

YOGI VEMANA UNIVERSITY :KADAPA
ZOOLOGY CBCS SYLLABUS COURSE STRUCTURE

YEAR	SEMESTER	PAPER	TITLE	HRS.	CREDITS	IA	ES	TOTAL
I	I	I	Biology of Non-chordates	4	3	25	75	100
			Practical - I	2	2	50	0	50
	II	II	Biology of Chordates	4	3	25	75	100
			Practical - II	2	2	0	50	50
II	III	III	Cell biology, Genetics and Evolution	4	3	25	75	100
			Practical - III	2	2	50	0	50
	IV	IV	Embryology, Physiology and Ecology	4	3	25	75	100
			Practical - IV	2	2	0	50	50
III	V	V	Animal Biotechnology	4	3	25	75	100
			Practical - V	2	2	50	0	50
		VI	Animal Husbandry	4	3	25	75	100
			Practical - VI	2	2	50	0	50
	VI	VII	Immunology	4	3	25	75	100
			Practical - VII	2	2	0	50	50
		Cluster VIII-A	Cluster Electives –VIII-A : Aquaculture					
			1. Principles of Aquaculture	4	3	25	75	100
			2. Aquaculture Management	4	3	25	75	100
			3. Post Harvest Technology	4	3	25	75	100
			Practical – VIII: 1	2	2	0	50	50
			Practical – VIII: 2	2	2	0	50	50
			Project Work-	2	2	0	50	50

ZOOLOGY SYLLABUS FOR I SEMESTER

ZOOLOGY - PAPER - I

ANIMAL DIVERSITY - NONCHORDATES

Periods:60

Max. Marks:100

Brief history, Significance of Diversity of Non Chordates

Protozoa

General characters

Classification of Protozoa up to classes with examples

Elphidium (type study)

Porifera

General characters

Classification of Porifera up to classes with examples

Sycon – External Characters, Types of cells,

Skeleton in Sponges

Canal system in sponges

Unit - II

Coelenterata

General characters

Classification of Coelenterata up to classes with examples

Obelia - External Characters, Structure of Polyp and Medusa

Polymorphism in coelenterates

Corals and coral reef formation

Platyhelminthes

General characters

Classification of Platyhelminthes upto classes with examples

Fasciola hepatica, Reproductive System, Life History and pathogenicity

Unit - III

Nemathelminthes

General characters

Classification of Nemathelminthes up to classes with examples

Annelida

General characters

Classification of Annelida up to classes with examples

Hirudinaria granulosa, Digestive System, Reproductive System

Coelomoducts

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

Unit - IV

Arthropoda

- General characters

- Classification of Arthropoda up to classes with examples

- Prawn, Appendages, Respiratory system

- Peripatus - Structure and affinities

Mollusca

- General characters

- Classification of Mollusca up to classes with examples

- Pearl formation in Pelecypoda

- Torsion in gastropods

Unit - V

Echinodermata

- General characters

- Classification of Echinodermata up to classes with examples

- Water vascular system in star fish

Hemichordata

- General characters

- Classification of Hemichordata up to classes with examples

- Balanoglossus - Structure and affinities

Non-Chordata larval forms

- Amphiblastula

- Nauplius

- Bipinnaria

- Tornaria

ZOOLOGY MODEL QUESTION PAPER FOR I SEMESTER

ZOOLOGY - PAPER - I

ANIMAL DIVERSITY - NONCHORDATES

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
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II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

- 9.

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ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER

ZOOLOGY - PAPER - I ANIMAL DIVERSITY - NONCHORDATES

Periods: 24

Max. Marks: 50

Observation of the following slides / spotters / models

Protozoa	: Elphidium, Paramecium - Binary fission and conjugation
Porifera	: Spoonbill, Euspongia, Sycon, Sycon - T.S and L.S
Coelenterata	: Obelia - colony and medusa, Physalia, Velella, Corallium, Gorgonia, Pennatula
Platyhelminthes	: Planaria, Fasciola hepatica, Fasciola larval forms - Miracidium, Redia, Cercaria, Echinococcus granulosus
Nemathelminthes	: Ascaris - Male and female, Ancylostoma duodenale
Annelida	: Neries, Heteroneries, Aphrodite, Hirudo, Trochophore larva
Arthropoda	: Mouth parts of male and female Anopheles and Culex, Mouth parts of housefly, Mouth parts of Scorpion, Nauplius, Mysis, Zoea larvae, crab, prawn, Scolopendra, Sacculina, Limulus, Peripatus
Mollusca	: Chiton, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva
Echinodermata	: Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Asterias, Bipinnaria larva
Hemichordata	: Balanoglossus, Tornaria larva

Demonstration of dissection / dissected / virtual dissection :

1. Leech / Prawn / Scorpion / Crab - Digestive system
2. Prawn - Appendages
3. Prawn / Scorpion / Crab - Nervous system
4. Pila / Unio - Digestive system
5. Mounting of Statocyst
6. Mounting of Radula

b Laboratory record work shall be submitted at the time of practical examination

b Compulsory one species to be adopted for demonstration only by the faculty

b Computer aided techniques should be adopted as per UGC guide lines



ZOOLOGY SYLLABUS FOR II SEMESTER

ZOOLOGY - PAPER - II

ANIMAL DIVERSITY - CHORDATES

Periods:60

Max. Marks: 100

Unit - I

General characters of Chordata

Prochordata

Salient features of Cephalochordata

Affinities of Cephalochordata

Salient features of Urochordata

Structure and life history of Herdmania

Significance of Retrogressive metamorphosis

Unit - II

Cyclostomata

General characters of Cyclostomata

Comparison of the Petromyzon and Myxine

Pisces

General characters of Fishes

Classification of fishes up to sub - class level with examples

Scoliodon, Digestive system, Heart, Brain

Migration in Fishes

Types of Scales

Dipnoi

Unit - III

3.1 Amphibia

General characters of Amphibian

Classification of Amphibia upto orders with examples.

Rana hexadactyla, Digestive system, Respiratory system, Heart

Reptilia

General characters of Reptilia

Classification of Reptilia upto orders with examples

Identification of Poisonous snakes and Skull in reptiles

Unit - IV

Aves

General characters of Aves

Classification of Aves upto subclasses with examples.

Columba livia, Digestive system, Respiratory system, Heart.

Migration in Birds

Flight adaptation in birds

Unit - V

Mammalia

General characters of Mammalia

Classification of Mammalia upto sub - classes with examples

Comparision of Prototherians, Metatherians and Eutherians

Dentition in mammals



ZOOLOGY MODEL QUESTION PAPER FOR II SEMESTER

ZOOLOGY - PAPER - II

ANIMAL DIVERSITY - CHORDATES

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

1. Amphioxus
2. Placoid scale
3. Quill feather
4. Prototheria
5. Anadromous migration
6. Draco
7. Emu
8. Apoda

II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

9. Explain the life history of Herdmania

OR

Explain the origin and general characters of chordates

10. Compare the characters of Petromyzon and Myxine

OR

Describe the structure of heart of Scoliodon

11. Describe the brain of Rana hexadactyla

OR

Explain the external features of Calotes

12. Write an essay on flight adaptations in birds

OR

Explain the respiratory system of Columba livia

13. Compare the characters of Metatheria and Eutheria

OR

Write an essay on dentition in mammals

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ZOOLOGY PRACTICAL SYLLABUS FOR II SEMESTER

ZOOLOGY - PAPER - II

ANIMAL DIVERSITY - CHORDATES

Periods: 24

Max. Marks: 50

Observation of the following slides / spotters / models

Protochordata	: Herdmania, Amphioxus, Amphioxus T.S. through pharynx
Cyclostomata	: Petromyzon, Myxine
Pisces	: Pristis, Torpedo, Channapleuronectes, Hippocampus, Exocoetus, Ehenis, Labeo, Catla, Clarius, Auguilla, Protopterus Placoid scale, Cycloid scale, Ctenoid scale
Amphibia	: Ichthyophis, Amblystoma, Siren, Hyla, Rachophous Axolotl larva
Reptilia	: Draco, Chamaeleon, Uromastix, Vipera russeli, Naja, Bungarus, Enhydrina, Testudo, Trionyx, Crocodilus
Aves	: Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo, Study of different types of feathers : Quill, Contour, Filoplume down
Mammalia	: Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog
Osteology	: Appendicular skeletons of Varanus, Pigeon Rabbit - Skull, fore limbs, hind limbs and girdles

Demonstration of dissection / dissected / virtual dissection:

1. V, VII, IX, X cranial nerves of shark / locally available fishes
2. Arterial system, venous system of Shark / Calotes / Fowl / Rat
3. Digestive system of fish

b Laboratory record work shall be submitted at the time of practical examination

b Compulsory one species to be adopted for demonstration only by the faculty



ZOOLOGY SYLLABUS FOR III SEMESTER

ZOOLOGY - PAPER - III

CYTOLOGY, GENETICS AND EVOLUTION

Periods:60

Max. Marks:100

Unit - I

1. Cytology - I

Definition, history, prokaryotic and eukaryotic cells, virus

Electron microscopic structure of eukaryotic cell.

Plasma membrane –Different models of plasma membrane.

Unit – II

2. Cell organelles

Structure and functions of Endoplasmic Reticulum

Structure and functions of Golgi apparatus

Structure and functions of Lysosomes

Structure and functions of Ribosomes

Structure and functions of Mitochondria

2.7. Chromatin, Chromosomes - Structure, types, functions

Unit - III

Genetics - I

Mendel's work on transmission on traits

Principles of inheritance

Incomplete dominance and codominance

Lethal alleles, Epistasis, Pleiotropy

Unit - IV

Genetics - II

Sex determination

Sex linked inheritance

Linkage and crossing over

Extra chromosomal inheritance

Human karyotyping

Unit - V

Evolution

Lamarckism, Darwinism, Hardy-Weinberg Equilibrium.

Variations, isolating mechanisms, natural selection

Speciation (Allopatric and Sympatric)

Macro evolutionary principles (Example: Darwin's finches)

ZOOLOGY MODEL QUESTION PAPER FOR III SEMESTER

ZOOLOGY - PAPER - III

CYTOLOGY, GENETICS AND EVOLUTION

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
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II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

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ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER

ZOOLOGY - PAPER - III

CYTOLOGY, GENETICS AND EVOLUTION

Periods: 24

Max. Marks: 50

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 Chironomus

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



ZOOLOGY SYLLABUS FOR IV SEMESTER

ZOOLOGY - PAPER - IV

EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY

Periods:60

Max. Marks: 100

Unit - I

Developmental Biology and Embryology

Gametogenesis

Types of eggs

Formation and functions of Foetal membrane in chick embryo

Development, types and functions of Placenta in mammals

Unit - II

Physiology - I

Elementary study of process of digestion

Absorption of digested food

Respiration - Pulmonary ventilation, transport of oxygen and carbondioxide

Circulation - Structure and functioning of heart, Cardiac cycle

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

Unit - III

Physiology - II

Nerve impulse transmission, origin and propagation of action potentials

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

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

Hormonal control of reproduction in a mammal

Unit - IV

Ecology - I

Meaning and scope of Ecology

Nutrient cycles - Nitrogen, carbon and phosphorus

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

Unit - V

Ecology - II

Habitat and ecological niche

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

Ecological succession
Zoogeography
Zoogeographical regions
Study of physical and faunal peculiarities of Oriental, Australian and Ethiopian regions

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ZOOLOGY MODEL PAPER FOR IV SEMESTER

ZOOLOGY - PAPER - IV

EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

- 1.
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II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

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ZOOLOGY PRACTICAL SYLLABUS FOR IV SEMESTER

ZOOLOGY - PAPER - IV

EMBRYOLOGY, PHYSIOLOGY AND ECOLOGY

Periods: 24

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

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ZOOLOGY SYLLABUS FOR V SEMESTER
ZOOLOGY - PAPER - V
ANIMAL BIOTECHNOLOGY

Periods:60

Max. Marks:100

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

Cloning Vectors: Plasmid vectors:pBR and pUC series, Bacteriophage, Cosmids.

Unit 2 Techniques of Recombinant DNA technology

Cloning: Use of linkers and adaptors

PCR: Basics of PCR.

Hybridization techniques: Southern, Northern and Western blotting,

Genomic and cDNA libraries: Preparation and uses

UNIT 3 Animal Cell Technology

Cell cultures: primary culture, secondary culture, Organ culture; Cryopreservation of cultures.

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

cells: Types of stem cells, applications of stem cell technology in cell based therapy.

Unit 4 Reproductive Technologies & Transgenic Animals

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

Transgenic Animals: Transgenic - sheep, - fish; applications

Unit 5 Applied Biotechnology

Industry: Fermentation: Different types of Fermentation: Short notes on - Submerged & Solid state; batch, Fed batch & Continuous;

Agriculture: fisheries – monoculture in fishes, polyploidy in fishes; DNA fingerprinting

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ZOOLOGY MODEL PAPER FOR V SEMESTER

ZOOLOGY - PAPER - V

ANIMAL BIOTECHNOLOGY

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
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II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

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ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER
ZOOLOGY - PAPER - V
ANIMAL BIOTECHNOLOGY

Periods: 24

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 EcoRI 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 SYLLABUS FOR V SEMESTER

ZOOLOGY - PAPER - VI

ANIMAL HUSBANDRY

Periods:60

Max. Marks: 100

UNIT – I	:	10 Hours
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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. 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. (Three each category). 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.

UNIT - V: 10 Hours

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

ZOOLOGY MODEL PAPER FOR V SEMESTER

ZOOLOGY - PAPER - VI

ANIMAL HUSBANDRY

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
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II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

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ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER
ZOOLOGY –PRACTICAL - VI

ANIMAL HUSBANDRY

Periods:24

Max. Marks: 50

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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.

ZOOLOGY SYLLABUS FOR VI SEMESTER

ZOOLOGY –ELECTIVE PAPER:VII

IMMUNOLOGY

Periods:60

Max. Marks:100

Unit - I

Overview of Immune system

Introduction to basic concepts in Immunology

Innate and adaptive immunity

Cells and organs of Immune system

Cells of immune system

Organs of immune system

Unit - II

Antigens

Basic properties of antigens

B and T cell epitopes, haptens

Factors influencing immunogenicity

Unit - III

Antibodies

Structure of antibody

Classes and functions of antibodies

3.1.3 Monoclonal antibodies

Unit - IV

Working of Immune system

Structure and functions of major histocompatibility complexes

Exogenous and Endogenous pathways of antigen presentation and processing

Basic properties and functions of cytokines

Unit - V

Immune system in health and disease

Classification and brief description of various types of hyper sensitivities

Introduction to concepts of autoimmunity and immunodeficiency

Vaccines

General introduction to vaccines

Types of vaccines

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ZOOLOGY MODEL PAPER FOR VI SEMESTER

ZOOLOGY - ELECTIVE PAPER – VII

IMMUNOLOGY

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
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II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

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ZOOLOGY PRACTICAL SYLLABUS FOR VI SEMESTER

ZOOLOGY - ELECTIVE PAPER – VII

IMMUNOLOGY

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



VI SEMESTER
ZOOLOGY SYLLABUS FOR CLUSTER ELECTIVE –VIII-A:
AQUACULTURE

Cluster Elective Paper: VIII-A-1

PRINCIPLES OF AQUACULTURE

Periods:60

Max.Marks:100

Unit – I

Introduction / Basics of Aquaculture
Definition, Significance and History of Aquaculture
Major cultivable species for aquaculture: freshwater, brackish water and marine.
Criteria for the selection of species for culture

Unit – II

Types of Aquaculture
Freshwater, Brackishwater and Marine
Concept of Monoculture, Polyculture, Composite culture, Monosex culture and Integrated fish farming
Culture practices
Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish.

Unit – III

Design and construction of aquafarms
Criteria for the selection of site for freshwater and brackish water pond farms
Design and construction of fish and shrimp farms
Nutrition and feeds
Natural food and Artificial feeds and their importance in fish and shrimp culture

Unit – IV

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

Unit – V

Culture of shrimp (*Penaeus monodon* or *Litopenaeus vannamei*)
Culture of pearl oysters
Culture of ornamental fishes – Setting up and maintenance of aquarium.

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.

ZOOLOGY MODEL PAPER FOR VI SEMESTER

Cluster Elective Paper: VIII-A-1

PRINCIPLES OF AQUACULTURE

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
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II. Answer any FIVE of the following :

5x10=50

Draw labeled diagrams wherever necessary

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Cluster Elective Paper: VIII-A-2
AQUACULTURE MANAGEMENT

Periods : 60

Max.Marks : 100

Unit – I

**Breeding and Hatchery
Management**

Bundh Breeding and Induced breeding of carp by
Hypophysation; and use of synthetic hormones
Types of fish hatcheries; Hatchery management of Indian major carps
Breeding and Hatchery management of *Penaeus monodon*

Unit – II

**Water quality
Management**

Water quality and soil characteristics suitable for fish and shrimp culture
Identification of oxygen depletion problems and control mechanisms in culture ponds
Liming materials, Organic manures and Inorganic fertilizers commonly used and
their implications in fish ponds

Unit – III

**Feed
Management**

Live Foods and their role in shrimp larval nutrition.
Supplementary feeds: Principal foods in artificial diets; Types of feeds; Feed
additives and Preservatives; role of probiotics.
Feed formulation and manufacturing; Feed storage

Unit – IV

Disease Management
Principles of disease diagnosis and health management;
Prophylaxis, Hygiene and Therapy of fish diseases
Etiology, Symptoms, prophylaxis and therapy of common fish diseases in fish ponds

Unit – V

Economics and Marketing

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

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

Fish Genetics

Genetic improvement of fish stocks – Hybridization of 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.
5. Halver 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 Circular No. 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.
12. MPEDA. 1993. Handbook on Aqua Farming - Live Feed. Micro Algal Culture. MPEDA Publication
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. Reddy PV GK, Ayyappa S, Thampy DM & 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 Aquaculture Development. Daya Publ. House
22. Stickney RR. 1979. Principles of Warm water Aquaculture. John-Wiley & sons Inc.
23. Swain P, Sahoo PK & Ayyappa 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.

ZOOLOGY MODEL PAPER FOR VI SEMESTER

ZOOLOGY - PAPER - VIII

Cluster Elective Paper: VIII-A-2

AQUACULTURE MANAGEMENT

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the following :

5x10=50

Draw labeled diagrams wherever necessary

9.

OR

10.

OR

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OR

12.

OR

13.

OR

Cluster Elective Paper: VIII-A-3

POST HARVEST TECHNOLOGY

Periods : 60

Max.Marks : 100

Unit – I

Handling and Principles of fish Preservation

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

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

Unit – II

Methods of fish Preservation

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

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

Unit – III

Processing and preservation of fish and fish by-products

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.

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

Unit – IV

Sanitation and Quality control

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

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

Unit – V

Quality Assurance, Management and Certification

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.

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.
4. Gopakumar K. (Ed.). 2002. Text Book of Fish Processing Technology. ICAR.
5. Govindan, TK. 1985. Fish Processing Technology, Oxford-IBH.
6. Hall GM. (Ed). 1992. Fish Processing Technology. Blackie.
7. Huss HH, Jakobsen M & Liston J. 1991. Quality Assurance in the Fish Industry. Elsevier.
8. John DEV. 1985. Food Safety and Toxicity. CRC Press.
9. Krenzer R. 1971. Fish Inspection and Quality Control. Fishing News.
10. Larousse J & Brown BE. 1997. Food Canning Technology. Wiley VCH.
11. Nambudiri DD. 2006. Technology of Fishery Products. Fishing Chimes.
12. Regenssein JM & Regenssein CE. 1991. Introduction to Fish Technology. VanNostrand Reinhold.
13. Rudolf K. 1969. Freezing and Irradiation of Fish. Fishing News (Books).
14. Sen DP. 2005. Advances in Fish Processing Technology. Allied Publ.

ZOOLOGY MODEL PAPER FOR VI SEMESTER

Cluster Elective Paper: VIII-A-3

: POST HARVEST TECHNOLOGY

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the following :

5x10=50

Draw labeled diagrams wherever necessary

9.

OR

10.

OR

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OR

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OR

13.

OR

ZOOLOGY PRACTICAL SYLLABUS CLUSTER ELECTIVE PAPER: VIII-A

VI SEMESTER

AQUACULTURE

PRACTICAL: I

Periods : 24

Max.Marks : 50

Cultivable fishes

1. Identification and study of important cultivable and edible fishes - Any Five
2. Identification and study of important cultivable and edible crustaceans - Any Three
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.

Pond Management

1. Water Quality -Determination of temperature, pH, salinity in the pond water sample;
Estimation of dissolved oxygen, free carbondioxide, total alkalinity
2. Soil analysis – Determination of soil texture, pH
3. Identification and study of common zooplankton, aquatic insects and aquatic weeds – Total 5

PRACTICAL - II

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

Post harvest Technology

1. 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.
2. Preparation of isinglass, collagen and chitosan from shrimp and crab shell. ?
3. Analysis worksheet, plan form and corrective action procedures in processing of fish.

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

1.A.S.Bhushnam	Chairman, BOS	Sri Lakshmi Srinivasa Degree College, Pullareddy Peta	
2. Nagendra Prasad	Member	SVDC,Kadapa	
3.K.Suryaprakasha Reddy	Member	SVDC,Kadapa	
4. Pitchi Reddy	Member	Sri Lakshmi Srinivasa Degree College, Pullareddy Peta	
5. Head/Coordinator Dept.of Zoology	University Nominee	Yogi Vemana University Kadapa	

Other Zoology lectures :-

1. L. Venkata Rami reddy SKSC, DC Proddatur
2. Swarana meri, SKR & SKR, Kadapa.
3. Aruna, SKR & SKR, Kadapa.
4. Venu Gopal, SKR & SKR, Kadapa.
5. P.Sabitha, SCNR, DC, Proddatur.
6. M.Rama Mohan SVDC,Proddatur
7. A.Ramesh Babu,Sri Hari Degree college, Kadapa.



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

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REVISED SYLLABUS OF B.Sc. (ZOOLOGY) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-21

PROGRAMME: THREE-YEAR B.Sc.

(Zoology)

*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities &
Model Q.P.)*

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

Structure of ZOOLOGY Syllabus

(Under CBCS for 3-year B.Sc. Programme)

(With domain subject covered during the first 4 Semesters with 5 Courses)

YEAR	SEM	PAPER	TITLE	MARKS (100)		CREDITS
				MID SEMESTER	END SEMESTER	
I	I	I	Animal Diversity – I Biology of Non-Chordates	25	75	04
			Practical - I	25	75	01
	II	II	Animal Diversity – II Biology of Chordates	25	75	04
			Practical - II	25	75	01
II	III	III	Cell biology, Genetics, Molecular Biology & Evolution	25	75	04
			Practical - III	25	75	01
	IV	IV	Physiology, Cellular Metabolism & Embryology	25	75	04
			Practical - IV	25	75	01
		V	Immunology & Animal Biotechnology	25	75	04
			Practical - V	25	75	01

PROGRAMME: THREE-YEAR B.Sc.

(With Chemistry, Botany and Zoology Disciplines)

As per the **National Education Policy, 2019** the **outcomes of Higher Education** include increased critical thinking abilities, higher order thinking and deeper learning, mastery of content, problem solving, team work and communication skills besides general engagement and enjoyment of learning including systematic research in India.

The overall objectives of the learning outcomes-based curriculum framework are to:

- Help formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes that are expected to be demonstrated by the holder of a qualification;
- Enable prospective students, parents, employers and others to understand the nature and level of learning outcomes (knowledge, skills, attitudes and values) or attributes a graduate of a programme should be capable of demonstrating on successful completion of the programme of study.

Programme Educational Objectives (PEOs):

PEO1 Higher Education: Empower students to pursue higher studies in various fields of Biology and Chemistry.

PEO2 Career: Enable students to pursue careers in Chemical, Biological and related fields as demonstrated by professional success at positions within industry, government, or academia.

PEO3 Social responsibility: Enable students to exhibit professionalism, ethical attitude, communication skills and team work in their profession.

Program Outcomes (POs):

The Learning Outcomes of the programme could be in consonance with the Bloom's Taxonomy, which includes –

1. Remember (Lower order)
2. Understand (Lower Order)
3. Apply (Lower Order)
4. Analyze (Higher Order)

5. Evaluate& Problem Solving (Higher Order)
6. Create (Higher Order)

PO1Critical thinking: Able to understand and utilize the principles of scientific enquiry, think analytically, clearly and evaluate critically while solving problems and making decisions during biological study.

PO2Effective communication: Able to formally communicate Scientific ideas and investigations of the biology discipline to others using both oral and written communication skills.

PO3Social interaction: Able to develop individual behaviour and influence society and social structure.

PO4Effective citizenship: Able to work with a sense of responsibility towards social awareness and follow the ethical standards in the society.

PO5Ethics: Ability to demonstrate and discuss ethical conduct in scientific activities.

PO6Environment and Sustainability: Able to understand the impact of biological science in societal and environmental contexts and demonstrate the knowledge for sustainable development.

PO7Self-directed and life-long learning: Able to recognize the need of life-long learning and engage in research and self-education.

Domain Subject: ZOOLOGY

***(Syllabus with Outcomes, Co-curricular Activities, References & Model Q.P
for Five Courses of 1, 2, 3, 4 & 5 Semesters)***

“The domain subject “Zoology”, embracing the fields of Animal diversity, Cell biology, Genetics, evolution, Animal physiology, Biochemistry, Embryology, Immunology, Molecular biology and Ecology gives the student a broad understanding of faunal diversity, various life processes involved in the development of an animal, its functioning, its response to environmental stimuli, molecular basis of life, new technological approach towards life, an insight for the lecturer into research and responsibility of the student towards environment”.

GENERAL CURRICULAR ACTIVITIES

➤ Lecturer-based:

- 1) **Class-room activities:** Organization of Group discussions, question-answer sessions, scientific observations, use of audio-visual aids, guidance programmes, examination and evaluation work (scheduled and surprise tests), quizzes, preparation of question banks, student study material, material for PG entrance examinations etc.
- 2) **Library activities:** Reading books and magazines taking notes from prescribed and reference books and preparation of notes on lessons as per the syllabus; Reading journals and periodicals pertaining to different subjects of study; Making files of news-paper cuttings etc.
- 3) **Lab activities:** Organization of practicals, maintenance of lab attendance registers/log registers, maintenance of glassware and chemicals
- 4) **Activities in the Seminars, workshops and conferences:** Organization of at least one seminar/workshop/conference per academic year either on academic/research aspects and inculcate research spirit among students
- 5) **Research activities:** Student study projects (General / RBPT model), Minor or Major research projects, Research guidance to research scholars, Publication of research articles/papers (at least one in 2 years) in UGC-recognized journals, Registration in Vidwan/Orcid/Scopus/Web of Science
- 6) **Smart Classroom Activities:** Organization of Departmental WhatsApp groups, Edmodo groups/Google Class Rooms/Adobe Spark groups for quick delivery of the subject; Preparation of Moocs content & presentation tube lessons by trained lecturers; Using smart/digital/e- class rooms (mandatory) wherever present; Utilization of youtube videos (subject to copy rights) etc.

➤ **Student-based:**

- 1) **Class-room activities:** Power point presentations, seminars, assignments
- 2) **Library activities:** Visit to library during library hour and preparation of notes
- 3) **Lab activities:** Maintenance of observation note book and record, keeping lab clean and tidy
- 4) **Activities in the Seminars, workshops and conferences:** Participation/presentation in seminar/workshop/conference

CO-CURRICULAR ACTIVITIES

OBJECTIVES:

The co-curricular activities are aimed at strengthening the theoretical knowledge with an activity related to the content taught in the class room. The aesthetic development, character building, spiritual growth, physical growth, moral values, creativity of the student.

The different types of co-curricular activities relevant to Zoology domain are listed below:

➤ **Academic - based**

- Preparation of Charts/Clay or Thermocol Models
- Debates, Essay Writing Competitions
- Group Discussions
- Departmental (Zoology) magazine
- Formation of Book clubs
- Animal album-making
- Viva-Voce

➤ **Lab/Research –based**

- Digital dissections
- Field Visit/Excursions/Zoological Tours and submission of report
- Training at research centres (aquaculture/apiculture/sericulture etc.)
- Exposure to scientific instruments and hands-on experience

➤ **Value - based**

- Organization of first-aid camp, swachhbharat, cleanliness week, girl-child importance, Nutrition and health awareness etc.

➤ **Observation of Days of National/International Importance**

World Cancer Day (February 4 th)	International Biological Diversity Day (May 22 nd)
Darwin Day (February 12 th)	World Turtle Day (May 23 rd)
National Science Day (Feb 28 th)	World blood Donor Day (June 14 th)
World Wildlife day (March 3 rd)	World Zoonoses Day (July 6 th)
National Vaccination Day (March 16 th)	World Mosquito Day (August 20 th)
World Health Day (April 7 th)	World Turtle Day (May 23 rd)
Earth Day (April 22 nd)	World Mosquito Day (August 20 th)
Malaria Day (April 25 th)	World Animal day (October 4 th)
World Hepatitis Day (May 19 th)	World Immunization Day (November 10 th)

AP STATE COUNCIL OF HIGHER EDUCATION

w.e.f. 2020-21 (Revised in April, 2020)

ZOOLOGY – SEMESTER I

PAPER – I: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES

HOURS: 60 (5X12)

Max. Marks: 100

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

- CO1** Describe general taxonomic rules on animal classification
- CO2** Classify Protozoa to Coelenterata with taxonomic keys
- CO3** Classify Phylum Platyhelminthes to Annelida phylum using examples from parasitic adaptation and vermin composting
- CO4** Describe Phylum Arthropoda to Mollusca using examples and importance of insects and Molluscs
- CO5** Describe Echinodermata to Hemichordata with suitable examples and larval stages in relation to the phylogeny

Learning objectives

1. To understand the taxonomic position of protozoa to helminthes.
2. To understand the general characteristics of animals belonging to protozoa to hemichordata.
3. To understand the structural organization of animals phylum from protozoa to hemichordata.
4. To understand the origin and evolutionary relationship of different phyla from protozoa to hemichordata.
5. To understand the origin and evolutionary relationship of different phylum from annelids to hemichordates.

ZOOLOGY SYLLABUS FOR I SEMESTER

PAPER – I: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES

HOURS:60 (5X12)

Max. Marks: 100

UNIT I

- 1.1 Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature
- 1.2 Whittaker's five kingdom concept and classification of Animal Kingdom.

Phylum Protozoa

- 1.3 General Characters and classification of protozoa up to classes with suitable examples
- 1.4 Protozoan – Pathogenicity (Trypanosoma, Plasmodium, Giardia, Leishmania, Trichomonas – causative agent, mode of infection, symptoms, Prevention and Controlling measures)
- 1.5 *Elphidium* (type study)

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

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 helminthes

Phylum Nemathelminthes

- 3.4 General characters and classification up to classes with suitable examples
- 3.5 Life cycle and pathogenecity of *Ascarislumbricoides*

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

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 Economic Impotance of insects- Silkworms, Honey bee and Lac insect.

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 Thermocol 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, 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"

ZOOLOGY MODEL PAPER FOR I SEMESTER

ZOOLOGY - PAPER - I

ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

- 9.

OR

- 10.

OR

- 11.

OR

- 12.

OR

13.

OR

□□□□□

ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER

ZOOLOGY - PAPER - I

ANIMAL DIVERSITY - BIOLOGY OF NONCHORDATES

Periods: 24

Max. Marks: 50

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*, *Paramoecium*, *Paramoecium* Binary fission and Conjugation, *Vorticella*, *Entamoebahistoltytica*, *Plasmodium vivax*

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

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

Platyhelminthes: *Planaria*, *Fasciola hepatica*, *Fasciolalarval* forms – Miracidium, Redia, Cercaria, *Echinococcusgranulosus*, *Taeniasolium*, *Schistosomahaematobiumvii*.

Nemathelminthes: *Ascaris*(Male & Female), *Drancunculus*, *Ancylostoma*, *Wuchereria*

Annelida: *Nereis*, *Aphrodite*, *Chaetopteurs*, *Hirudinaria*, Trochophore larva

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

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

Echinodermata: *Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon*,
Bipinnaria larva

Hemichordata: *Balanoglossus*, Tornaria larva

2. Dissections:

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

2. Insect Mouth Parts

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

4. 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

5. Computer - aided techniques should be adopted or show virtual dissections

REFERENCE 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
International Edition

AP STATE COUNCIL OF HIGHER EDUCATION

w.e.f. 2020-21 (Revised in April, 2020)

ZOOLOGY –SEMESTER II

PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

HOURS :60 (5X12)

Max. Marks:100

Course Outcomes:

By the completion of the course the graduate should be able to -

CO1 Describe general taxonomic rules on animal classification of chordates

CO2 Classify Protochordata to Mammalia with taxonomic keys

CO3 Understand Mammals with specific structural adaptations

CO4 Understand the significance of dentition and evolutionary significance

CO5 Understand the origin and evolutionary relationship of different phyla from Protochordata to mammalia.

Learning objectives

1. To understand the animal kingdom .
2. To understand the taxonomic position of Protochordata to Mammalia.
3. To understand the general characteristics of animals belonging to Fishes to Reptilians.
4. To understand the body organization of Chordata.
5. To understand the taxonomic position of Protherian mammals.

ZOOLOGY SYLLABUS FOR II SEMESTER

PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

HOURS: 60 (5X12)

Max. Marks: 100

Unit - I

- 1.1 General characters and classification of Chordata upto classes
- 1.2 Protochordata- Salient features of Cephalochordata , Affinities of Cephalochordata.
- 1.3 Salient features of Urochordata
- 1.4 Structure and life history of *Herdmania* (Retrogressive metamorphosis)

Unit - II

- 2.1 Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*
- 2.2 Pisces : General characters of Fishes
- 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

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 upto orders with examples
- 3.5 *Calotes*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 3.6 Identification of Poisonous and Non-poisonous snakes.

Unit - IV

- 4.1 Aves General characters and classification (**Ratitae and Carinatae**)
- 4.2 *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 4.3 Migration in Birds
- 4.4 Flight adaptation in birds

Unit - V

- 5.1 General characters of Mammalia
- 5.2 Classification of Mammalia upto sub - classes with examples
- 5.3 Comparison of Prototherians, Metatherians and Eutherians
- 5.4 Dentition in mammals

Co-curricular activities (suggested)

- Preparation of charts on Chordate classification (with representative animal photos) and retrogressive 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 study notes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrate heart/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

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- Arumugam, N. Chordate Zoology, Vol. 2. SarasPlublication. 278 pages. 200 figs.
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- 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.
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- 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.

ZOOLOGY MODEL PAPER FOR II SEMESTER

ZOOLOGY - PAPER - II

ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

1. *Amphioxus*
2. Placoid scale
3. Quill feather
4. Prototheria
5. Anadromous migration
6. *Draco*
7. Emu
8. Apoda

II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

9. Explain the life history of *Herdmania*

OR

Explain the origin and general characters of chordates

10. Compare the characters of *Petromyzon* and *Myxine*

OR

Describe the structure of heart of *Scoliodon*

11. Describe the brain of *Rana hexadactyla*

OR

Explain the external features of *Calotes*

12. Write an essay on flight adaptations in birds

OR

Explain the respiratory system of *Columba livia*

13. Compare the characters of Metatheria and Eutheria

OR

Write an essay on dentition in mammals

□ □ □ □ □

ZOOLOGY PRACTICAL SYLLABUS FOR II SEMESTER

ZOOLOGY - PAPER - II

ANIMAL DIVERSITY - BIOLOGY OF CHORDATES

Periods: 24

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 – Vertebrata
2. P.S.Verma, A manual of Practical Zoology – Chordata

AP STATE COUNCIL OF HIGHER EDUCATION

w.e.f. 2020-21 (Revised in April, 2020)

ZOOLOGY – SEMESTER III

**PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND
EVOLUTION**

HOURS:60 (5X12)

Max. Marks:100

Course Outcomes:

The overall course outcome is that the student shall develop deeper understanding of what life is and how it functions at cellular level. This course will provide students with a deep knowledge in Cell Biology, Animal Biotechnology and Evolution and by the completion of the course the graduate shall able to –

- CO1** To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.
- CO2** Describe fine structure and function of plasma membrane and different cell organelles of eukaryotic cell.
- CO3** To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes, various types of inheritance patterns existing in animals
- CO4** Acquiring in-depth knowledge on various aspects of genetics involved in sex determination, human karyotyping and mutations of chromosomes resulting in various disorders
- CO5** Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins.
- CO6** Understand the principles and forces of evolution of life on earth, the process of evolution of new species and apply the same to develop new and advanced varieties of animals for the benefit of the society

Learning Objectives

- To understand the origin of cell and distinguish between prokaryotic and eukaryotic cell
- To understand the role of different cell organelles in maintenance of life activities
- To provide the history and basic concepts of heredity, variations and gene interaction
- To enable the students distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance.
- To acquaint student with basic concepts of molecular biology as to how characters are expressed with a coordinated functioning of replication, transcription and translation in all living beings
- To provide knowledge on origin of life, theories and forces of evolution
- To understand the role of variations and mutations in evolution of organisms

ZOOLOGY SYLLABUS FOR III SEMESTER
PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND
EVOLUTION

HOURS: 60 (5X12)

Max. Marks: 100

Unit – I Cell Biology

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
- 1.2 Electron microscopic structure of animal cell.
- 1.3 Plasma membrane –Models and transport functions of plasma membrane.
- 1.4 Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes
- 1.5 Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

(Note: 1. General pattern of study of each cell organelle – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams)
2. Need not study cellular respiration under mitochondrial functions)

Unit – II Genetics - I

- 2. 1 Mendel's work on transmission of traits
- 2. 2 Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes
- 2. 3 Polygenes (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance)
- 2. 4 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)
- 2. 5 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

Unit – III Genetics - II

- 3.1 Mutations & Mutagenesis
- 3.2 Chromosomal Disorders (Autosomal and Allosomal)
- 3.3 Human Genetics – Karyotyping, Pedigree Analysis (basics)
- 3.4 Basics on Genomics and Proteomics

UNIT IV: Molecular Biology

- 4.1 Central Dogma of Molecular Biology

4.2 Basic concepts of -

- a. DNA replication – Overview (Semi-conservative mechanism, Semi-discontinuous mode, Origin & Propagation of replication fork)
- b. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications (basics)
- c. Translation – Initiation, Elongation and Termination

4.3 Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

Unit - V

5.1 Origin of life

5.2 Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory

5.3 Neo-Darwinism: Modern Synthetic Theory of Evolution, Hardy-Weinberg Equilibrium

5.4 Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

Co-curricular activities (Suggested)

- Model of animal cell
- Working model of mitochondria to encourage creativity among students
- Photo album of scientists of cell biology
- Charts on plasma membrane models/cell organelles
- Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
- Observation of blood group inheritance in students, from their parents and grand parents
- Karyotyping and preparation of pedigree charts for identifying diseases in family history
- Charts on chromosomal disorders
- Charts on central dogma/lac operon/genetic code
- Model of semi-conservative model of DNA replication
- Model of tRNA and translation mechanism
- Power point presentation of transcription or any other topic by students
- Draw geological time scale and highlight important events along the time line

- Chart on industrial melanism to teach directed selection, Darwin's finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.

REFERENCES:

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2. Cell Biology by De Robertis
3. Bruce Alberts, Molecular Biology of the Cell
4. Rastogi, Cytology
5. Varma & Aggarwal, Cell Biology
6. C.B. Pawar, Cell Biology
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21. Gupta P.K., 'Genetics

ZOOLOGY MODEL PAPER FOR III SEMESTER

ZOOLOGY - PAPER - III

CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

- 9.

OR

- 10.

OR

- 11.

OR

- 12.

OR

- 13.

OR

□ □ □ □ □

ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER

ZOOLOGY - PAPER - III

CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION

Periods: 24

Max. Marks: 50

Learning Objectives:

- Acquainting and skill enhancement in the usage of laboratory microscope
- Hands-on experience of different phases of cell division by experimentation
- Develop skills on human karyotyping and identification of chromosomal disorders
- To apply the basic concept of inheritance for applied research
- To get familiar with phylogeny and geological history of origin & evolution of animals

I. Cell Biology

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 *Chironomus*

II. Genetics

1. Study of Mendelian inheritance using suitable examples and problems
2. Problems on blood group inheritance and sex linked inheritance
3. Study of human karyotypes (Down's syndrome, Edwards, syndrome, Patau syndrome, Turner's syndrome and Klinefelter syndrome)

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. Study of Genetic Drift by using examples of Darwin's finches (pictures)
5. Visit to Natural History Museum and submission of report

REFERENCE BOOKS

1. Burns GW. 1972. *The Science of Genetics. An Introduction to Heredity*. Mac Millan Publ. Co.Inc.
2. Gardner EF. 1975. *Principles of Genetics*. John Wiley & Sons, Inc. New York.
3. Harth and Jones EW. 1998. *Genetics – Principles and Analysis*. Jones and BarHett Publ. Boston.
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AP STATE COUNCIL OF HIGHER EDUCATION

w.e.f. 2020-21 (Revised in April, 2020)

ZOOLOGY – SEMESTER IV

**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND
EMBRYOLOGY**

HOURS : 60 (5X12)

Max. Marks: 100

Course Outcomes:

This course will provide students with a deep knowledge in Physiology, Cellular metabolism and Molecular Biology and by the completion of the course the graduate shall able to –

CO1 Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.

CO2 Understand the muscular system and the neuro-endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.

CO3 Describe the structure, classification and chemistry of biomolecules and enzymes responsible for sustenance of life in living organisms

CO4 Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules

CO5 Describe the key events in early embryonic development starting from the formation of gametes upto gastrulation and formation of primary germ layers.

Learning Objectives

- To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals.
- To instil the concept of hormonal regulation of physiology, metabolism and reproduction in animals.
- To understand the disorders associated with the deficiency of hormones
- To demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- To provide insightful knowledge on the structure and classification of carbohydrates, proteins, lipids and enzymes
- To demonstrate an understanding of fundamental biochemical principles such as the function of biomolecules, metabolic pathways and the regulation of biochemical processes
- To make students gain proficiency in laboratory techniques in biochemistry and orient them to apply the scientific method to the processes of experimentation and hypothesis testing.

ZOOLOGY SYLLABUS FOR IV SEMESTER
PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND
EMBRYOLOGY

HOURS: 60 (5X12)

Max. Marks: 100

UNIT I Animal Physiology - I

1.1 Process of digestion and assimilation

1.2 Respiration - Pulmonary ventilation, transport of oxygen and CO₂

(Note: Need not study cellular respiration here)

1.3 Circulation - Structure and functioning of heart, Cardiac cycle

1.4 Excretion - Structure and functions of kidney urine formation, counter current Mechanism

UNIT II Animal Physiology - II

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

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

2.3 Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas

2.4 Hormonal control of reproduction in a mammal

UNIT III Cellular Metabolism – I (Biomolecules)

3.1 Carbohydrates - Classification of carbohydrates. Structure of glucose

3.2 Proteins - Classification of proteins. General properties of amino acids

3.3 Lipids - Classification of lipids

3.4 Enzymes: Classification and Mechanism of Action

UNIT IV Cellular Metabolism – II

4.1 Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis

4.2 Lipid Metabolism – β -oxidation of palmitic acid

4.3 Protein metabolism - Transamination, Deamination and Urea Cycle

Unit – V Embryology

- 5.1 Gametogenesis
- 5.2 Fertilization
- 5.3 Types of eggs
- 5.4 Types of cleavages
- 5. 5 Development of Frog upto formation of primary germ layers
- 5.6 Types of Placenta

Co-curricular activities (Suggested)

- Chart on cardiac cycle, human lung, kidney/nephron structure etc.
- Working model of human / any mammalian heart.
- Chart of sarcomere/location of endocrine glands in human body
- Chart affixing of photos of people suffering from hormonal disorders
- Student study projects such as identification of incidence of hormonal disorders in the local primary health centre, studying the reasons thereof and measures to curb or any other as the lecturer feels good in nurturing health awareness among students
- Chart on structures of biomolecules/types of amino acids (essential and non-essential)Chart preparation by students on Glycolysis / kreb's cycle/urea cycle etc.
- Model of electron transport chain
- Preparation of models of different types of eggs in animals
- Chart on frog embryonic development, fate map of frog blastula, cleavage etc.

REFERENCE BOOKS

1. Eckert H. *Animal Physiology: Mechanisms and Adaptation*. W.H. Freeman & Company.
2. Flöray E. *An Introduction to General and Comparative Animal Physiology*. W.B. Saunders Co., Philadelphia.
3. Goel KA and Satish KV. 1989. *A Text Book of Animal Physiology*, Rastogi Publications, Meerut, U.P.
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7. Developmental Biology by Balinsky
8. Developmental Biology by Gerard Karp
9. Chordate embryology by Varma and Agarwal
10. Embryology by V.B. Rastogi
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ZOOLOGY MODEL PAPER FOR IV SEMESTER

ZOOLOGY - PAPER - IV

ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

Time : 3 hrs

Max. Marks : 75

I. Answer any FIVE of the following :

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

- 9.

OR

- 10.

OR

- 11.

OR

- 12.

OR

13.

OR

□□□□□

ZOOLOGY PRACTICAL SYLLABUS FOR IV SEMESTER

ZOOLOGY - PAPER - IV

ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

Periods: 24

Max. Marks: 50

Learning Objectives:

- Identification of an organ system with histological structure
- Deducing human health based on the information of composition of blood cells
- Demonstration of enzyme activity *in vitro*
- Identification of various biomolecules of tissues by simple colorimetric methods and also quantitative methods
- Identification of different stages of earl embryonic development in animals

I. ANIMAL PHYSIOLOGY

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Study of activity of salivary amylase under optimum conditions
3. T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
4. Differential count of human blood

II. CELLULAR METABOLISM

1. Estimation of total proteins in given solutions by Lowry's method.
2. Estimation of total carbohydrate by Anthrone method.
3. Qualitative tests for identification of ammonia, urea and uric acid
4. Protocol for Isolation of DNA in animal cells

III. 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. Construction of fate map of frog blastula

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

AP STATE COUNCIL OF HIGHER EDUCATION

w.e.f. 2020-21 (Revised in April, 2020)

ZOOLOGY – SEMESTER IV

COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

HOURS : 60 (5X12)

Max. Marks: 100

Course Outcomes:

This course will provide students with a deep knowledge in immunology, genetics, embryology and ecology and by the completion of the course the graduate shall able to –

- CO1** To get knowledge of the organs of Immune system, types of immunity, cells and organs of immunity.
- CO2** To describe immunological response as to how it is triggered (antigens) and regulated (antibodies)
- CO3** Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.
- CO4** Get familiar with the tools and techniques of animal biotechnology.

Learning Objectives

- To trace the history and development of immunology
- To provide students with a foundation in immunological processes
- To be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major Histocompatibility Complex in terms of immune response and transplantation
- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
 - To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
 - To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.

- To understand principles of animal culture, media preparation.

ZOOLOGY SYLLABUS FOR SEMESTER - IV
COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

HOURS : 60 (5X12)

Max. Marks: 100

Unit – I Immunology – I (Overview of Immune system)

- 1.1 Introduction to basic concepts in Immunology
- 1.2 Innate and adaptive immunity, Vaccines and Immunization programme
- 1.3 Cells of immune system
- 1.4 Organs of immune system

Unit – II Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)

- 2.1 Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants; Factors influencing immunogenicity
- 2.2 Antibodies: Structure of antibody, Classes and functions of antibodies
- 2.3 Structure and functions of major histocompatibility complexes
- 2.4 Exogenous and Endogenous pathways of antigen presentation and processing
- 2.5 Hypersensitivity – Classification and Types

Unit – III Techniques

- 2.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
- 2.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures
- 2.3 Stem cells: Types of stem cells and applications
- 2.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

Unit – IV Applications of Animal Biotechnology

- 3.1 Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology
- 3.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery
- 3.3 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications
- 3.4 Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

Unit - V

- 1.1. PCR: Basics of PCR.
- 4.2 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)
- 4.3 Hybridization techniques: Southern, Northern and Western blotting
- 4.4 DNA fingerprinting: Procedure and applications
- 4.5 Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

Co-curricular activities (suggested)

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students
- Visit to research laboratory in any University as part of Zoological tour and exposure and/or hands-on training on animal cell culture.
- Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishes etc.

REFERENCE BOOKS

1. Immunology by Ivan M. Riott
2. Immunology by Kubey
3. Sreekrishna V. 2005. *Biotechnology –I, Cell Biology and Genetics*. New Age International Publ.New Delhi, India.

ZOOLOGY MODEL PAPER FOR V SEMESTER

COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Time: 3 hrs

Max. Marks: 75

I. Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

II. Answer any FIVE of the following:

5x10=50

Draw labeled diagrams wherever necessary

- 9.

OR

- 10.

OR

- 11.

OR

- 12.

OR

- 13.

OR

□ □ □ □ □

ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER
COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Periods: 24

Max. Marks: 50

Learning Objectives:

- Acquainting student with immunological techniques vis-à-vis theory taught in the classroom
- Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
- Demonstrate basic laboratory skills necessary for Biotechnology research
- Promoting application of the lab techniques for taking up research in higher studies

I. IMMUNOLOGY

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

II. Animal biotechnology

1. DNA quantification using DPA Method.
2. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
4. Cleaning and sterilization of glass and plastic wares for cell culture.
5. Preparation of culture media.

REFERENCE BOOKS

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson

2. Practical Immunology A Laboratory Manual; LAP LAMBERT Academic Publishing

3. Manual of laboratory experiments in cell biology by Edward, G

4. Laboratory Techniques by Plummer

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ANDHRAPRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

REVISED UG SYLLABUS UNDER CBCS

(Implemented from Academic Year - 2020-21)

PROGRAMME: FOUR YEAR B.SC. (Hons)

Domain Subject: ZOOLOGY

Skill Enhancement Courses (SECs) for Semester V, from 2022-23

(Syllabus with Learning Outcomes, References, Co-curricular Activities & Model Q.P. Pattern)

Structure of SECs for Semester-V

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

Univ Code	Course Number	Name of Course	Hours/Week Theory +Practical	Credits Theory+ Practical	Marks	
					IA-20 FW- 05	Sem End T+P
	6&7					
	6A	SUSTAINABLE AQUACULTURE MANAGEMENT	3+3	3+2	25	75+50
	7A	POST HARVEST TECHNOLOGY OF FISH AND FISHERIES	3+3	3+2	25	75+50

OR

	6B	LIVE STOCK MANAGEMENT-I (BIOLOGY OF DAIRY ANIMALS)	3+3	3+2	25	75+50
	7B	LIVE STOCK MANAGEMENT -II (DAIRY PRODUCTION AND MANAGEMENT)	3+3	3+2	25	75+50

OR

	6C	POULTRY MANAGEMENT- I (POULTRY FARMING)	3+3	3+2	25	75+50
	7C	POULTRY MANAGEMENT- II (POULTRY PRODUCTION AND MANAGEMENT)	3+3	3+2	25	75+50

OR

	6D	SERI CULTURE -I***	3+3	3+2	25	75+50
	7D	SERI CULTURE -II	3+3	3+2	25	75+50

*** To be taught by Zoology Teachers

Note: For Semester-V, for the domain subject Zoology, any one of the four pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C or 6D & 7D. The pair shall not be broken (ABCD allotment is random, not on any priority basis).

Note-2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.

Four – year B.Sc. (Hons)
Domain Subject: ZOOLOGY
IV Year B. Sc.(Hons)–Semester –V

Max Marks: 100+50

Course6 B: LIVE STOCK MANAGEMENT-I
(BIOLOGY OF DAIRY ANIMALS)
(Skill Enhancement Course (Elective), - Credits: 05)

I. Learning Outcomes:

- Students at the successful completion of the course will be able to
- Select the suitable breeds of livestock for rearing
- Relate the anatomy of udder with letdown of milk
- Identify and manipulate the reproductive behavior of cattle
- Inspect the economics of dairy farming
- Apprise the various breeding techniques employed in live stock

II. Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit 1: Livestock census; Breeds of Dairy cattle, Buffaloes and Goats. Indigenous, Exotic and Crossbred Cattle breeds any three.

Unit 2: Anatomy of Udder; Development of udder; Lacto genesis and Galactopoises; Letdown of milk.

Unit 3: Artificial insemination; Oestrous cycle; Symptoms of heat in cows and buffaloes. Conception, Pregnancy diagnosis in cattle. Multi ovulation and embryo transfer technique. Cloning.

Unit4: Economic traits of Dairy cattle. Methods of selection of dairy animals.

Unit5: Systems of Dairy cattle breeding. Inbreeding, out breeding, Cross breeding, Grading up. Breeding systems (Cross breeding of cattle and Grading up of buffaloes).

III. References:

1. Textbook of Animal Husbandry-GC Benarjee
2. Handbook of Animal Husbandry –ICAR Edition
3. Principles and practices of Dairy Farm–Jagdish Prasad

Web resources:

1. <http://ecoursesonline.iasri.res.in/course/index.php?categoryid=42>
2. <https://vetsebooks.blogspot.com/p/e-books.html>
3. <https://www.basu.org.in/study-materials/veterinary-science/>
4. <https://vikaspedia.in/agriculture/livestock/cattle-buffalo/breeds-of-cattle-buffalo>

Course 6 B: LIVE STOCK MANAGEMENT-I-PRACTICAL SYLLABUS (BIOLOGY OF DAIRY ANIMALS)

IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to

1. Examine the points of dairy cow
2. Understand the behavioral changes of cow during the reproductive period
3. Differentiate the merits and demerits of cross breeds in cattle

V. Practical(Laboratory) Syllabus:(30hrs) (Max.50Marks)

1. Points dairy cow. (Explanation with observation of charts- Model evaluation to be performed by the student in the laboratory)
2. Identification of different breeds of dairy cattle and buffaloes.(Observation of Charts of breeds in the laboratory- at least 3 breeds should be identified by the students in their locality with video, photo)
3. Male and female reproductive systems of cow – Model/ Chart (Student has to draw a labeled diagram of the male and female reproductive systems of cow – acquire skill to identify the parts).
4. Symptoms of heat in cow (Study and Understanding the physiological symptoms during heat).
5. Artificial in semi nation (Flow chart of implements – Procedure- precautions)
6. Pregnancy diagnosis in cattle.
7. Study comparative merits of cows and buffaloes; zebu and cross bred cows (Examination of merits

VI. Lab References:

1. Principles and practices of Dairy Farm–Jadish Prasad
2. Dairy cow points: <https://www.icar.org/Guidelines/05-Conformation-Recording.pdf>
3. Pregnancy test protocol: <https://cgspace.cgiar.org/bitstream/handle/10568/109408/Milk%20testing%20lab%20protocol.pdf?sequence=1&isAllowed=y>

Web resources suggested by the teacher concerned and the college librarian including reading material

VII. Co-Curricular Activities

a) **Mandatory:**(Lab/ field training of students by teacher :(lab:10 + filed: 05):

1. For Teacher: Training of students by the teacher in laboratory/field for not less than 15 hours on principles and practices of dairy industry- breeds –artificial insemination- reproductive behavior of cows etc. as per the syllabus above.
2. For Student: Students shall individually visit to any of the nearby cattle rearing centers/ veterinary hospital/Raithu Bharosa Kendra and make observations of the procedure and quality enhancement activities and submit a handwritten Fieldwork/Project work Report in 10 pages.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements*
5. (IE)Unit tests,

b) **Suggested Co-Curricular Activities**

1. Collection of various cattle breed images from the web to prepare a album
2. Visit the sites of Veterinary colleges in India and preparation of brief report on the videos and content/ employment details
3. Sketch a model dairy farm with details
4. Invited lecture and presentation on related topics by experts
5. Seminar, Assignment, Group discussion. Quiz, Collection of Material, Invited lecture, Video preparation etc.

Four – year B.Sc. (Hons)
Domain Subject: ZOOLOGY
IV Year B. Sc.(Hons)–Semester –VY

Max Marks: 100+50

Course 7B: LIVE STOCK MANAGEMENT -II
(DAIRY PRODUCTION AND MANAGEMENT)
(Skill Enhancement Course (Elective), - Credits: 05)

I. Learning Outcomes:

Students at the successful completion of the course will be able to

- Identify and suggest the suitable housing system for the dairy farming
- Understand management practices for the dairy farming
- Learn the process of milk pasteurization
- Prepare cream from milk

II. Syllabus: *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit1: Systems of Housing of Dairy cattle- Loose Housing and Conventional Dairy Barns. Drawing of layouts for dairy cattle dwellings; Criteria for selecting site for establishing Dairy farm buildings; Water requirement of dairy animals.

Unit2: Management of different classes of Dairy animals- Milk producing animals, pregnant animals dry animals, heifers and calves. Management practices for Dairy farm; Identification, Dehorning, Castration, Deworming, Vaccination, Disinfection, and Milking.

Unit 3: (a) Pasteurization of milk: Definition, objects of pasteurization, objections to pasteurization, Principles of heat exchange. Methods of pasteurization: LTLT, HTST and Uperization.
(b) Sterilization of milk. Homogenization: Factors influencing homogenization

Unit 4: Market milk: Toned milk, double toned milk, Reconstituted milk, Standardized milk and full cream milk–Standards and methods of manufacture.

Unit 5: Cream: Types of cream, composition, methods of cream separation, gravity and centrifugal methods, types of cream separators, factors affecting fat losses in skim milk and fat percentage in cream.

III. References:

1. Textbook of Animal Husbandry-G C Benarjee
2. Handbook of Animal Husbandry –ICAR Edition
3. Principles and practices of Dairy Farm–Jagdish Prasad
4. <http://ecoursesonline.iasri.res.in/course/index.php?categoryid=42>
5. <https://vetsebooks.blogspot.com/p/e-books.html>
6. <https://www.basu.org.in/study-materials/veterinary-science/>
7. <https://vikaspedia.in/agriculture/livestock/cattle-buffalo/breeds-of-cattle-buffalo>

Course 7 B: LIVE STOCK MANAGEMENT -II – PRACTICAL SYLLABUS
(DAIRY PRODUCTION AND MANAGEMENT)

IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- Design a model dairy farm layout
- Understand procedure of milk pasteurization at milk processing centers
- Identify various important management practices in dairy farming

V. Practical (Laboratory) Syllabus:(30hrs) (Max.50Marks)

1. Dairy Farm layout (In the laboratory student has to sketch a dairy farm with all its components)
2. Identification of cows (students have to identify the breeds of cows from the images/charts – have to identify any two breeds in the vicinity of the college/ their locality).
3. Dehorning of calves : (Method - protocol- precautions)
4. Castration of bulls (Method – Apparatus- Time-importance)
5. Deworming of dairy cattle : (Schedule – method- benefits)
6. Pasteurization of milk (Batch Method- procedure- Observation)
7. Sterilization of milk (In bottle sterilization- procedure – protocol)
8. Cream separation (By gravity method- procedure- hands on experiment)

VI. Lab References

1. Handbook of Animal Husbandry –ICAR Edition
2. Dairy farm layout : <https://www.youtube.com/watch?v=dmukHUEUvKc>
3. Dehorning procedure : <http://www.omafra.gov.on.ca/english/livestock/dairy/facts/09-003.htm>
4. Castration of bulls: <https://vikaspedia.in/agriculture/livestock/general-management-practices-of-livestock/castration-of-ruminants>
5. Deworming: https://kvk.icar.gov.in/API/Content/PPupload/k0347_10.pdf
6. Pasteurization of milk : <http://www.jnkvv.org/PDF/08042020170652part%203.pdf>
7. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1690>
8. Cream separation: <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=147910>

Web resources suggested by the teacher concerned and the college librarian including reading material

VII. Co-Curricular Activities

a) **Mandatory:** (Lab/field training of students by teacher; lab 10+ field :05)

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on skills of dairy management – housing-management of dairy animals of various stages- procedure of preparation of marketable milk with procedures like sterilization, pasteurization and other techniques)
2. For Student: Student shall (individually) visit a nearby dairy farm- house hold cattle rearing – make observations on aspects like housing – management – feed- milk- revenue- breed selection- qualities of breed –etc. A handwritten Fieldwork/Project work Report to be submitted in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.*
5. (IE) Unit tests.

b) Suggested Co-Curricular Activities

1. Sketch model dairy house with details
2. Web resources on Protocols in the management of stages of cattle
3. Properties of varieties of milk from the market observation
4. Assignment, Seminar, Invited lecture, Group discussion. Quiz, Collection of Material, Video preparation etc.

Suggested Question Paper Pattern
Semester-wise Revised Syllabus under CBCS, 2020-21

Four – year B.Sc.(Hons)
Domain Subject: ZOOLOGY
IV Year B. Sc.(Hons)–Semester –V

Course Code:

Max.Marks:75

Time:3 hrs

SECTION - A(Total: 10 Marks)

Very Short Answer Questions (10 Marks: 5x2)

1.
2.
3.
4.
5.

SECTION - B (Total: 5x5=25Marks)

(Answer any Five questions. Each answer carries 5 marks) (At least 1 question should be given from each Unit)

6.
7.
8.
9.
10.
11.
12.
13.

SECTION C

(Total: 4x10 = 40 Marks)(Answer any four questions. Each answer carries 10 marks
(At least 1 question should be given from each Unit)

14.
15.
16.
17.
18.
19.

@ @ @ @ @ @ @ @ @ @ @ @ @ @

Draft Syllabus Prepared by;

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