ASD GOVT. DEGREE COLLEGE FOR WOMEN (A)
(Re- Accredited by NAAC with B Grade)
Jagannaickpur, Kakinada, East Godavari, AP – 533002

DEPARTMENT OF ZOOLOGY & AQUACULTURE TECHNOLOGY

2020-2021

ZOOLOGY

ASD GOVT. DEGREE COLLEGE FOR WOMEN (A)

(Re-Accredited by NAAC with 'B' Grade)

Jagannaickpur, Kakinada, East Godavari, AP – 533002.

ANIMAL DIVERSITY - BIOLOGY OF NON- CHORDATES

(Course Code: ZOO201306) **2020-2021**

SEMESTER-I PAPER-I CREDITS: 4 HRS/WK: 4

Course Outcomes:

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

- Describe general taxonomic rules on animal classification.
- Classify Protozoa to Coelenterata with taxonomic keys.
- Classify Phylum Platyhelminthes to Annelida phylum using examples from parasitic adaptation and vermin composting
- Describe Phylum Arthropoda to Mollusca using examples and importance of insects and Molluscans
- Describe Echinodermata to Hemichordata with suitable examples and larval stages in relation to the phylogeny.

Learning objectives

- To understand the taxonomic position of Protozoa to Helminths.
- To understand the general characteristics of animals belonging to Protozoa to Hemichordate.
- To understand the structural organization of animal phyla from Protozoa to Hemichordata.
- To understand the origin and evolutionary relationship of different phyla from Protozoa to Hemichordata.
- To understand the origin and evolutionary relationship of different phyla from Annelida to Hemichordata.

UNIT I

1.1 Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature

1.2 Whittaker's five kingdom concept and classification of Animal Kingdom.

Additional Input: Branches of Biology, Scope of Zoology

Phylum Protozoa

1.3 General Characters and classification of protozoa up to classes with suitableexamples

1.4 Locomotion, nutrition and reproduction in Protozoans

1.5 *Elphidium* (type study)

Additional Input: Common Parasitic Protozoans

UNIT –II

Phylum Porifera

2.1 General characters and classification up to classes with suitable examples

2.2 Skelton in Sponges

2.3 Canal system in sponges

Additional Input: Systematic Position of Porifera

Phylum Coelenterata

2.4 General characters and classification up to classes with suitable examples

2.5 Metagenesis in *Obelia*

2.6 Polymorphism in coelenterates

2.7 Corals and Coral reefs

Phylum Ctenophora:

2.8 General Characters and Evolutionary significance (affinities)

Unit – III

Phylum Platyhelminthes

3.1 General characters and classification up to classes with suitable examples

3.2 Life cycle and pathogenicity of *Fasciola hepatica*

3.3 Parasitic Adaptations in helminths

Phylum Nemathelminths

3.4 General characters and classification up to classes with suitable examples.

3.5. Life cycle and pathogenicity of *Ascaris lumbricoides*

Additional Input: Wuchereria, Enterobius

Unit – IV

Phylum Annelida

4.1 General characters and classification up to classes with suitable examples

4.2 Evolution of Coelom and Coelomoducts

4.3 Vermiculture - Scope, significance, earthworm species, processing, Vermicompost, economic importance of vermicompost

Additional Input: Organic Farming

Phylum Arthropoda

4.4 General characters and classification up to classes with suitable examples

4.5 Vision and respiration in Arthropoda

4.6 Metamorphosis in Insects

4.7 *Peripatus* - Structure and affinities

4.8 Social Life in Bees and Termites

Additional Input: Beneficial Insects

Unit – V

Phylum Mollusca

5.1 General characters and classification up to classes with suitable examples

5.2 Pearl formation in Pelecypoda

5.3 Sense organs in Mollusca

Phylum Echinodermata

5.4 General characters and classification up to classes with suitable examples

5.5 Water vascular system in star fish

5.6 Larval forms of Echinodermata

Phylum Hemichordata

5.7 General characters and classification up to classes with suitable examples

5.8 *Balanoglossus* - Structure and affinities.

Co-curricular activities (suggested)

- Preparation of chart/model of phylogenic tree of life, 5-kingdom classification, *Elphidium* life cycle etc.
- Visit to Zoology Museum or Coral Island as part of Zoological tour.
- Charts on life cycle of *Obelia*, polymorphism, sponge spicules.

- Clay models of canal system in sponges.
- Preparation of charts on life cycles of *Fasciola* and *Ascaris.*
- Visit to adopted village and conducting awareness campaign on diseases, to people as part of Social Responsibility.
- Plaster-of-Paris or Pharmocol model of *Peripatus*
- Construction of a vermicompost in each college, manufacture of manure by students and donating to local farmers
- Models of compound eye, bee hive and termitarium (termitaria) by students
- Visit to Apiculture Centre and short-term training as part of apprenticeship programme of the govt. Of Andhra Pradesh.
- Chart on pearl forming layers using clay or Thermocol
- Visit to a pearl culture rearing industry/institute
- Live model of water vascular system
- Phylogeny chart on echinoderm larvae and their evolutionary significance
- Preparation of charts depicting the feeding mechanism, 3 coeloms, Tornaria larva etc., of *Balanoglossus*

REFERENCE BOOKS

1. **L.H. Hyman** „*The Invertebrates' Vol I, II and V.* – M.C. Graw Hill Company Ltd.
2. **Kotpal, R.L. 1988 - 1992** Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. **E.L. Jordan and P.S**. Verma *Invertebrate Zoology'* S. Chand and Company.
4. **R.D. Barnes** '*Invertebrate Zoology'* by W.B. Saunders CO., 1986.
5. **Barrington. E.J.W**., „*Invertebrate structure and Function'* by ELBS.
6. **P.S. Dhami and J.K. Dhami.** Invertebrate Zoology. S. Chand and Co. New Delhi.
7. **Parker, T.J. and Haswell** - A text book of Zoology' by, W.A., Mac Millan Co.London.
8. **Barnes, R.D. (1982).** Invertebrate Zoology, V Edition.

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ANIMAL DIVERSITY - BIOLOGY OF NON- CHORDATES

PRACTICALS

(Course Code: ZOO201306P)

2020-2021

Semester-I Paper-I Credits: 1 Hrs/Wk: 2

Learning Outcomes:

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labeled record of identified museum specimens

Syllabus:

1. **Study of museum slides / specimens / models (Classification of animals up to orders)**

Protozoa: Amoeba, *Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax*

Porifera: *Sycon, Spongilla, Euspongia, Sycon*- T.S & L.S, Spicules, Gemmule

Coelenterata: *Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula*.

Platyhelminthes: *Planaria, Fasciola hepatica, Fasciola* larval forms – Miracidium, Redia, Cercaria, *Echinococcus granulosus, Taenia solium, Schistosoma haematobium*.

Nemathelminths: *Ascaris (Male & Female), Drancunculus, Ancylostoma,Wuchereria* **Annelida:** *Nereis, Aphrodite, Chaetopteurs, Hirudinaria,* Trochophore larva

Arthropoda: Cancer, Palaemon**,** Scorpion, *Scolopendra, Sacculina, Limulus, Periapt's,* Larvae - Nauplius, Mysis, Zoea, Mouth parts of male &female *Anopheles* and *Culex,* Mouthparts of Housefly and Butterfly.

Mollusca: *Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus,* Glochidium larva

Echinodermata: *Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Ante don,* Bipinnaria larva

Hemichordata: *Balanoglossus,* Tornaria larva.

2. Dissections:

Prawn: Appendages, Digestive system, Nervous system, Mounting of Statocyst

Insect Mouth Parts

Laboratory Record work shall be submitted at the time of practical examination

An **"Animal album**" containing photographs, cut outs, with appropriate write up about the above-mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose **Computer - aided techniques should be adopted or show virtual dissections**

RFERENCE MANUALS:

1. Practical Zoology- Invertebrates S.S. Lal
2. Practical Zoology - Invertebrates P.S. Verma
3. Practical Zoology - Invertebrates K.P. Kurl
4. Ruppert and Barnes (2006) Invertebrate Zoology,8th Edition, Holt Saunders InternationalEdition.

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ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

(Course Code: ZOO202306)

2020-2021

Semester-II **Paper-II** **Credits: 4** **Hrs/Wk: 4**

Course Outcomes: By the completion of the course the graduate should able to -

- Describe general taxonomic rules on animal classification of chordates
- Classify Protochordata to Mammalian with taxonomic keys
- Understand Mammals with specific structural adaptations
- Understand the significance of dentition and evolutionary significance
- Understand the origin and evolutionary relationship of different phyla from Prochordata to mammalian.

Learning objectives

- To understand the animal kingdom.
- To understand the taxonomic position of Protochordata to Mammalia.
- To understand the general characteristics of animals belonging to Fishes to Reptilians.
- To understand the body organization of Chordata.
- To understand the taxonomic position of Protherian mammals.

Unit I

1.1 General characters and classification of Chordata up to class level

1.2 Protochordata- Salient features of Cephalochordate,

1.3 Structure of *Branchiostoma*

1.4 Affinities of Cephalochordate.

1.5 Salient features of Urochordata

1.6 Structure and life history of *Herdmania*

1.7 Retrogressive metamorphosis –Process and Significance.

Unit II

2.1 Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*

2.2 Pisces: General characters and classification of Fishes up to class level

2.3 ***Scoliodon*:** External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain.

2.4 Migration in Fishes

2.5 Types of Scales

2.6 Dipnoi.

Additional Input: Aortic arches, Vena Cavae, Cranial Nerves in *Scoliodon*

Unit - III

3.1 General characters of Amphibia

3.2 Classification of Amphibia up to orders with examples.

3. 3 *Rana hexadactyla*: External features, Digestive system, Respiratory system,Structure and function of Heart, structure and functions of the Brain

3.4 Reptilia: General characters of Reptilia, Classification of Reptilia up to orderswith examples

3.5 *Calotes*: External features, Digestive system, Respiratory system, Structure andfunction of Heart, structure and function of Brain

3.5. Identification of Poisonous snakes and Non poisonous snakes.

3.6. Skull in reptiles

Additional Input: Snake bite and first aid

Unit - IV

4.1 **Aves:** General characters of Aves

4.2 *Columba livia*: External features, Digestive system, Respiratory system, Structure andfunction of Heart, structure and function of Brain

4.3 Migration in Birds

4.4 Flight adaptation in birds

Additional Input: Types of feathers

Unit – V

5.1 General characters of Mammalia

5.2 Classification of Mammalia up to sub - classes with examples

5.3 Comparision of Prototherians, Metatherians and Eutherians

5.4 Dentition in mammals

Additional Input: Discontinuous distribution in Mammals

Co-curricular activities (suggested)

- Preparation of charts on Chordate classification (with representative animal photos) andretrogressive metamorphosis
- Thermocol or Clay models of Herdmania and Amphioxus
- Visit to local fish market and identification of local cartilaginous and bony fishes
- Maintaining of aquarium by students
- Thermocol model of fish heart and brain
- Preparation of slides of scales of fishes
- Visit to local/nearby river to identify migratory fishes and prepare studynotes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrateheart/brain/lungs, identification of snakes etc.)
- Collecting and preparation of Museum specimens with dead frogs/snakes/lizards etc.,and/or their skeletons
- Additional input on types of snake poisons and their antidotes (student activity).
- Collection of bird feathers and submission of report on Plumology
- Taxidermic preparation of dead birds for Zoology Museum
- Map pointing of prototherian and metatherian mammals
- Chart preparation for dentition in mammals

REFERENCE BOOKS

- J.Z. Young, 2006. The life of vertebrates. (The Oxford University Press, New Delhi).646 pages. Reprinted
- Arumugam, N. Chordate Zoology, Vol. 2. Saras Plublication. 278 pages. 200 figs.
- A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd., UK). 852 pages. (Revised edition of Parker &Haswell, 1961).
- M. Ekambaranatha Ayyar, 1973. A manual of zoology. Part II. (S. Viswanathan Pvt. Ltd., Madras).
- P.S. Dhami& J.K. Dhami, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.

- Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books,6 Vols., 1573 pp., tables, figs.
- A.K. Sinha, S. Adhikari& B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages.
- R.L.Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut).632 pages.
- E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092 pages.
- G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169 pp.
- Sandhu, G.S. & H. Bhaskar, H. 2004. Textbook of Chordate Zoology. Campus Books,2 vols., xx, 964 p., figs.
- Veena, 2008. Lower Chordata. (Sonali Publ.), 374 p., tables, 117 figs.

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PRACTICAL SYLLABUS FOR II SEMESTER -ZOOLOGY PAPER - II

ANIMAL DIVERSITY - BIOLOGY OF CHORDATES Practicals

(Course Code: ZOO202306P) **2020-2021**

Periods: 24 **Credits:1** **Hrs/Wk:2** **Max. Marks: 50**

Learning Outcomes:

- To understand the taxidermic and other methods of preservation of chordates.
- To identify chordates based on special identifying characters.
- To understand internal anatomy of animals through demo or virtual dissections,thus directing the student for "empathy towards the fellow living beings"
- To maintain a neat, labeled record of identified museum specimens.

Observation of the following Slides / Spotters / Models

1. Protochordata: *Herdmania, Amphioxus, Amphioxus* T.S through pharynx.2. Cyclostomata: *Petromyzon and Myxine.*
3. Pisces: *Pristis, Torpedo, Hippocoampus ,Exocoetus, Echeneis, Labeo, Catla, Clarius,Channa, Anguilla.*
4. Amphibia: *Ichthyophis, Amblystoma, Axolotl larva, Hyla,*
5. Reptilia: *Draco, Chamaeleon, Uromastix,,Testudo, Trionyx, Russels viper, Naja,* Krait, *Hydrophis, Crocodile.*
6. Aves: *Psittacula, Eudynamis, Bubo, Alcedo.*
7. Mammalia: *Ornithorhynchus, Pteropus, Funambulus.*

Dissections-

1. *Scoliodon* IX and X, Cranial nerves
2. *Scoliodon* Brain
3. Mounting of fish scales

Note: 1. Dissections are to be demonstrated only by the faculty or virtual.

2. Laboratory Record work shall be submitted at the time of practical examination.

REFERENCE BOOKS:

1. S.S.Lal, Practical Zoology –Vertebrate
P.S.Verma, A manual of Practical Zoology – Chordata

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ZOOLOGY SYLLABUS – SEMESTER III

PAPER – III: CYTOLOGY, GENETICS AND EVOLUTION

Course Code: ZOO3306 (2020-2021)

HOURS:60 **Credits:4 Hrs/Wk:4** **Max. Marks:100**

Unit - I

1. Cytology - I

1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma

1.2 Electron microscopic structure of eukaryotic cell.

1.3 Plasma membrane –Different models of plasma membrane.

Unit – II

2. Cell organelles

2.1 Structure and functions of Endoplasmic Reticulum

2.2 Structure and functions of Golgi apparatus

2.3 Structure and functions of Lysosomes

2.4 Structure and functions of Ribosomes

2.5 Structure and functions of Mitochondria

2.6 Nucleus

2.7. Chromatin - Structure and significance, Chromosomes - Structure, types, functions

Unit - III

3.1 Genetics - I

3.1.1 Mendel's work on transmission on traits

3.1.2 Principles of inheritance

3.1.3 Incomplete dominance and codominance

3.1.4 Lethal alleles, Epistasis, Pleiotropy

Unit - IV

4.1 Genetics - II

4.1.1 Sex determination

4.1.2 Sex linked inheritance

4.1.3 Linkage and crossing over

4.1.4 Extra chromosomal inheritance

4.1.5 Human karyotyping

Unit - V

5.1 Evolution

5.1.1 Origin of life

5.1.2 Lamarckism, Darwinism, Neo – Darwinism, Hardy-Weinberg Equilibrium.

5.1.3 Variations, isolating mechanisms, natural selection

5.1.4 Types of natural selection (directional, stabilizing, disruptive)

5.1.5 Artificial selection and forces of evolution

5.1.6 Speciation (Allopatric and Sympatric)

5.1.7 Macro evolutionary principles (Example: Darwin's finches)

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Semester-III, Paper-III

CYTOLOGY, GENETICS AND EVOLUTION

Course Code: ZOO3306P (2020-2021)

PRACTICAL SYLLABUS

I. Cytology

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of *Chiranomous*

II. Genetics

1. Study of Mendelian inheritance using suitable examples
2. Study of linkage recombination, gene mapping using the data
3. Study of human karyotypes

III. Evolution

1. Study of fossil evidences
2. Study of homology and analogy from suitable specimens and pictures
3. Phylogeny of horse with pictures
4. Darwin's finches (pictures)
5. Visit to natural history museum and submission of report

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ZOOLOGY-Semester-IV, Paper-IV

EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY

Course Code: ZOO4306 (2020-2021)

Credits:4 Hrs/Wk:4

Unit - I

1.1 Developmental Biology and Embryology

1.1.1 Gametogenesis

1.1.2 Fertilization

1.1.3 Types of eggs

1.1.4 Types of cleavages

1.2 Development of Frog up to formation of primary germ layers

1.3 Formation and functions of Fetal membrane in chick embryo

1.4 Development, types and functions of the Placenta in mammals

Unit - II

2.1 Physiology - I

2.1.1 Elementary study of process of digestion

2.1.2 Absorption of digested food

2.1.3 Respiration - Pulmonary ventilation, transport of oxygen and carbondioxide

2.1.4 Circulation - Structure and functioning of heart, Cardiac cycle

2.1.5 Excretion - Structure of nephron, urine formation, counter current mechanism

Unit - III

3.1 Physiology - II

3.1.1 Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers

3.1.2 Muscle contraction - Ultra structure of muscle fibre, molecular and chemical basis of muscle contraction

3.1.3 Endocrine glands - Structure, secretions and the functions (of hormones) of pituitary, thyroid, parathyroid, adrenal glands and pancreas

3.1.4 Hormonal control of reproduction in a mammal

Unit - IV

4.1 Ecology - I

4.1.1 Meaning and scope of Ecology

4.1.2 Important abiotic factors of Ecosystem - Temperature, light, water, oxygen and CO_2

4.1.3 Nutrient cycles - Nitrogen, carbon and phosphorus

4.1.4 Components of Ecosystem (Example:lake), food chains and food web,energy flow in ecosystem

Unit - V

5.1 Ecology - II

5.1.1 Habitat and ecological niche

5.1.2 Community interactions - Mutualism, commensalism, parasitism, competition,predation

5.1.3 Ecological succession

5.1.4 Population studies

5.2 Zoogeography

5.2.1 Zoogeographical regions

5.2.2 Study of physical and faunal peculiarities of Oriental, Australian and Ethiopian regions

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ZOOLOGY PAPER-IV, SEMESTER-IV

EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY PRACTICALS

Course Code: ZOO4306P (2020-2021)

Credits:1 Hrs./Wk:2 Max.Marks:50

I. Embryology

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Study of chick embryos of 18 hours, 24 hours, 33 hours and 48 hours of incubation

II. Physiology

1. Qualitative tests for identification of carbohydrates, proteins, and fats
2. Qualitative tests for identification of ammonia, urea and uric acid
3. Study of activity of salivary amylase under optimum conditions
4. Study of prepared slides of T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage

III. Ecology

1. Determination of pH of given sample
2. Estimation of dissolved oxygen of given sample
3. Estimation of total alkalinity of given sample
4. Estimation of salinity of given sample

REFERENCE BOOKS:

- Harper's Illustrated Biochemistry
- Cell and molecular biology: Concepts & experiments. VI Ed. John Wiley &sons. Inc.
- Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Laboratory techniques by Plummer.

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ZOOLOGY- PAPER-V SEMESTER-V

PAPER - V ANIMAL BIOTECHNOLOGY

Course Code: ZOO5311 (2020-2021)

Credits:4 Hrs/Wk:4

Unit 1:

Tools of Recombinant DNA Technology - Enzymes and Vectors

Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering

DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases

Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 basedvectors, Cosmids, BACs, YACs,

Unit 2

Techniques of Recombinant DNA Technology

Cloning: Use of linkers and adaptors

Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated delivery

PCR: Basics of PCR.

DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing

Hybridization techniques: Southern, Northern and Western blotting,

Genomic and cDNA libraries: Preparation and uses

UNIT 3

Animal Cell Technology

Cell culture media: Natural and Synthetic

Cell cultures: primary culture, secondary culture, continuous cell lines; Protocols for Primary CellCulture; Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures.

Hybridoma Technology: Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb

Stem cells: Types of stem cells, applications

Unit 4

Reproductive Technologies & Transgenic Animals

Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization , super ovulation, Embryo transfer, Embryo cloning

Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications

Unit 5

Applied Biotechnology

Industry: Fermentation: Different types of Fermentation: Short notes on - Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized; Downstream processing - Filtration, centrifugation, extraction, chromatography, spray drying and lyophilization**Agriculture:** fisheries – monoculture in fishes, polyploidy in fishes; DNA fingerprinting

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ZOOLOGY PAPER-V SEMESTER-IV

PAPER - V ANIMAL BIOTECHNOLOGY PRACTICALS

Course Code: ZOO5311P (2020-2021)

Credits:4 Hrs /Wk:4 Max. Marks: 50

Any SIX of the following:

1. Maintenance and storage of*E.coli* DH5 alpha cells.
2. Isolation of Plasmid DNA from *E.coli*
3. Preparation of genomic DNA from *E. coli*/animals/ human.
4. DNA quantification using agarose gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.
6. Preparation for insertion and vector for ligation.
7. Performance of ligation reaction using T4 DNA ligase.
8. Preparation of competent cells
9. Transformation of *E. coli* with plasmid DNA using CaCl2,
10. Selection of transformants on X-gal and IPTG
11. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
12. Interpretation of sequencing gel electropherograms
13. Amplification of DNA by PCR
14. Packing and sterilization of glass and plastic wares for cell culture.
15. Preparation of culture media.

SUGGESTED READING

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
5. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
6. Brown TA. (2007). Genomes-3. Garland Science Publishers
7. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
8. Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994.BIOS Scientific Publishers Limited.
9. Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
10. P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
11. B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001)

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ZOOLOGY- PAPER-VI SEMESTER-V

PAPER - VI ANIMAL HUSBANDRY Course Code: ZOO5312 (2020 -2021)

Credits:4 Hrs/Wk:4

UNIT – I : 10 Hours

General introduction to poultry farming. Principles of poultry housing. Poultry houses. Systems of poultry farming. Management of chicks, growers and layers. Management of Broilers.

UNIT – II: *10 Hours*

Poultry feed management – Principles of feeding. Nutrient requirements for different stages of layers and broilers. Methods of feeding. Poultry diseases – viral, bacterial, fungal and parasitic (two each); symptoms, control and management.

UNIT – III: *10 Hours*

Selection, care and handling of hatching eggs. Egg testing. Methods of hatching. Brooding and rearing. Sexing of chicks.

UNIT- IV: *20 Hours*

Breeds of Dairy Cattle and Buffaloes – Definition of breed; Classification of Indian Cattle breeds, exotic breeds and Indian buffalo breeds. Systems of inbreeding and crossbreeding. Housing of dairy animals – Selection of site for dairy farm; systems of housing – loose, housing system. Conventional dairy barn. Cleaning and sanitation of dairy farm. Weaning of calf. Castration and dehorning. Deworming and Vaccination programme. Records to be maintained in a dairy farm.

UNIT - V: *10 Hours*

Care and management of dairy animals - Care and management of calf, heifer, milk animal, dry andpregnant animal, bulls and bullocks.

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ZOOLOGY- PAPER-VI SEMESTER-V

PAPER - VI ANIMAL HUSBANDRY Practical Course Code: ZOO5312P (2020 -2021)

Credits:4 Hrs/Wk:4

1. Study of various breeds of layers and broilers (photographs)
2. Identification of disease causing organisms in poultry birds (as per theory)
3. Study of the anatomy of a poultry bird by way of dissecting a bird. (Demonstration)
4. Study of various activities in a poultry farm (layers and broilers) and submission of a report.
5. Study of various breeds of cattle (photographs/microfilms)
6. Study of various activities carried out in a dairy farm and submission of a report.

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ZOOLOGY- SEMESTER-VI

ELECTIVE PAPER: VII-(A)

(Course Code: ZOO6308) (2020-2021)

ZOOLOGY - ELECTIVE PAPER: VII-(A)

IMMUNOLOGY

Periods:60 **Max. Marks:100**

Unit - I

1.1 Overview of Immune system

1.1.1 Introduction to basic concepts in Immunology

1.1.2 Innate and adaptive immunity

1.2 Cells and organs of Immune system

1.2.1 Cells of immune system

1.2.2 Organs of immune system

Unit - II

2.1 Antigens

2.1.1 Basic properties of antigens

2.1.2 B and T cell epitopes, haptens and adjuvants

2.1.3 Factors influencing immunogenicity

Unit - III

3.1 Antibodies

3.1.1 Structure of antibody

3.1.2 Classes and functions of antibodies

3.1.3Monoclonal antibodies

Unit - IV

4.1 Working of Immune system

4.1.1 Structure and functions of major histocompatibility complexes

4.1.2 Exogenes and Endogenes pathways of antigen presentation and processing

4.1.3 Basic properties and functions of cytokines

Unit - V

5.1 Immune system in health and disease

5.1.1 Classification and brief description of various types of hyper sensitivities

5.1.2 Introduction to concepts of autoimmunity and immunodeficiency

5.2 Vaccines

5.2.1 General introduction to vaccines

5.2.2 Types of vaccines

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ZOOLOGY- SEMESTER-VI

ELECTIVE PAPER: VII-(A) 2020-2021

IMMUNOLOGY PRACTICAL

(Course Code: ZOO6308P)

Periods: 24 **Max. Marks: 50**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
    a. ELISA
    b. Immunoelectrophoresis

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-1 (2020-2021)

PRINCIPLES OF AQUACULTURE (Course Code: ZCE20316)

Unit – I

1.1 Introduction / Basics of Aquaculture

1.1.1 Definition, Significance and History of Aquaculture

1.1.2 Present status of Aquaculture – Global and National scenario

1.1.3 Major cultivable species for aquaculture: freshwater, brackish water and marine.

1.1.4 Criteria for the selection of species for culture

Unit – II

2.1 Types of Aquaculture

2.1.1 Freshwater, Brackishwater and Marine

2.1.2 Concept of Monoculture, Polyculture, Composite culture, Monosex culture andIntegrated fish farming

2.2Culture systems

2.2.1 Ponds, Raceways, Cages, Pens, Rafts and water recirculating systems

2.3Culture practices

2.3.1Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish and shrimp.

Unit – III

3.1 Design and construction of aquafarms

3.1.1 Criteria for the selection of site for freshwater and brackish water pond farms

3.1.2 Design and construction of fish and shrimp farms

3.2 Seed resources

3.2.1 Natural seed resources and Procurement of seed for stocking: Carp and shrimp

3.3 Nutrition and feeds

3.3.1 Nutritional requirements of a cultivable fish and shellfish

3.3.2 Natural food and Artificial feeds and their importance in fish and shrimp culture

Unit – IV

4.1 Management of carp culture ponds

4.1.1 Culture of Indian major carps: Pre-stocking management – Dewatering, drying, ploughing/desilting; Predators, weeds and algal blooms and their control, Liming and fertilization; Stocking management – Stocking density and stocking; Post-stocking management – Feeding, water quality, growth and health care; and Harvesting of ponds

***4.2* Culture of giant freshwater prawn,** *Macrobrachium rosenbergii*

Unit – V

5.1 Culture of shrimp (*Penaeus monodon* or *Litopenaeus vannamei*)
5.2 Culture of pearl oysters
5.3 Culture of seaweeds-species cultured, culture techniques, important by-products, prospects
5.4 Culture of ornamental fishes – Setting up and maintenance of aquarium; and breeding.

REFERENCES BOOKS

1. Bardach, JE *et al*. 1972. *Aquaculture – The farming and husbandry of freshwater and marine organisms*, John Wiley & Sons, New York.
2. Bose AN et al.1991. *Coastal aquaculture Engineering*. Oxford & IBH Publ.Co.Pvt.Ltd.
3. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn.* Daya Publ. House.
4. FAO. 2007. *Manual on Freshwater Prawn Farming*.
5. Huet J. 1986. *A text Book of Fish Culture*. Fishing News Books Ltd.
6. ICAR. 2006. *Hand Book of Fisheries and Aquaculture*. ICAR.
7. Ivar LO. 2007. *Aquaculture Engineering*. Daya Publ. House.
8. Jhingran V.G. 2007. *Fish and Fisheries of India*. Hindustan Publ. Corporation, India.
9. Landau M. 1992. *Introduction to Aquaculture*. John Wiley & Sons.
10. Lovell RT.1998. *Nutrition and Feeding of fishes*. Chapman & Hall.
11. Mcvey JP. 1983. *Handbook of Mariculture*. CRC Press.
12. MPEDA: *Handbooks on culture of carp, shrimp, etc*.
13. New MB. 2000. *Freshwater Prawn Farming*. CRC Publ.
14. Pillay TVR.1990. *Aquaculture- Principles and Practices*, Fishing News Books Ltd., London.
15. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. 2nd Ed. Blackwell
16. Rath RK. 2000. *Freshwater Aquaculture*. Scientific Publ.
14. Stickney RR. 1979. *Principles of Warmwater Fish Culture*, John Wiley & Sons
15. Wheaton FW. 1977. *Aquacultural Engineering*. John Wiley & Sons.

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-1 (2020-2021)

PRINCIPLES OF AQUACULTURE PRACTICAL: I (Course Code: ZCE20316P)

Periods : 24 Max.Marks : 50

Cultivable fishes

1. Identification and study of important cultivable and edible fishes - Any ten
2. Identification and study of important cultivable and edible crustaceans - Any five
3. Identification and study of common aquarium fishes – Any five
4. General description and recording biometric data of a given fish.

Diseases

1. Identification and study of fish and shrimp diseases - Using specimens / pictures
2. External examination of the diseased fish – diagnostic features and procedure.
3. Autopsy of fish – Examination of the internal organs.
4. Determination of dosages of chemicals and drugs for treating common diseases.

Pond Management

1. Water Quality -Determination of temperature, pH, salinity in the pond water sample; Estimation of dissolved oxygen, free carbondioxide, total alkalinity, totalhardness, phosphates and nitrites.
2. Soil analysis – Determination of soil texture, pH, conductivity, available nitrogen, available phosphorus and organic carbon.
3. Identification and study of common zooplankton, aquatic insects and aquatic weeds – Each

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-2 (2020-2021)

AQUACULTURE MANAGEMENT

(Course Code: ZCE20317)

Periods: 60 Max.Marks: 100

Unit – I

1.1 Breeding and Hatchery Management

1.1.1 Bundh Breeding and Induced breeding of carp by Hypophysation; and use of synthetic hormones

1.1.2 Types of fish hatcheries; Hatchery management of Indian major carps

1.1.3 Breeding and Hatchery management of *Penaeus monodon*/ *Litopenaeus vannamei*

1.1.4 Breeding and Hatchery management of giant freshwater prawn.

Unit – II

2.1 Water quality Management

2.1.1 Water quality and soil characteristics suitable for fish and shrimp culture

2.1.2 Identification of oxygen depletion problems and control mechanisms in culture ponds

2.1.3 Aeration: Principles of aeration and Emergency aeration

2.1.4 Liming materials, Organic manures and Inorganic fertilizers commonly used and their implications in fish ponds

Unit – III

3.1 Feed Management

3.1.1 Live Foods and their role in shrimp larval nutrition.

3.1.2 Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed additives and Preservatives; role of probiotics.

3.1.3 Feed formulation and manufacturing; Feed storage

3.1.4 Feeding strategies: Feeding devices, feeding schedules and ration size; Feed evaluation- feed conversion efficiencies and ratios

Unit – IV

Disease Management

4.1.1 Principles of disease diagnosis and health management;

4.1.2 Prophylaxis, Hygiene and Therapy of fish diseases

4.1.3 Specific and non-specific defense systems in fish; Fish immunization and vaccination

4.1.4Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish ponds
4.1.5Etiology, Symptoms, prophylaxis and therapy of common shrimp diseases in shrimp ponds

Unit – V

5.1 Economics and Marketing

5.1.1 Principles of aquaculture economics – Capital costs, variable costs, cost-benefit analysis

5.1.2Fish marketing methods in India; Basic concepts in demand and price analysis

5.2 Fisheries Extension

5.1.3 Fisheries Training and Education in India; Role of extension in community development.

5.3 Fish Genetics

5.1.4 Genetic improvement of fish stocks – Hybridization of fish.

5.1.5 Gynogenesis, Androgenesis, Polyploidy, Transgenic fish, Cryopreservation of gametes, Production of monosex and sterile fishes and their significance in aquaculture.

REFERENCE BOOKS

1. Boyd CE. 1979. *Water Quality in Warm Water Fish Ponds*. Auburn University
2. Boyd, CE. 1982. *Water Quality Management for Pond Fish Culture.* Elsevier Sci. Publ. Co.
3. Chakraborty C & Sadhu AK. 2000. *Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn*. Daya Publ. House
4. Conroy CA and Herman RL. 1968. *Text book of Fish Diseases*. TFH (Great Britain) Ltd, England.

5Halver J & Hardy RW. 2002. *Fish Nutrition*. Academic Press.

6. Ian C. 1984. *Marketing in Fisheries and Aquaculture*. Fishing News Books.
7. ICAR. 2006. *Handbook of Fisheries and Aquaculture*. ICAR.
8. Jhingran VG. 2007. *Fish and Fisheries of India.* Hindustan Publishing Corporation, India.
9. Jhingran VG & Pullin RSV. 1985. *Hatchery Manual for the Common, Chinese and Indian Major Carps*. ICLARM, Philippines.
10. Kumar D. 1996. *Aquaculture Extension Services Review: India.* FAO Fisheries CircularNo. 906, Rome.
11. Lavens P & Sorgeloos P. 1996*. Manual on the Production and Use of Live Food for Aquaculture.* FAO Fisheries Tech. Paper 361, FAO.
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13. New MB. 1987. *Feed and Feeding of Fish and Shrimp. A Manual on the Preparation and Preservation of Compound Feeds for Shrimp and Fish in Aquaculture.* FAO – ADCP/REP/87/26
14. Pandian TJ, Strüssmann CA & Marian MP. 2005. *Fish Genetics and Aquaculture Biotechnology*. Science Publ.

15.Pilley, TVR & Dill, WMA. 1979. *Advances in Aquaculture*. Fishing News Books, Ltd. England.

16. Pillay TVR & Kutty MN. 2005. *Aquaculture- Principles and Practices*. Blackwell.
17. Ray GL. 2006. *Extension, Communication and Management*. 6th Ed. Kalyani Publ. Delhi.

18. ReddyPVGK, AyyappanS, ThampyDM & Gopalakrishna 2005.*Text Book of Fish Genetics and Biotechnol.* ICAR

19. Reichenbach KH. 1965. *Fish Pathology.* TFH (Gt. Britain) Ltd, England.

20.Shang YC. 1990. *Aquaculture Economic Analysis - An Introduction.* World Aquaculture Society, USA.

21. Singh B. 2006. *Marine Biotechnology and Aquculture* Development. Daya Publ. House

22.Stickney RR. 1979. *Principles of Warm waterAquaculture*. John-Willey & sons Inc.

23. Swain P, Sahoo PK & Ayyappan S. 2005. *Fish and Shellfish Immunology: An Introduction*. Narendra Publ.

24. Thomas PC, Rath SC & Mohapatra KD.2003.Breeding and Seed Production of Finfish and Shellfish. Daya Publ.

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-2 (2020-2021)

AQUACULTURE MANAGEMENT PRACTICAL – II (Course Code: ZCE20317P)

Periods :24 Max.Marks : 50

Nutrition

1. Identification and study of Live food organisms – Any five
2. Formulation and preparation of a balanced fish feed
3. Estimation of Proximate composition of aquaculture feeds – Proteins, carbohydrates, lipids, moisture, ash content.
4. Gut content analysis to study artificial and natural food intake.

Post harvest Technology

1. Evaluation of fish/ fishery products for organoleptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish products, examination of salt, protein, moisture in dried / cured products, examination of spoilage of dried / cured fish products, marinades, pickles, sauce.
3. Preparation of isinglass, collagen and chitosan from shrimp and crab shell. ?
4. Developing flow charts and exercises in identification of hazards – preparation of hazard analysis worksheet, plan form and corrective action procedures in processing of fish.

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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-3 (2020-2021)

POSTHARVEST TECHNOLOGY

(Course Code: ZCE20318)

Periods : 60 Max.Marks : 100

Unit – I

1.1 Handling and Principles of fish Preservation

1.1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.

1.1.2 Principles of preservation– cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to lowradiation of gamma rays.

Unit – II

2.1 Methods of fish Preservation

2.1.1 Traditional methods - sun drying, salt curing, pickling and smoking.

2.1.2 Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, Irradiation and Accelerated Freeze drying (AFD).

Unit – III

3.1 Processing and preservation of fish and fish by-products

3.1.1 Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.

3.1.2 Fish by-products – fish glue, ising glass, chitosan, pearl essence, shark fins, fish leather and fish maws.

3.2 Seaweed Products

3.2.1 Preparation of agar, algin, and carrageen. Use of seaweeds as food for human consumption, indisease treatment and preparation of therapeutic drugs.

Unit – IV

4.1Sanitation and Quality control

4.2.1 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.

4.2.2 Quality Control of fish and fishery products – pre-processing control, control during processing, and control after processing.

4.2 General Regulatory affairs in industries

Unit – V

5.1 Quality Assurance, Management and Certification

5.1.1 Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.

5.1.2 National and International standards – ISO 9000: 2000 Series of Quality Assurance System, *Codex Alimentarius*.

REFERENCE BOOKS

1. Balachandran KK. 2001. *Post-harvest Technology of Fish and Fish Products*. Daya Publ.
2. Bond, et al. 1971. *Fish Inspection and Quality Control*. Fishing News Books, England.
3 Clucas IJ. 1981. *Fish Handling, Preservation and Processing in the Tropics*. Parts I, II. FAO.
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ZOOLOGY- SEMESTER-VI

ZOOLOGY - Cluster Elective Paper: VIII-B-3 (2020-2021)

POSTHARVEST TECHNOLOGY (Course Code: ZCE20318P)

PRACTICAL - III

Project Work

Visit to a fish breeding centre / fish farms and submit a project report
or
Visit to a feed manufacturing unit and submit a project report
or
Visit to a shrimp hatchery / shrimp farms and submit a project report
or
Visit to a shrimp processing unit and submit a project report

A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (A)
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DEPARTMENT OF ZOOLOGY-SKILL DEVELOPMENT COURSES

To be Offered for Semesters II (2020-2021)

ZOOLOGY STREAM-DAIRY TECHNOLOGY SYLLABUS

Total 30 hrs (02h/wk), 02 Credits & Max. Marks 50

Learning Outcomes:

After successful completion of the course, students will be able to;

1. Understand the pre-requisites for starting a Dairy farm
2. Recognize different breeds of Cows & buffaloes following safety precautions.
3. Prepare and give recommended feed and water for livestock
4. Maintain health of livestock along with productivity
5. Vaccination of cattle, nutrients requirements
6. Entrepreneurship i.e., Effectively market dairy products
7. Ensure safe and clean dairy farm and Standard safety measures to be taken in establishing am industry
8. Efficiently start and manage to establish or develop a Dairy Industry

SYLLABUS:

Section I (Introduction and Establishment of a Dairy Farm): 05 Hrs

1.1 Dairy development in India – Dairy Cooperatives (NDRI, NDDB, TCMPF) (1hr)1.2 Constraints of Present Dairy Farming and Future Scope of Dairy Farmer. (1 hr)

1.3 Selection of site for dairy farm; Systems of housing – Loose housing system, Conventional Dairy Farm; Records to be maintained in a dairy farm. (2 hrs)

Section II (Livestock Identification and Management): 13 Hrs

2.1 Breeds of Dairy Cattle and Buffaloes – Identification of Indian cattle and buffalo breeds and Exotic breeds; Methods of selection of Dairy animals. (5 hrs)

2.2 Systems of inbreeding and crossbreeding. (2 hrs)

2.3 Weaning of calf, Castration, Dehorning, Deworming and Vaccination programme (3 hrs)

2.4 Care and management of calf, heifer, milk animal, dry and pregnant animal, bulls and bullocks. (3 hrs)

Section III (Feed Management, Dairy Management, Cleaning and Sanitation): 8 Hrs

3.1 Basic Principles of Feed, Important Feed Ingredients, Feed formulation and FeedMixing (2 hrs)

3.2 Operation Flood –Definition of Milk and Nutritive value of milk and ICMR recommendation of nutrients –Per Capita Milk production and availability in India and Andhra Pradesh -Methods of Collection and Storage of Milk– Labelling and Storage ofmilk products (4 hrs)

3.3 Cleaning and sanitation of dairy farm – Safety precautions to prevent accidents in an industry. (2 hrs)

Reference books:

1. Dairy Science: Petersen (W.E.) Publisher – Lippincott & Company
2. Principles and practices of Dairy Farm –Jagdish Prasad
3. Text book of Animal Husbandry - G C Banerjee
4. Hand book of Animal Husbandry - ICAR Edition
5. Outlines of Dairy Technology – Sukumar (De) – Oxford University press
6. Indian Dairy Products – Rangappa (K.S.) & Acharya (KT) – Asia Publishing House.
7. The technology of milk Processing – Anantha Krishnan, C.P., Khan, A.Q.and Padmanabhan, P.N. – Shri Lakshmi Publications.
8. Dairy India 2007, Sixth edition
9. Economics of Milk Production – Bharati Pratima Acharya Publishers.
10. http://www.asci-india.com/BooksPDF/Dairy%20Farmer%20or%20Entrepreneur.pdf
11. https://labour.gov.in/industrial-safety-health