALS - (ALL LATEST EDITION)**

- Introduction to Instrumental Analysis, Robert Braun, McGraw Hill International Edition
- A biologist guide to principles and techniques of practical biochemistry K Wilson and K. H. Goulding ELBs Edition
- Instrumentation, Upadhyay and Nath, Meerut Publications
- Instrumentation and Techniques, R.C. Bajpayee, Himalayan Publications

**IV. Suggested activities**

- Adoption of lab instruments by the student groups for their maintenance

The following is the blue print

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**Domain Subject: ZOOLOGY**

**TOOLS AND TECHNIQUES IN BIOLOGY LAB**  
**COURSE 14-A LAB**

Hours- 30

Max. Marks-50

**I. Learning outcomes**

After the successful completion of this course the student should be able to

- Acquire knowledge on usage of tools in college labs
- Handle the Instruments in the Laboratory
- Centrifuge/Stain the biological samples

**II. Syllabus**

Parts study, principles and use of following instruments for different techniques:

1. pH meter: Determination of pH of different soil and water samples.
2. Spectrophotometer: Preparation of absorption spectrum.
3. Chromatography: Paper and thin layer chromatography.
4. Centrifuge: Extraction proteins and carbohydrates from tissues.
5. Electrophoresis: Paper and gel electrophoresis.
6. Microscope: Parts study and principles of various microscopes.
7. Demonstration of cryostat.  
(And Other exercise related to theory paper).

**Lab web resources:**

<https://www.vlab.co.in/>



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**Domain Subject: ZOOLOGY**  
**COURSE 14 B**  
**TOXICOLOGY AND BIOSTATISTICS**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning out comes**

After the successful completion of this course the student should be able to

- Know the Principles of Toxicology
- Understand the Toxic effects certain toxicants
- Apply statistics in the biological data analysis
- Analyze sample data with statistical tools

**II. Syllabus**

**UNIT-1**

- 1.1 General Principles of Toxicology. Areas of toxicology.
- 1.2. Toxic dose tolerance. Risk and safety. Routes and sites.
- 1.3 Routes and sites of transportation.

**UNIT – 2:**

- 2.1 Toxic effects of Pesticides.
- 2.2. Toxic effects of Organochlorines.
- 2.3. Toxic effects of Organophosphates.
- 2.4. Toxic effects of Carbamates.

**UNIT – 3:**

- 3.1 Scope and application of statistics in Biology
- 3.2 Sampling – Characteristics, advantages and methods of sampling and sampling errors
- 3.3. Frequency distribution: Preparation of ordered, discrete and continuous tables

**UNIT – 4:**

- 4.1 Diagrammatic presentation of data : Data presentation by diagrams, graphs and curves
- 4.2. Measures of central tendency : Mean, median and mode
- 4.3 . Measures of dispersion : Standard deviation, variance and coefficient of variance
- 4.4 . Analysis of Variance - Correlation and regression

**UNIT-5 :**

- 5.1. Probability: Measurement, terminology and laws
- 5.2. Probability distributions: Binomial, Poisson and normal distributions
- 5.3. Tests of significance: Chi-square test, t-test, anova

**III. Suggested Text Books**

1. A Textbook of Modern Toxicology, 4th Ed.", by Ernest Hodgson, ISBN: 978-0-470-46206-5
2. M.V. Ismail. Biostatistics, 1st Edition, Laxmi Publication Pvt. Ltd
3. Gupta and Kumar: Statistics
4. J. Zar: Biostatistics.

#### **IV. Reference Books**

- Casarett & Doull's Toxicology: The Basic Science of Poisons, 9th Edition. (2018). Greece: McGraw-Hill Education.
- Burcham, P. C. (2013). An Introduction to Toxicology. United Kingdom: Springer London.
- General and Applied Toxicology. (2009). United Kingdom: John Wiley & Sons.
- Perspectives in Basic and Applied Toxicology. (2016). United Kingdom: Elsevier Science.
- Applied toxicology: approaches through basic science. (1997). Germany: Springer Verlag
- Bernard Rosner (2015), Fundamentals of Biostatistics, 7th Edition, Brooks/Cole, 20 Channel Center Street Boston, MA 02210, USA
- Veer Bala Rastogi (2015) Biostatistics, Medtech; 3rd edition, New Delhi-110002
- Mercurio, S., Understanding Toxicology, Jones and Bartlett Learning, Burlington, MA, 952 p.(2017).
- Stine, K. E., Brown, T. M., Principles of Toxicology, 3rd edition, CRC Press, Boca Raton, FL, 437pp.(2015).
- W.W. Daniel: Biostatistics – A foundation for analysis in the Health Sciences.
- Sokal, R.R. & F.J. Rohlf. Biometry. Freeman, San Francisco.
- Snedecor, G.W. and W.G. Cochran. Statistical methods for environmental biologists. John Wiley & sons. New York.
- Murray, J.D. Mathematical Biology. Springer – Verlag, Berlin.

#### **V. Suggested Activities**

- Project on toxicology studies on any model lab animal
- Ecological Modeling with statistics applications
- Calculate the mean/median/mode of Zoology marks of your class.
- Take the details of admissions of your college(5 years data) and represent in graph
- Result Analysis of your class for all the previous semesters in graph
- Observe statistical data of your favorite cricketer in IPL /ODI/Test. Write down his/her average runs scored/average wickets taken. Observe all the statistical words used in IPL and observe all the Graphs shown in IPL.

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**Domain Subject: ZOOLOGY**  
**COURSE 14 B - LAB**  
**LAB- TOXICOLOGY AND BIostatISTICS**

Hours- 30

Max. Marks-50

**I. Learning out comes**

After the successful completion of this course the student should be able to skill up with

- Toxicology assessment
- Statistical application in analysis
- data analysis with Statistics
- Ecological modeling

**II. Syllabus**

1. Toxic dose tolerance test-Lc 50 on any model animal
2. Sampling – Lottery method and Random digits
3. Frequency distribution
4. Graphical presentation of the data
5. Measures of Central Tendency – Mean, median and mode
6. Measures of Dispersion – S.D. & C.V. (Standard deviation and Coefficient of variation)
7. Probability
8. Coefficient of Correlation
9. Ecological modeling – Case study.

**III. Lab Web Resources:**

<https://vlab.amrita.edu/?sub=3&brch=277&sim=1494&cnt=2>

<https://www.merlot.org/merlot/viewMaterial.htm?id=878009>

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**COURSE 14 C**

**ENVIRONMENT BIOLOGY AND ENVIRONMENT PHYSIOLOGY**  
Hours- 60+30 Max. Marks-T100+P50

**I. Learning out comes**

By the successful completion of the course the graduate should able to –

- Know the structure and Components of Ecosystem
- Understand the Community dynamics
- Know the natural resources and their conservation
- Understand the Stress physiology
- Understand the importance of yoga and meditation

**II. Syllabus**

**UNIT- 1**

- 1.1 Structure and components of ecosystem. Types and functions of ecosystem. Ecological modeling. Limiting factors
- 1.2 Energy flow, food chain, food web and trophic levels, ecological pyramids. Ecological succession
- 1.3 Biogeochemical cycles: water cycle, carbon, oxygen and nitrogen cycles.

**UNIT-2**

- 2.1 Population dynamics- Dynamics of population growth. Factors that increase or decrease population.
- 2.2 Community dynamics- Characteristics and composition- Development and classification of communities.
- 2.3 Renewable and non-renewable resources: Forest, water and mineral resources. Conservation of energy sources.

**UNIT-3**

- 3.1 Levels of adaptation. - Mechanisms of adaptation.
- 3.2. Adaptations to different environments. Marine, shores and estuaries. Freshwater. Terrestrial Life.
- 3.3 Adaptations to different environments. Aerial-Polar-Deep Sea environment- Desert- cave- Wet land- Parasitic habitats.

**UNIT-4**

- 4.1 Stress Physiology - Basic concepts of environmental stress and strain, Concept of elastic and plastic strain.
- 4.2. Stress avoidance, stress tolerance and stress resistance. Acclimatization, acclimation and adaptation.
- 4.3 Endothermic and physiological mechanism of regulation of body temperature.

## **UNIT-5**

5.1 Stress physiology in different conditions

5.2 Physiological response to oxygen deficient stress. Physiological response to body exercise.

5.3 Effect of meditation and yoga

### **III. Suggested Text books**

FUNDAMENTALS OF ECOLOGY Odum P.

### **IV. Reference Books**

- ECOLOGY with special reference to animal & man S. Charles, Kendeigh Prentice hall of India Pvt. Ltd. New Delhi
- ELEMENTS OF TROPICAL ECOLOGY- Yanney Ewusie (English language Book Society, Heine mann educational book publication)
- ANIMAL PHYSIOLOGY, MECHANISM AND ADAPTATION - Eckert, R., W,H, Freeman and Co.
- BIOCHEMICAL ADAPTATION- Hochachka, P.W, and Somero S.N, Princeton, New Jersey
- ANIMAL PHYSIOLOGY: ADAPTATION AND ENVIRONMENT. - Schiemiidt Nielsen, Cambridge
- GENERAL & COMPARATIVE ANIMAL PHYSIOLOGY Hoar W.S. Princeton Hall of India

### **V. Suggested activities**

- Case study Meditation and yoga
- Collection of specimens from various environments

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**COURSE 14 C - LAB**  
**ENVIRONMENT BIOLOGY AND ENVIRONMENT PHYSIOLOGY- LAB**  
Hours- 30 Max. Marks-P50

**I. Learning out comes**

By the successful completion of the course the graduate should able to –

- Observe the opercular activity of a model fish
- Study Toxicology effects
- Observe the adaptations in various animals

**II. Syllabus**

1. Study of the effects of starvation / surfacing prevention on opercular activity in a teleost fish
2. Study of effect of fluoride toxicity on muscle protein in a fish.
3. Study of changes in chromatophores in fish kept against white and black backgrounds.
4. Toxicity test (LC 50)
5. Adaptive modification of feet or claws in birds.
6. Adaptive modification in mouth parts of insects.
7. Analysis of soil and water.
8. Study of biogeochemical cycles by way of models.

Visit to some natural habitats and man made habitats to study the human impact on environment.

Water analysis for fresh and waste water

**III. Lab web resources:**

<https://sites.google.com/site/cynthiajdowns/teaching>

<https://www.scientistcindy.com/environmental-biology-laboratory.html>

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**Domain Subject: ZOOLOGY**  
**COURSE 14 D**

**ANIMAL BEHAVIOUR AND CHRONOBIOLOGY**

Hours-60+30

Max. Marks-100+50

**I. Learning outcomes**

By the successful completion of the course the graduate should be able to –

- Conceptualize ethology profiles of various scientists
- Understand the concepts of Ethology
- Know the animal behavior patterns
- Observe the adaptations in various animals
- Understand the principles of chronobiology

**II. Syllabus**

**UNIT 1:**

1.1 Introduction to Animal Behaviour

1.2 Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen

1.3 Proximate and ultimate causes of behaviour Methods and recording of a behaviour

**UNIT 2: Patterns of Behaviour**

2.1 Stereotyped Behaviours (Orientation, Reflexes)

2.2 Individual Behavioural patterns; Instinct vs. Learnt Behaviour

2.3 Associative learning, classical and operant conditioning, Habituation, Imprinting.

**UNIT 3: Social and Sexual Behaviour**

3.1 Social Behaviour: Concept of Society; Communication and the senses

3.2 Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.

3.3 Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

**UNIT 4: Introduction to Chronobiology**

4.1 Historical developments in chronobiology; Biological oscillation: the concept of Average, amplitude, phase and period.

4.2 Adaptive significance of biological clocks

4.3 Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.

**UNIT 5: Biological Rhythm**

5.1 Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms

5.2 Concept of synchronization and masking; Photic and non-photic zeitgebers

5.3 Circannual rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.

### **III. Text Books**

### **IV. Reference Books**

- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
- Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. De Coursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barenz and Noble Inc. New York, USA
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

### **V. Suggested activities**

- Observation – recording of behavior pattern of pet animals /animals in the community
- Observation of behavioural changes in Honey bees



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**COURSE 14 D - LAB**

**ANIMAL BEHAVIOUR AND CHRONOBIOLOGY- LAB**

Hours-30

Max. Marks-50

### **I. Learning outcomes**

By the successful completion of the course the graduate should be able to –

- Understand behavioral responses of insects
- Know the geotaxis behaviour patterns
- Observe phototaxis behavior in various larvae

### **II. Syllabus**

To study nests and nesting habits of the birds and social insects.

1. To study the behavioral responses of wood lice to dry and humid conditions.
2. To study geotaxis behaviour in earthworm.
3. To study the phototaxis behaviour in insect larvae.
4. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioral activities of animals and prepare a short report.
5. Study and actogram construction of locomotor activity of suitable animal models.
6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).

### **III. Lab resources:**

Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ SpringerVerlag, Germany.

- <https://ccb.ucsd.edu/the-bioclock-studio/education-resources/basics/part2.html>
- <https://ccb.ucsd.edu/the-bioclock-studio/education-resources/basics/index.html>

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**COURSE 14 E**

**MOLECULAR AND HUMAN GENETICS**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning outcomes**

By the successful completion of the course the graduate should be able to –

- Understand the genetic analysis of mutants
- Understand the Cytogenetic mapping
- Know the recombination and transpositions at molecular level
- Understand the uses of microorganisms in biotechnology
- Understand biology of transformed cells

**II. Syllabus**

UNIT 1

- 1.1 Basic of genetic analysis: Terminology, Mutants and revertants, Uses of mutants
- 1.2 Genetic analysis of mutants, Site directed mutagenesis

UNIT-2

- 2.1 Genome analysis
- 2.2 Cytogenetic mapping
- 2.3 Genetic linkage mapping using molecular markers, Physical mapping

UNIT-3

- 3.1 Recombination and transposition at molecular level: Sister chromatid exchanges and homologous recombination, Site specific recombination, Transposition
- 3.2 Computer analysis of genetic sequences: General concepts in sequence analysis, Identification of functional sequences
- 3.3 Gene cloning

UNIT-4

- 4.1 Uses of microorganisms in biotechnology
- 4.2 New methods for genetically manipulating plants and animals
- 4.3 Applications of transgenic plants and animals

UNIT-5

- 5.1 Biology of human races, Mutation and human diversity, Determination of mutation rates
- 5.2 Prenatal diagnosis and genetic counseling: Prenatal diagnosis of birth defects, Uses of amniocentesis
- 5.3 Transformed Cells-Oncogenes-Carcinogens-Cancer therapy

### **III. Text Books**

### **IV. Reference Books**

- Atherly, A.G. Girton, J.R. and Mc Donald, J.F., The Science of Genetics. College, Publishing, Harcourt Brace College, Publishers. NY.
- Watson, J.D.; Hopkins; N.H.; Roberts, J.W.; Steitz, J.A. and Weiner, A.M. Biology of Genes, The Benjamin/Cummings Publishing Company Inc. Tokya
- Griffiths, A.J.F., Gelbart, W.M.; Miller, J.H.; Lewontin, R.C. and Modern Genetic Analysis. W.H. Freeman and Company, New York.
- Brooker, R.J. Genetics: Analysis and Principles. Benjamin/Cumming, Longman Inc.
- Manage, E.J. and manage, A.P. Basic Human Genetics. Sinauer, Associates, Inc.
- Hartl, Daniel L. Human genetics. Harper and Row
- Rothwell, N.V. Human Genetics. Prentice-Hall.
- Winchester, A.M. heredity, Evolution and Humankind. West Publishing Company.

### **V. Suggested Activities**

- Preparation of Album with genomic applications

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**COURSE 14 E- LAB**

**MOLECULAR AND HUMAN GENETICS LAB**

Hours- 30

Max. Marks-50

**I. Learning outcomes**

By the successful completion of the course the graduate should be able to –

- Quantify micro-organisms from the samples
- Acquire skills on motility test

**II. Syllabus**

1. Sampling and quantification of microorganisms in air and water.
2. Isolation of bacteria (Streak plate, spread plate, pour plate, serial dilution)
3. Tests for Motility
4. Observation of morphology - shape and arrangement of cells.
5. Methods of inoculation of different microbes in media.
6. Testing of Blood Sugar
7. Testing of Liver Function Test (Bilirubin, SGOT, SGPT, Alkaline Phosphatase, Albumin, Globulin, Total Protein) -KIT
8. Testing of Renal Function Test (Urea, Uric acid, Creatine, Creatinine)-KIT

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**COURSE 14F**  
**BIOSYSTEMATICS & TAXONOMY**

Hours- 60+30

Max. Marks-T100+P50

**I. Learning outcomes**

By the successful completion of the course the graduate should be able to –

- Understand the concepts of Biosystematics and taxonomy
- Acquire skills on collection of samples for Taxonomic studies
- Understand the rules of ICZN
- Understand the different types of molecular species concepts

**II. Syllabus**

**UNIT-1**

- 1.1 Definition and basic concepts of Biosystematics and taxonomy
- 1.2 Historical resume of systematic Stages in taxonomy
- 1.3 Importance of taxonomy Aims and tasks of a taxonomist

**UNIT-2**

- 2.1 Trends in Biosystematics-concepts of different conventional and newer aspects- Ecotaxonomy- Behavioural taxonomy- Cytotaxonomy- Biochemical taxonomy- Numerical taxonomy
- 2.2 Dimension of speciation and species concept- Typological species concept-Biological species concept

**UNIT-3**

- 3.1 Evolutionary species concept- Polytypic & monotypic species, subspecies, infraspecific groups, super species and other kind of species.
- 3.2 Concept of zoological classification - Theories of biological classification Kinds & Component of classification-Phyletic Lineages-Linnaean hierarchy

**UNIT-4**

- 4.1 Taxonomic collections, methods & data recording-Collecting ways and data collection
- 4.2 Preservation of collected material and curating-Methods of identification and problems encountered in identification
- 4.3 Taxonomic characters and taxonomic keys Preparation of taxonomic publication and taxonomic paper

**UNIT-5**

- 5.1 Zoological Nomenclature- International code of Zoological Nomenclature (ICZN)
- 5.2 Operative principles and important rules of nomenclature- Important Latin words & abbreviations and Linnaean Signs

**III. Text Books:**

**IV. Reference Books:**

- M.Kato.The Biology of Biodiversity. Springer.
- E.O. Wilson, biodiversity. Academic Press, Washington.

- G.G. Simpson, Principle of animal taxonomy. Oxford IBH Publishing company.
- E. Mayer. Elements of Taxonomy. Oxford IBH Publishing company.
- E.O. Wilson. The diversity of Life (The College edition W.W. Norton & Co.
- B.K. Tikadar. Threatened Animal of India, ZSI publication Calcutta
- V.C. Kapoor. Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co.
- J.c. Avise, Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.

**V. Suggested Activities:**

- Project work on the Taxonomic key – with reference to local species
- Take photos of at least 20 varieties of butterflies from your mobile and observe them carefully and describe each species. Observe their size, colour of the wings, spots on the wings, colour pattern on the wings, number of colours on wings.
- Take photo of different Birds and try to identify them

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**COURSE 14F**  
**BIOSYSTEMATICS & TAXONOMY**

Hours- 30

Max. Marks-50

**I. Learning outcomes**

By the successful completion of the course the graduate should be able to –

- Assess the Biosystematics and taxonomy at local area
- Understand the climate influence on the Taxonomic diversity

**II. Syllabus**

1. Composition assessment of the taxonomic diversity / biodiversity in a habitat (e.g. grassland, arid land, wet land, etc.). – Detailed report
2. Influence of climatic conditions on taxonomic diversity in a given habitat.
3. Preparation of models showing the status of certain taxa or species in a particular habitat.-project
4. Collection and preservation techniques
5. Taxidermy-Definition and methods (reptiles birds and mammals)

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**SKILL ENHANCEMENT COURSES**  
**(AQUACULTURE)**  
**THEORY COURSE – 15 A**  
**MARICULTURE**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the basic principles and objectives of mariculture
- Learn the techniques of site selection and preparation for mariculture
- Understand the types of culture systems used in mariculture
- Understand the culture aspects of fin fish and crustaceans in mariculture
- Understand the culture aspects of mussel farming, pearl oysters and seaweeds of mariculture

**II. SYLLABUS**

**UNIT-I:**

- 1.1 Definition, history and scope of mariculture
- 1.2 Principles and objectives of mariculture
- 1.3 Advantages and disadvantages of mariculture

**UNIT-II:**

- 2.1 Factors affecting site selection for mariculture
- 2.2 Techniques for site preparation
- 2.3 Environmental impact assessment and management

**UNIT-III:**

- 3.1 Types of mariculture systems: open sea culture, closed system, land-based tanks, and cages
- 3.2 Design and construction of mariculture systems
- 3.3 Water quality management in mariculture systems

**UNIT-IV:**

- 4.1 Culture of milkfish, grey mullets, Asian seabass, groupers
- 4.2 Culture of Crustaceans-Shrimp culture, Mud crab culture

**UNIT-5:**

- 5.1 Mussel farming
- 5.2 Culture of pearl oysters
- 5.3 Culture of seaweeds

**III. REFERENCE BOOKS**

1. Mariculture: Principles and Practices by John A. Hargreaves and James E. McVey
2. Aquaculture: Farming Aquatic Animals and Plants by John S. Lucas and Paul C. Southgate
3. Aquaculture Engineering by Odd-Ivar Lekang
4. Handbook of Mariculture: Aquaculture of Bivalve Molluscs by John W. Castello and C. D. D. Tacon
5. Marine Aquaculture: Opportunities for Growth by National Research Council



6. Aquaculture Production Systems by James E. McVey
7. Mariculture: Principles and Practices by B. Madhusoodana Kurup and K. K. Vijayan.
8. Marine Aquaculture: Principles and Practices by N. P. Kurup and K. K. Vijayan.
9. Marine Fisheries and Mariculture by R. B. Simha and S. S. Mishra.
10. Handbook of Fisheries and Aquaculture by B. C. Mahapatra.
11. Fishery Science and Aquaculture: Principles and Practices by R. K. Singh and P. C. Thomas.
12. Mariculture and Aquaculture Engineering by K. R. Gupta.

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**SKILL ENHANCEMENT COURSES**  
**(AQUACULTURE)**  
**PRACTICAL COURSE – 15A**  
**MARICULTURE**

Hours-30

Max. Marks-P50

**I. LEARNING OUTCOMES**

By successful completion of this lab course the graduate is able to gain

- Skill in water quality management techniques for mariculture systems
- Skill in identification and characters of different marine cultivable fin fishes
- Skill in identification and characters of different marine cultivable shrimps and crabs
- Skill in identification and characters of different marine cultivable bivalves
- Skill in identification and characters of different marine cultivable seaweeds

**II. SYLLABUS**

1. Techniques for water quality improvement- Aeration, Filtration, Nutrients management, chemical treatment and RAS
2. Identification of cultivable finfish-Mugil cephalus, Chanos chanos, Lates calcarifer, Cromileptes altivelis, Epinephelus areolatus.
3. Identification of cultivable shrimps and crabs-Penaeus indicus, Penaeus merguensis, Penaeus monodon, Scylla serrata, Scylla tranquibarica
4. Identification of cultivable bivalves- Crossostrea madrasensis, Pinctada fucata, Perna viridis, Perna indica, Anadara granosa.
5. Identification of seaweeds\_Ulva, Sargassum, Gelidiella, Gracilaria, Hypnae

**III. REFERENCE BOOKS**

1. Marine Aquaculture: Opportunities for Growth edited by Sandra Shumway and Gary Loveridge
2. Seaweeds: Edible, Available, and Sustainable edited by Ole G. Mouritsen and Jonas Drotner Mouritsen
3. Marine Shrimp Culture: Principles and Practices by James M. Wyban
4. Mariculture: Principles and Practices by John A. Hargreaves and James E. McVey
5. Handbook of Mariculture: Aquaculture of Bivalve Molluscs by John W. Castello and C. D. D. Tacon
6. Marine Aquaculture: Opportunities for Growth by National Research Council
7. Mariculture: Principles and Practices by B. Madhusoodana Kurup and K. K. Vijayan.
8. Marine Fisheries and Mariculture by R. B. Simha and S. S. Mishra.
9. Handbook of Fisheries and Aquaculture by B. C. Mahapatra.
10. Mariculture and Aquaculture Engineering by K. R. Gupta.

**IV. CO-CURRICULAR ACTIVITIES**

- Visit to a mariculture farm to observe site selection and practical techniques

- Interactions with industry experts
- Attending/ Conducting Seminars and workshops on mariculture
- Participate in mariculture-related competitions and quizzes

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**SKILL ENHANCEMENT COURSES**  
**(AQUACULTURE)**  
**THEORY COURSE –15B**  
**ORNAMENTAL FISHERY**

Hours- 60+30

Max. Marks-T100+P50

## **I. LEARNING OUTCOMES**

By the successful completion of the course the graduate shall able to –

- Understand the basics of ornamental fishery
- Understand about types of ornamental fishes
- Gain knowledge about freshwater ornamental fishes' habitats, feeds and breeding units
- Gain knowledge about Marine environment ornamental fishes' habitats, feeds and breeding units
- Understand the principles of ornamental fish production techniques
- Apply proper management practices for water quality, disease prevention, and health management in ornamental fish farming
- Gain knowledge about the commercial production of aquarium fishes and plants.

## **II. SYLLABUS**

### **UNIT-I: INTRODUCTION**

- 1-1 Aquarium and ornamental fishes – introduction
- 1-2 Present status of Aquarium trade in the world and India
- 1-3 Aquarium accessories – aerators, filters, lighters and heaters
- 1-4 Water quality needs and different kinds of feeds

### **UNIT-II: FRESH WATER ORNAMENTAL FISHES**

- 2-1 Live bearers, gold fish, koi, gourami, barbs and tetras, angel fish and cichlid fish
- 2-2 Brood stock development, breeding, larval rearing and grow out
- 2-3 Larval feeds and feeding

### **UNIT- III: MARINE ORNAMENTAL FISHES**

- 3-1 Varieties and habitat of marine ornamental fishes
- 3-2 major marine ornamental fish resources of India
- 3-3 Collection and transportation of live fish, use of anaesthetics
- 3-4 Breeding of marine ornamental fish
- 3-5 Other aquarium animals – sea anemones, lobsters, worms, shrimps, octopus and starfish

### **UNIT IV: AQUARIUM MANAGEMENT**

- 4-1 Setting up fresh water, marine and reef aquariums
- 4-2 Water quality management for different types of aquariums
- 4-3 Common diseases of aquarium fish, diagnosis and treatment
- 4-4 Temperature acclimatization and oxygen packing for aquarium fish

### **UNIT V: COMMERCIAL PRODUCTION OF AQUARIUM FISH AND PLANTS**

- 5-1 Commercial production units of ornamental fish- requirements and design
- 5-2 Commercial production of goldfish, live bearers, gouramies, barbs, angels and tetras
- 5-3 Mass production of aquarium plants
- 5-4 Retail marketing and export of ornamental fish

### **III. REFERENCE BOOKS**

1. Jameson JD and Santhanan R 1996. Manual of ornamental fishes and farming technologies, Fisheries College and research institute, Tuticorn
2. Stephen Spotte 1993. Marine aquarium keeping. John wiley and sons, USA
3. Dick Mills 1998. Aquarium fishes, Dorling Kindersly Ltd, London
4. Van Ramshort JD 1978. The complete aquarium encyclopaedia, Elseveir
5. Ornamental Fish Production and Management by A. K. Roy and N. K. Barman
6. Ornamental Fish Farming by F. C. Thomas and R. S. Liew
7. Ornamental Fish Culture and Aquarium Management by B. S. Bisht

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**SKILL ENHANCEMENT COURSES**  
**(AQUACULTURE)**  
**PRACTICAL COURSE – 15 B**  
**ORNAMENTAL FISHERY**

Hours-30

Max. Marks-50

**I. LEARNING OUTCOMES**

By the successful completion the course graduate will acquire

- Skill in identification of different types of aerators and their usages
- Skill in using different methods of water circulation methods in aquarium
- Skill in identification of aquarium plants, marine aquarium fishes, fresh water aquarium fishes
- Skill in breeding of egg layers and live bearers

**II. SYLLABUS**

1. Study of aerators – types and structures
2. Water circulation methods in aquarium and filtration
3. Collection and identification of aquarium plants
4. Identification of common marine aquarium fishes
5. Identification of common fresh water aquarium fishes
6. Breeding of egg layers
7. Breeding of live bearers
8. Evaluation of significance of aquaria for commercial and domestic use

**III. REFERENCE BOOKS**

1. "Ornamental Fish Farming: Principles, Procedures, and Practices" by P.K. Panda and A.K. Jana
2. "Handbook of Ornamental Fish" by Dr. D. D. Sharma and Dr. M. N. Bhat
3. "Ornamental Fishes and Aquatic Invertebrates: Self-Assessment Color Review" by Chris Andrews and Adrian Exell
4. "Ornamental Fishes and Aquatic Plants" by Dr. B. C. Jana
5. "Ornamental Fish Culture and Aquarium Management" by K. Gopalakrishnan and K. K. Vijayan

**IV. CO-CURRICULAR ACTIVITIES**

1. Visit to ornamental fish farms
2. Guest lectures by experts in the field
3. Participation in ornamental fish shows and exhibitions
4. Conducting water quality tests and monitoring parameters
5. Participating in a business plan competition for an ornamental fish farm.

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**AP STATE COUNCIL OF HIGHER EDUCATION**  
**Semester-wise Revised Syllabus under CBCS 2020-21**

**Four Year – B.Sc. (Hons), Semester – VIII**

**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**

**(DAIRY)**

**THEORY COURSE – 16 A**

**LIVESTOCK ECONOMICS, MARKETING AND BUSINESS MANAGEMENT**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOME**

- Understand the basic concepts and principles of livestock economics, marketing, and business theory
- Identify the key factors that influence the livestock industry
- Understand the principles of livestock production and management
- Analyze the factors that affect the productivity and profitability of livestock enterprises
- Understand the principles of livestock marketing and sales
- Analyze the factors that influence the demand and supply of livestock products
- Understand the principles of livestock business management
- Understand the policies and regulations that govern the livestock industry

**II. SYLLABUS**

**UNIT-I: Introduction--Basic concepts**

1.1 Principles of livestock economics, marketing, and business theory

1.2 Key factors influencing the livestock industry

**UNIT-II: Livestock Production and Management**

2.1 Principles of livestock production and management

2.2 Factors affecting the productivity and profitability of livestock enterprises

2.3 Livestock breeding, feeding, and health management

**UNIT-III: Livestock Marketing and Sales**

3.1 Principles of livestock marketing and sales

3.2 Factors influencing the demand and supply of livestock products

3.3 Livestock product processing and packaging

**UNIT- IV Livestock Business Management**

4.1 Principles of livestock business management

4.2 Financial and economic analysis of livestock enterprises

4.3 Livestock business planning and risk management

**UNIT-V: Livestock Policy and Regulations**

5.2 Livestock policies and regulations

5.2 Impact of policy and regulatory changes on livestock enterprises

5.3 Livestock industry development and sustainability

## **6 REFERENCE BOOKS**

1. Livestock Economics and Marketing by Ramesh Chand and R.P. Singh
2. Livestock Production and Management by N. Srinivasulu and D. Dhandapani
3. Dairy Farming: A Way to Livelihood by S.S. Sengar
4. Livestock Business Management by P. R. Bhat
5. Economic Analysis of Animal Diseases by N.S. Randhawa and R.K. Singh
6. Animal Husbandry and Veterinary Science by V.K. Kapoor
7. Principles of Agricultural Economics by C.B. Singh and R.K. Singh
8. Livestock Economics and Marketing by John D. Lawrence and Gary W. Williams
9. Livestock Management and Marketing by M. Saiful Islam and Mohammad M. Rahman
10. Agricultural Marketing and Price Analysis by Bailey Norwood and Jayson L. Lusk
11. Livestock Production and Marketing by Donald R. Monke
12. Livestock Economics: Theory and Practice by John W. Longworth and Paul R. Beedle

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**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(DAIRY)**  
**PRACTICAL COURSE – 16 A**  
**LIVESTOCK ECONOMICS, MARKETING AND BUSINESS MANAGEMENT**  
Hours- 30 Max. Marks-P50

**I. LEARNING OUTCOMES**

- Identify and observe the different types of livestock farms and their production practices
- Analyse the market dynamics and competition in the livestock industry
- Knowledge on Government policies such as subsidies, taxes, import/export regulations, and animal welfare regulations
- Skill in maintenance of records to be maintained in livestock management
- Skill in maintenance of records to be maintained in livestock business

**II. SYLLABUS**

1. Visit to a livestock farm and report on animal husbandry practices- Feeding, Breeding and Health management.
2. Conduct a market analysis of a particular livestock product such as beef, pork, or chicken to understand consumer preferences, market trends, and competition.
3. Government policies on subsidies, taxes, import/export regulations, and animal welfare regulations.
4. Records to be maintained in livestock management - Production record, Breeding record, Veterinary record, Personnel record
5. Records to be maintained in livestock business: Financial records, Sales and marketing records, Inventory records,
6. Develop a business plan for a livestock enterprise which involve researching the costs of production, developing marketing strategies, and analyzing potential risks and opportunities.

**III. REFERENCE BOOKS**

1. Practical Manual for Livestock Economics and Marketing by Ramesh Chand and R.P. Singh
2. Practical Manual for Livestock Production and Management by N. Srinivasulu and D. Dhandapani
3. Practical Manual for Dairy Farming by S.S. Sengar
4. Practical Manual for Livestock Business Management by P. R. Bhat
5. Livestock Economics and Marketing by Ramesh Chand and R.P. Singh
6. Livestock Production and Management by N. Srinivasulu and D. Dhandapani
7. Livestock Business Management by P. R. Bhat
8. Agricultural Marketing in India: Analysis, Planning and Development by K.N. Rahaman
9. Economic Analysis of Animal Diseases by N.S. Randhawa and R.K. Singh
10. Principles of Agricultural Economics by C.B. Singh and R.K. Singh

#### **IV. CO-CURRICULAR ACTIVITIES**

1. Visiting a livestock farm and preparing a report
2. Participation in Livestock shows and competitions
3. Collection of different livestock breeds that are with market value
4. Participation in Livestock auctions
5. Guest lectures by industry professionals

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**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(DAIRY)**  
**THEORY COURSE – 16 B**  
**LIVESTOCK ENTREPRENEURSHIP**

Hours- 60

Max. Marks- P50

**I. LEARNING OUTCOMES**

- Understand the concept and importance of Livestock Entrepreneurship
- Analyze the market and develop a business plan for a Livestock Entrepreneurship venture
- Evaluate financial options and risk management strategies for a Livestock Entrepreneurship venture
- Identify and describe different Livestock Production Systems
- Evaluate animal nutrition and feeding practices for various livestock species
- Evaluate animal health and disease management practices for various livestock species
- Understand breeding and genetics principles for various livestock species
- Understand marketing principles and sales strategies for Livestock products
- Understand the legal and regulatory framework related to Livestock Entrepreneurship

**II. SYLLABUS**

**UNIT-I: Introduction to Livestock Entrepreneurship**

- 1.1 Definition of Livestock Entrepreneurship
- 1.2 Importance of Livestock Entrepreneurship
- 1.3 Characteristics of successful Livestock Entrepreneurs
- 1.4 Challenges faced by Livestock Entrepreneurs

**UNIT-II: Market Analysis and Business Planning**

- 2.1 Market analysis and its importance
- 2.2 Steps in developing a business plan
- 2.3 Sources of finance for Livestock Entrepreneurs
- 2.4 Risk management strategies

**UNIT-III: Livestock Production and Management**

- 3.1 Livestock production systems
- 3.2 Principles of animal nutrition and feeding
- 3.3 Animal health and disease management
- 3.4 Breeding and genetics of livestock

**UNIT-IV: Marketing and Sales Strategies**

- 4.1 Principles of marketing
- 4.2 Marketing mix and its components
- 4.3 Sales strategies for Livestock products
- 4.4 Branding and promotion

## **UNIT-V: Legal and Regulatory Framework**

- 5.1 Laws and regulations related to Livestock Entrepreneurship
- 5.2 Compliance requirements for Livestock Entrepreneurs
- 5.3 Intellectual property rights in Livestock Entrepreneurship

### **III. REFERENCE BOOKS**

1. Livestock Entrepreneurship by Donald R. Mooney and Daniel J. Morreale
2. Principles of Marketing by Philip Kotler and Gary Armstrong
3. Small Business Management by Justin G. Longenecker, J. William Petty, Leslie E. Palich, and Frank Hoy
4. The Legal Environment of Business: A Managerial Approach by Sean P. Melvin
5. Agricultural Marketing and Price Analysis by Bailey Norwood, Jayson Lusk, and Jason Shogren
6. Animal Agriculture and Environmental Sustainability: Future Challenges by Fabio A. Diaz, Manuela Juárez, and Juan A. Fernandez
7. Entrepreneurship in Agriculture and Rural Development by Eugenio Diaz-Bonilla and Jamie Morrison
8. Fundamentals of Financial Management by Eugene F. Brigham and Joel F. Houston

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**SKILL ENHANCEMENT COURSES**  
**(DAIRY)**  
**PRACTICAL COURSE – 16 B**  
**LIVESTOCK ENTREPRENEURSHIP**

Hours-30

Max. Marks-50

**I. LEARNING OUTCOMES**

- Skill in identification of different breeds of livestock.
- Skill in health management of livestock.
- Skill in livestock management practices for different livestock species
- Skill development in entrepreneurship skills
- Design and develop Livestock products for the market
- Identify and analyze market opportunities for Livestock products
- Identify the major challenges faced by Livestock Sector in India
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**II. SYLLABUS**

1. Identification of different livestock breeds (cattle, buffaloes, pigs, goats and sheep)
2. Study on different vaccinations schedules for livestock species
3. Treatment of common diseases for livestock species
4. Study on Farm management practices for livestock species
5. Series of activities involved in Livestock marketing and value chain management
6. Keys components in market analysis, product development, branding, pricing, and distribution of livestock products
7. Study on development of entrepreneurship skills such as innovation, creativity and networking
8. Study on major challenges faced by Livestock Sector in India

**III. REFERENCE BOOKS**

1. Livestock Production and Management by Gyanendra Singh
2. Handbook of Animal Husbandry by A.M. Michael
3. Business Planning and Management by Vasant Desai
4. Dairy Farming: Challenges and Opportunities by B.V. Mehta
5. Livestock Economics by Dinesh Kumar
6. Livestock Breeding, Nutrition, and Management by Gurbir Singh
7. Marketing Management by Philip Kotler
8. Livestock Entrepreneurship by Sanjay Kumar Singh
9. Principles of Marketing by Kotler & Keller
10. Legal Aspects of Business by Akhileshwar Pathak
11. Animal Husbandry and Veterinary Science by A.M. Michael
12. Entrepreneurship Development and Management by S. Anil Kumar

#### **IV. CO-CURRICULAR ACTIVITIES**

1. Field visits to Livestock farms and related enterprises
2. Inviting Livestock Entrepreneurs as guest speakers to share their experiences and challenges
3. Business plan competition among students
4. Market research and product development projects
5. Workshops on animal nutrition, health, and breeding techniques

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**Four Year – B.Sc. (Hons), Semester – VIII**

**Domain Subject: ZOOLOGY**

**SKILL ENHANCEMENT COURSES**

**(POULTRY)**

**THEORY COURSE – 17 A**

**POULTRY ECONOMICS, MARKETING AND INTEGRATION**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

- Understand the basic principles of poultry economics, marketing, and integration.
- Identify the key factors that influence poultry production, marketing, and integration.
- Develop skills in market research, pricing strategies, and promotional activities for poultry products.
- Develop an understanding of supply chain management in the poultry industry.
- Develop skills in business planning and management for poultry enterprises.
- Gain knowledge about different innovations and new developments in poultry industry

**II. SYLLABUS**

**UNIT-I:**

- 1.1 Definition and scope of poultry economics and marketing
- 1.2 Importance of poultry industry in the economy
- 1.3 Overview of the global poultry market

**UNIT-II:**

- 2.1 Economics of poultry production
- 2.2 Cost and returns analysis for poultry farming
- 2.3 Determinants of poultry production

**UNIT-III:**

- 3.1 Market research for poultry products
- 3.2 Pricing strategies for poultry products
- 3.3 Promotion and branding of poultry products

**UNIT-IV**

- 4.1 Supply chain management in poultry integration
- 4.2 Benefits and challenges of poultry integration
- 4.3 Business planning and management for integrated poultry enterprises

**UNIT-V:**

- 5.1 Innovations and new developments in the poultry industry
- 5.2 Sustainability and ethical considerations in poultry production and marketing
- 5.3 Global trends in poultry economics and marketing

### III. REFERENCE BOOKS

1. Poultry Production and Management by Dr. M.G. Patel (Krishikosh, 2019)
2. Poultry Business Management by Dr. R.R. Sharma and Dr. R.N. Chatterjee (Vikas Publishing House, 2016)
3. Poultry Farming: Indian Perspective by Dr. D.K. Singh (Daya Publishing House, 2014)
4. Handbook of Poultry Science and Technology by B. Kannan and T. Ramasamy (New India Publishing Agency, 2015)
5. Poultry Diseases and Their Control by Dr. B. R. Yadav and Dr. J.K. Chaudhari (Daya Publishing House, 2013)
6. Poultry Marketing and Management by Dr. J.P. Sinha (Kalyani Publishers, 2014)
7. Poultry Economics and Marketing" by Dr. S.K. Srivastava and Dr. M.K. Singh
8. Poultry Farming and Marketing" by Dr. R.C. Roy
9. Poultry Business in India" by Dr. Suresh Kumar Sharma
10. Poultry Science by Colin G. Scanes
11. Poultry Production and Management by James R. Gillespie
12. Resources from the following organizations in India:National Institute of Animal Nutrition and Physiology (NIANP),Indian Council of Agricultural Research (ICAR), Central Poultry Development Organization (CPDO), Poultry India

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**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**PRACTICAL COURSE – 17 A**  
**POULTRY ECONOMICS, MARKETING AND INTEGRATION**  
Hours-30Max. Marks-P50

**I. LEARNING OUTCOMES**

- Gain knowledge about data on prices, quantities, and quality of different poultry products from your local poultry market.
- Skill of analysing various costs involved in poultry production and calculate the loss and profitability.
- Understand about different methods of Poultry processing and value addition
- Skill in management of health issues in local farm.
- Gain knowledge about different Poultry equipment's and their market prices.
- Skill of identifying Poultry breeds and genetics characters
- Skill in estimating the costs, revenues, analyzing the risks and challenges in poultry sector
- Skill in analyzing consumer behavior in relation to poultry products

**II. SYLLABUS**

1. Collection of data on prices, quantities, and quality of different poultry products from your local poultry market (Any wholesale markets, retail outlets, and supermarkets)
2. Collection and analysing the data on from a local poultry farm on various costs involved in poultry production such as feed, labor, housing, medication, and electricity. to calculate the total cost of production, break-even point, and profitability of the farm.
3. Study on different methods of Poultry processing and value addition such as slaughtering, evisceration, chilling, grading, and packaging, and understand the quality standards and hygiene practices followed in the plant.
4. Recording the vaccination and medication practices followed by the farmer in your local poultry farm.
5. Study on different Poultry equipment- feeders, drinkers, heaters, and ventilation systems used in your local farm.
6. Collection of data from Poultry breeding farm- Noting the selection and mating practices followed by the breeder, analyze the genetic traits of the birds
7. Prepare a business plan for a poultry farm by identifying the market opportunities, estimating the costs and revenues, and analyzing the risks and challenges.
8. Conducting market research and analyzing consumer behavior in relation to poultry products

### **III. REFERENCE BOOKS**

1. Poultry Feed Formulation: Mathematics and Computer Applications by Ravi Ravindran
2. Poultry Production Systems: Behaviour, Management and Welfare by C. Weeks and A.M. Nicol
3. Commercial Chicken Meat and Egg Production by D. D. Bell and W. D. Weaver
4. Practical Management of Poultry by H. V. McKay
5. Poultry Housing and Management by Michael Roberts
6. Hatchery Management Guide for Game Bird and Small Poultry Flock Owners by James Hermes

### **IV. CO-CURRICULAR ACTIVITIES**

1. Poultry field trips to local farms or processing facilities
2. Participation in poultry exhibitions and fairs
3. Research projects on poultry economics and marketing
4. Develop a business plan for a small-scale poultry operation
5. Conduct a market analysis for a new poultry product or service

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**AP STATE COUNCIL OF HIGHER EDUCATION**  
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**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**THEORY COURSE – 17 B**  
**POULTRY ENTREPRENEURSHIP**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

- Understand about different types of egg marketing, activities involved and challenges faced in marketing of eggs.
- Understand about different poultry enterprises.
- Gain knowledge about different Government Supporting schemes to Poultry Industry
- Understand about financial losses caused and follow precautionary measures.  
Understand about Financial Management in Poultry Entrepreneurship

**II. SYLLABUS**

**UNIT-I: MARKETING OF EGGS**

- 1.1 Egg Marketing – Types - Organized and Unorganized Marketing
- 1.2 Marketing Activities — Collection, Cleaning and Washing, Candling, Grading, Oiling, Package (Materials, Pulp Trays, Plastic Trays, Egg cartoons and other packing materials) Types of Packing, Manual and Machinery packing, Mode of Transportation, Methods of Marketing, Agencies involved (NECC): Wholesale Merchants, Retailers. Co-operative Private byes, Shop Agency, Village buyers, Auction of Eggs.
- 1.3 Major Problems in Egg Marketing
- 1.4 Factors Influencing the Marketing cost.

**UNIT - II: POULTRY ENTERPRISES**

- 2.1 Factors involving to produce Eggs in Layer Farms and Other Products of Egg  
(Shell Utility: as a feed, Fertilizer, Decoration)
- 2.2 Different methods of cooking of Eggs
- 2.3 Marketing Channels
- 2.4 Farmer share in Egg Marketing

**UNIT - III: GOVERNMENT SUPPORT TO POULTRY INDUSTRY**

- 3.1 Subsidiaries by the Government for the Promotion of Egg Marketing
- 3.2 Technical Support sponsored by the Government for Marketing of Eggs
- 3.3 Technical Support sponsored by the Government for Marketing of Meat
- 3.4 The Government contribution for the construction of Egg storage

**UNIT - IV: POULTRY ECONOMICS**

- 4.1 Value of Broken Eggs during transportation
- 4.2 Value of the Dead Birds (Broilers) during transportation
- 4.3 Precautions to prevent mortality of Birds during transportation
- 4.4 Prevention methods for Egg Breakage during the transportation

## **UNIT-V: FINANCIAL MANAGEMENT IN POULTRY ENTREPRENEURSHIP**

- 5.1 Basic accounting principles
- 5.2 Financial statements and their analysis
- 5.3 Budgeting and cost management in Poultry Entrepreneurship
- 5.4 Sources of finance for Poultry Entrepreneurship

### **III. REFERENCE BOOKS**

1. Poultry Science by Colin G. Scanes
2. Poultry Production by Leslie E. Card
3. Poultry Science by A. K. Verma and M. P. Sagar.
4. Commercial Poultry Production in India by M. K. Shivaram.
5. Poultry Business Management by Dr. R.R. Sharma and Dr. R.N. Chatterjee (Vikas Publishing House, 2016)
6. Poultry Farming: Indian Perspective by Dr. D.K. Singh (Daya Publishing House, 2014)
7. Poultry Marketing and Management by Dr. J.P. Sinha (Kalyani Publishers, 2014)
8. Poultry Economics and Marketing" by Dr. S.K. Srivastava and Dr. M.K. Singh
9. Poultry Farming and Marketing" by Dr. R.C. Roy
10. Poultry Business in India" by Dr. Suresh Kumar Sharma
11. Poultry Science by Colin G. Scanes
12. Poultry Production and Management by James R. Gillespie
13. Resources from the following organizations in India: National Institute of Animal Nutrition and Physiology (NIANP), Indian Council of Agricultural Research (ICAR), Central Poultry Development Organization (CPDO), Poultry India

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**SKILL ENHANCEMENT COURSES**  
**(POULTRY)**  
**PRACTICAL COURSE – 17 B**  
**POULTRY ENTREPRENEURSHIP**

Hours- 30

Max. Marks-50

**I. LEARNING OUTCOMES**

- Skill in identification of quality and defective eggs
- Skill in estimation of yield for a dressed chicken
- Identification of different marketing methods for poultry products
- Skill and observation in Candling of Eggs
- Demonstration on different Marketing methods for poultry products

**II. SYLLABUS**

1. Simple Tests to Know the quality of Eggs
2. Identification of quality defects in Eggs
3. Study on Candling of Eggs
4. Evaluation of Dressing yield of dressed chicken
5. Marketing methods for disposal of Eggs and Poultry Products in different making units
6. Study on different poultry companies in our district (egg production, Hatchery, chicken, feed etc.)

**III. REFERENCE BOOKS**

1. Poultry Feed Formulation: Mathematics and Computer Applications by Ravi Ravindran
2. Poultry Production Systems: Behavior, Management and Welfare by C. Weeks and A.M. Nicol
3. Commercial Chicken Meat and Egg Production by D. D. Bell and W. D. Weaver
4. Practical Management of Poultry by H. V. McKay
5. Poultry Housing and Management by Michael Roberts
6. Hatchery Management Guide for Game Bird and Small Poultry Flock Owners by James Hermes

**IV. CO-CURRICULAR ACTIVITIES**

1. Poultry field trips to local farms or processing facilities
2. Hatch and raise their own chickens
3. Poultry science fairs
4. Develop a business plan for a small-scale poultry operation
5. Conduct a market analysis for a new poultry product or service
6. Go to wholesale shop of eggs and observe how he is doing business and know the marketing opportunities

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**SKILL ENHANCEMENT COURSES**  
**(SERICULTURE)**  
**THEORY COURSE – 18 A**  
**SERICULTURE MARKETING**

Hours- 60+30

Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

- Understand the concept and scope of sericulture marketing
- Analyse the market structure and channels for silk and silk products
- Identify different types of marketing research in sericulture
- Apply appropriate data collection methods and techniques
- Understand the concept and importance of segmentation, targeting, and positioning in sericulture marketing
- Understand the product life cycle and its stages in sericulture marketing
- Understand the importance of pricing in sericulture marketing

**II. SYLLABUS**

**UNIT-I: Introduction to Sericulture Marketing**

- 1.1 Definition, Scope and importance of sericulture marketing
- 1.2 Market structure and channels for silk and silk products
- 1.3 Role of government and non-government organizations in sericulture marketing
- 1.4 Marketing problems of silk industry

**UNIT-II: Marketing Research for Sericulture**

- 2.1 Definition and importance of marketing research
- 2.2 Types of marketing research in sericulture
- 2.3 Data collection methods and techniques
- 2.4 Data analysis and interpretation

**UNIT-III: Segmentation, Targeting, and Positioning in Sericulture Marketing**

- 3.1 Definition and importance of segmentation, targeting, and positioning
- 3.2 Bases for market segmentation in sericulture
- 3.3 Target market selection and evaluation criteria
- 3.4 Product positioning strategies in sericulture

**UNIT-IV: Product Development and Management in Sericulture Marketing**

- 4.1 Product life cycle and its stages
- 4.2 New product development process in sericulture
- 4.3 Product mix and product line decisions
- 4.4 Branding and packaging in sericulture marketing

**UNIT-V: Pricing Strategies in Sericulture Marketing**

- 5.1 Importance of pricing in sericulture marketing
- 5.2 Factors affecting pricing decisions in sericulture
- 5.3 Cost-based and value-based pricing methods
- 5.4 Price adjustment strategies in sericulture

### **III. REFERENCE BOOKS**

1. Sericulture Marketing and Management by D. D. Pradhan
2. Marketing of Sericulture Products by R. R. Umarani and T. S. Ashalatha
3. Sericulture Marketing and Export Management by B. K. Sinha and R. P. Singh
4. Marketing of Sericulture Products by M. V. Rao and P. N. Rao
5. Sericulture Marketing: An Overview by P. Jagan Mohan Rao and P. Ravindra Babu
6. Sericulture Marketing: A Study of Karnataka by S. Venkataramanaiah and S. A. Patil
7. Marketing Management in Sericulture by S. Sivakumar and S. Kannan
8. Sericulture Marketing and Export by S. Ramakrishnan and K. Saravanan
9. Marketing Strategies for Sericulture by K. C. Gupta and N. K. Tripathi
10. Sericulture Marketing: Principles and Practices by S. S. Bhatia and R. K. Saxena

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**SKILL ENHANCEMENT COURSES**  
**(SERICULTURE)**  
**PRACTICAL COURSE – 18A**  
**SERICULTURE MARKETING**

Hours- 30

Max. Marks-P50

**I. LEARNING OUTCOMES**

- Identify different channels for distribution of sericulture products.
- Understand the importance of branding and packaging in sericulture marketing.
- Develop effective communication strategies to promote sericulture products.
- Conduct market research and analyze the data to make informed marketing decisions
- Understand the role of technology in sericulture marketing.
- Awareness on Government schemes in department of sericulture at national and state level.

**II. SYLLABUS**

1. A study on distribution channels for Marketing sericulture products to reach customers.
2. A study on different Brands and packing in sericulture marketing
3. Effective communication strategies in sericulture marketing through storytelling, visuals, influencer marketing, branding, and certification.
4. Steps involved in conducting market research and analysis in sericulture marketing
5. A study on technological advancements in sericulture marketing-E-commerce platforms, Digital marketing, Mobile apps, Blockchain technology, Augmented reality
6. A study on Government schemes in department of sericulture at national level and state level (India & Andhra Pradesh)

**III. REFERENCE BOOKS**

1. Sericulture and Silk Industry by K. M. Shareef and M. A. Siraj
2. Marketing of Silk and Silk Products in India by B. B. Singh and R. K. Sharma
3. Silk Industry in India: The Challenges Ahead by K. M. Shareef and M. A. Siraj
4. Sericulture Entrepreneurship and Marketing by P. Raghupathi
5. Sericulture and Rural Development by S. K. Singh and K. M. Shareef
6. Silk: Production, Process, Marketing and Utilization by S. B. Kute and S. V. Dahatonde
7. Sericulture and Silk Marketing by T. R. Krishnan and R. Rajalakshmi
8. Marketing of Sericulture Products by V. Venkatesan and V. Mathivanan
9. Development of Sericulture Industry in India by S. K. Singh
10. Silk Marketing in India: Problems and Prospects by P. C. Mahapatra and G. Panda.



#### **IV. CO-CURRICULAR ACTIVITIES**

1. Visit to sericulture farm to observe the silk production process and data collecting about marketing.
2. Case studies of successful and unsuccessful marketing campaigns in the sericulture.
3. Organize an exhibition of silk products to showcase the various uses of silk and the different types of silk products available in the market
4. Data collection on role of government and non-government organizations in sericulture marketing

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**AP STATE COUNCIL OF HIGHER EDUCATION**  
**Semester-wise Revised Syllabus under CBCS 2020-21**  
**Four Year – B.Sc. (Hons), Semester – VIII**  
**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SERICUTLURE)**  
**THEORY COURSE – 18 B**  
**SERICULTURE ENTREPRENEURSHIP HUMAN RESOURCE DEVELOPMENT**  
Hours- 60+30Max. Marks-T100+P50

**I. LEARNING OUTCOMES**

- Develop an understanding of the sericulture industry and its entrepreneurial opportunities
- Acquire practical skills in mulberry cultivation, silkworm rearing, silk production, and quality control
- Develop competencies in human resource management, financial management, and legal and regulatory compliance
- Understand the importance of innovation and sustainability in sericulture entrepreneurship
- Develop the ability to apply theoretical knowledge to practical situations

**II. SYLLABUS**

**UNIT-I: Introduction to Sericulture Entrepreneurship**

- 1.1 Definition of sericulture entrepreneurship
- 1.2 Importance and scope of sericulture entrepreneurship
- 1.3 Entrepreneurial opportunities in sericulture
- 1.4 Entrepreneurial competencies and skills required for sericulture entrepreneurship

**UNIT-II: Sericulture Production and Management**

- 2.1 Mulberry cultivation and management
- 2.2 Silkworm rearing
- 2.3 Silk production and processing
- 2.4 Quality control and marketing

**UNIT-III: Human Resource Development in Sericulture**

- 3.1 Recruitment and selection of employees
- 3.2 Training and development of employees
- 3.3 Performance appraisal and feedback
- 3.4 Motivation and retention strategies

**UNIT-IV: Financial Management in Sericulture**

- 4.1 Financial planning and forecasting
- 4.2 Sources of finance

4.3 Cost accounting and budgeting

4.4 Financial analysis and control

**UNIT-V: Legal and Regulatory Framework of Sericulture Entrepreneurship**

5.1 Legal aspects of sericulture entrepreneurship

5.2 Intellectual property rights

5.3 Environmental laws and regulations

5.4 Government policies and incentives

**III. REFERENCE BOOKS**

1. Sericulture and Sericultural Industry by R.M. Pandey
2. Entrepreneurship in Sericulture by D.N. Patel
3. Sericulture: An Economic Analysis by B.K. Singh and S.K. Singh
4. Human Resource Management in Sericulture by V.N. Kulkarni
5. Financial Management in Sericulture by R.K. Khandelwal
6. Legal and Regulatory Framework of Sericulture Entrepreneurship by M.K. Mishra
7. Sericulture and Silk Industry in India by M. B. Lalsare and N. N. Mahapatra
8. Human Resource Development: Theory and Practice by Jeff Gold and Rick Holden
9. Human Resource Development: Theories and Practices by Rao T. V.
10. Hand Book on Silkworm Rearing by Central Silk Board
11. Human Resource Development: Concepts, Strategies and Development by A.S. Chawla
12. Human Resource Development and Management by T.V. Rao

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**Domain Subject: ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SERICULTURE)**  
**PRACTICAL COURSE – 18 B**  
**SERICULTURE ENTREPRENEURSHIP HUMAN RESOURCE DEVELOPMENT**  
Hours- 30 Max. Marks-50

**I. LEARNING OUTCOMES**

- Define and explain the concept of sericulture entrepreneurship
- Understand the sericulture production cycle and management techniques
- Identify recruitment and selection strategies for sericulture staff
- Design training and development plans for sericulture staff
- Develop marketing and financial strategies for sericulture entrepreneurship
- Analyze sericulture entrepreneurship policies and regulations

**II. SYLLABUS**

1. Develop a financial plan for a sericulture entrepreneurship venture that includes revenue projections, operating costs, and cash flow projections.
2. Conduct a feasibility study for a sericulture entrepreneurship venture that assesses the potential for success based on market demand, production costs, and other relevant factors.
3. Identify and evaluate potential funding and investment opportunities for a sericulture entrepreneurship venture.
4. Develop a recruitment and selection plan for sericulture staff that includes job descriptions, qualifications, and selection criteria.
5. Develop a training and development plan for sericulture staff that addresses the skills and knowledge needed to effectively manage sericulture production and entrepreneurship.
6. Develop a performance management system for sericulture staff that includes performance evaluation criteria, performance feedback, and performance improvement plans.
7. Develop a marketing plan for sericulture products that includes product positioning, target markets, pricing strategies, and distribution channels.
8. Conduct a site visit to a successful sericulture entrepreneurship venture and analyze the production, marketing, and financial strategies used.

**III. REFERENCE BOOKS**

1. Handbook of Practical Sericulture by Padma Shree Dr. K. Murugan
2. Sericulture Entrepreneurship Development by D. Prasad and G. R. Pawar
3. Sericulture and Silk Production by R. Elanchezian
4. Human Resource Management: Theory and Practice by John Bratton and Jeffrey Gold
5. Human Resource Development by Werner and DeSimone

6. Human Resource Development: Concepts and Practices by Sudhir Andrews

**IV. CO-CURRICULAR ACTIVITIES**

1. Case studies of successful sericulture entrepreneurship ventures
2. Field visits to sericulture entrepreneurship ventures
3. Entrepreneurship project development and presentation

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