SHIVAJI UNIVERSITY, KOLHAPUR.

B

Accredited By NAAC

2009

Revised Syllabus For

Bachelor of Science (part III) Zoology,

(Subject to modifications to be made time to time)

Syllabus to be implemented from June 2013

SHIVAJI UNIVERSITY, KOLHAPUR
Revised Syllabus for Bachelor of Science
B. Sc. III – Zoology –To be implemented from June 2013

GENERAL OBJECTIVES OF THE COURSE

A) Aims:

1) To impart the knowledge of animal science to the pupils.
2) To make the pupils to use the knowledge in their daily life.
3) To make the pupils aware of natural resources and environment.
4) Application of knowledge in Zoology for nutrition, agriculture & live stock.
5) To provide practical experiences which form a part of their learning processes.
6) To develop aptitude for scientific work & ability to pursue studies far beyond graduation.
7) To encourage the pupils to take life science as a carrier which is the need now a days.
8) To make the pupils fit for the society.

B) Objectives -

1) To impart knowledge is the basic aim of education. The students are expected to acquire the knowledge of animal science, natural phenomenon, manipulation of nature & environment by man.
2) Understanding the scientific terms, concepts, facts, phenomenon & their interrelationships.
3) Applications of the knowledge.
4) To develop skills in practical work, experiments & laboratory materials, instruments.
5) To develop interests in the subject & scientific hobbies.
6) To develop scientific attitude which is the major objective? This makes the students open minded, critical observations, curiosity, thinking etc.
7) Abilities to apply scientific methods, collection of scientific data, problem solving, organize science exhibitions, clubs etc.
8) Appreciation of the subject, contributions of scientists, scientific methods, scientific programs etc.

5. DURATION

- The course shall be full time course.
- The duration of course shall be three years.

6. PATTERN

Pattern of Examination will be semester for theory and annual for practical
With INTERNAL ASSESSMENT (Project/Seminar/Field work for theory) Scheme

10. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English.

11. STRUCTURE OF COURSE

B.Sc. III – Zoology
THEORY – No. of papers : Eight, Practicals: No of practicals : Four
SEMESTER V-Paper IX to XII & SEMESTER **VI**- Paper XIII to XVI

SEMESTER-V Theory

Sr. No.	Subject		Marks	Uni.	Internal
1	Zoology	Paper- IX	**50**	**40**	**10**
2	Zoology	Paper- X	**50**	**40**	**10**
3	Zoology	Paper- XI	**50**	**40**	**10**
4	Zoology	Paper- XII	**50**	**40**	**10**

Total=200

SEMESTER-VI Theory

Sr. No.	Subject		Marks	Uni.	Internal
5	Zoology	Paper- XIII	**50**	**40**	**10**
6	Zoology	Paper- XIV	**50**	**40**	**10**
7	Zoology	Paper- XV	**50**	**40**	**10**
8	Zoology	Paper- XVI	**50**	**40**	**10**

Total = 200

PRACTICALS- Annual

09	Practical—I	50
10	Practical – II	50
11	Practical – III	50
12	Practical – IV	50
	Total	**200**

Total = 600

12. SCHEME OF TEACHING AND EXAMINATION

Teaching scheme (Hrs/Week)

Sr. No	Sem. - V	Sem. - VI	L	P	Total
1	Paper No IX	Paper No. XIII	3		
2	Paper No X	Paper No XIX	3		
3	Paper No XI	Paper No XV	3		
4	Paper No XII	Paper No XVI	3		
	Total		12		12
	Practical I- P			5	
	Practical II- P			5	
	Practical III- P			5	
	Practical IV- P			5	
	Total			20	20
	Total				**32**

13 SCHEME OF EXAMINATION

Question paper will be set in the view of the / in accordance with the entire syllabus and preferably covering each unit of syllabi.

14. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS (FOR REVISED SYLLABUS)

Refer copy of revised syllabus

14. **OTHER FEATURES**

1. Required Books, Journals stated in each syllabus of Part I, Part II and Part III Zoology and Fisheries.

A) LIBRARY :

Reference and Text Books, Journals, and Periodicals, Reference Books for Advanced Studies.

B) SPECIFIC EQUIPMENTS: Necessary to run the Course (T.V., L.C.D., and Overhead Projector), (Computer and necessary software's, operating systems etc.)

C) LABORATORY SAFETY EQUIPMENTS

- Fire Extinguishers at least two sets in each laboratory. (Lab. area 600 sq.ft.)
- Leakage of gases be avoided.
- Primary medical aid box (First Aid Kit)
- Sugar / Glucose – 500 gm pack: Pinch of sugar and a cup of drinking water in hypoglycemic condition. OR In extreme weakness of student or person concerned.
- Rules of animal ethics should be strictly followed.

D. **LABORATORY INSTRUCTIONS**

1) Always wear an apron inside the laboratory. Do not wear it outside.
2) Do not drink or eat inside the laboratory.
3) Do not place pencil, fingers or any material in the mouth. Moisten labels with water.
4) Use microscopes and other instruments carefully.
5) Discard all used glassware such as test tube, pipettes, petry-plates, glass slides in a receptacle meant for it.
6) Put cotton plugs, papers, matches, waste dissection material etc. in a waste-paper basket. Do not throw them in sink not leave them on desk or floor.
7) Regard all cultures as pathogenic. Take every precaution against infection.
8) Report all accidents to the instructor immediately.
9) Wash hands thoroughly with soap and water before and after dissection and experiment.
10) Always turn off water, gas and electricity before leaving the laboratory.
11) When students enter in lab. they should have – A Laboratory Journal, pencil and eraser, foot rule, dissection box with dissecting instruments, a small napkin.
12) All drawings must be made with drawing pencil only.
13) As the journal is to represent student's bonafide work during the whole year, student should keep it as clean as possible and

DO NOT LOOSE IT.

14) Students should not forget that unless their journals are certified, they are not allowed to appear for the university examination

COMMON NATURE OF QUESTION FOR THEORY PAPER MENTIONED SPERATELY:

SHIVAJI UNIVERSITY, KOLHAPUR

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To be implemented from June 2013

SEMESTER-V

PAPER - IX

FUNCTIONAL ANATOMY OF NON-CHORDATES.

Unit – I

I. **Protozoa :** (4)
   1. Nutrition in Protozoa.
   2. Reproduction in Protozoa.

II. **Porifera :** (2)
   1. Canal Systems.

III. **Coelenterata :** (4)
   1. Polymorphism.
   2. Corals and Coral reef. .

IV. Salient features of Ctenophora with suitable example (1)

V. Insect metamorphosis and its hormonal control (3)

VI. **Mollusca :**
   Torsion and Detorsion in Gastropoda (2)

Unit – II

VII. **Annelida:**

Type Study - Leech: - (15)
1. Systematic position.
2. Habits and habitat.
3. Morphology and body wall.
4. Locomotion.
5. Food, feeding and digestive system.
6. Haemo-coelomic system.
7. Excretory system.
8. Nervous system.
9. Sense organs.
10. Reproductive system, copulation and cocoon formation.
11. Parasitic adaptations.
12. Economic importance of Leech.

Unit – III

VIII. **Echinodermata:**

Type study –Sea star. - (10)

a. Systematic position.
b. Habits and habitat.
c. Morphology and body wall.
d. Food, feeding and digestive system.
e. Water vascular system and locomotion.
f. Reproductive system.
g. Nervous system and sense organs.
h. Haemal and perihaemal system.

IX. Structure and significance of Tornaria larva. (1)

X. Minor phyla: Salient features of - (3)

1. Bugula 2. Sagitta. 3. Lingula.

Total periods. - (45)

REFERENCE BOOKS:

1. Invertebrate Zoology - (W.B. Saunders Co.) - Barnes R.D.
2. Modern Text Book of Zoology, Invertebrates - R.L.Kotpal.
3. Invertebrate Zoology- E. L. Jordon, S. Chand and Co. New Delhi.
4. Life of Invertebrates - S.N. Prasad, Vikas publishing House, New Delhi.
5. Invertebrate Zoology- P.S. Dhami and J.K. Dhami, R. Chand & Co. New Delhi.
6. A Text Book of Zoology Invertebrates, Parker and Haswell, edited by Marshall and Williams, CBS Publishers and Distributors, New Delhi.
7. A Life of Invertebrates- Russell & Hunter.
8. Practical Zoology, Invertebrates- S.S. Lal.

PAPER- X

BIOSTATISTICS, BIOINFORMATICS AND MEDICAL ZOOLOGY.

Unit – I

I. Biostatistics :-

1) Classification – (2)
a) Defination
b) Collection of data
c) Basis of classification
d) Types of classification.

2) Frequency distribution - (3)

a) Principles of frequency distribution.
b) Graphical representation.
i) Histogram- equal and unequal classes.
ii) Polygon and frequency curve.
iii) Ogive curve.

3) Tabulation – (3)
a) Definition.
b) Requirements of a good table.
c) Parts of the table.
d) Types of tabulation.

4) Measures of central Tendency – mean, median, mode. (4)

5) Dispersion – Mean Deviation, Standard Deviation. (2)

Unit-II

6) Correlation- (6)
a) Scatter diagram.
b) Types of correlation.
c) Correlation coefficient and examples based on.
i) Karl Pearson's correlation coefficient.
ii) Spearman's Rank correlation coefficient.

II) Bioinformatics :-

1) Study of computer and computer devices. (2)

2) Three levels of Bioinformatics in structural Biology. (2)

3) Applications of Bioinformatics in life sciences. (1)

Unit – III

III) Medical Zoology: –

1) Brief introduction to pathogenic microbes (8)
a) Viruses – Herpes virus and Rabies Virus.
b) Spirochaetes.
c) Bacteria – *Salmonella typhii, Mycobacterium tuberculosis*

2) Pathogenic protozoans and their control. (3)
Entamoeba histolytica and Plasmodium vivax.

3) Pathogenic helminthes and their control (3)
Ascaris and Wauchereria

4) Mosquitoes as vector of the following human diseases and their control- (4)
Malaria, Dengue and Chikungunya

5) Study of following antibiotics with reference to origin, chemical nature and action.- (3)
Ampicillin and Norphloxin.

Total Periods - (45)

REFERENCE BOOKS

1.Infotechnology- S. Chand and Co.
2. Bioinformatics- Murti, Himalaya Publications.
3. General Parasitology- Cheng, T.C. Academic Press.
4. Medical Parasitology- Dey and Dey, Allied Agency, Kolkata.
5. Parasitology- K. D. Chaterjee, Chaterjee Medical Publication, Kolkata.
6. Parasitotogy-Chandler, Allied Agency, Kolkata.
7. Essentials of Parasitology - Gerald D. Smidth.
8. Economic Zoology- Shukla and Upadhyay.
9. Medical Zoology - R. C. Sobti, Shoban Lal & Co.
10. An Introduction to bioinformatics- S. Sundar rajan & R. Balaji- Himalaya Publishing house, Delhi.
11. Z S I publications.

PAPER – XI
PHYSIOLOGY

Unit – I

I. **Nutrition** - 1. Nutritional requirement & balanced diet .
2. Digestion and absorption. (5)

II. **Metabolism**- 1. Carbohydrate metabolism:- Glycogenesis, Glycogenolysis, Glycolysis, Kreb's cycle and Gluconeogenesis.
2. Protein metabolism: - Transamination, Deamination.
3. Lipid metabolism. (β- oxidation hypothesis) (8)

Unit-II

III. **Vitamins** - With reference to source, role and deficiency: - (4)
1.Water soluble B -Complex and C.
2.Fat soluble : A,D, E and K.

IV. **Respiration** - 1. Transport of respiratory gases.
2. Chemical and nervous regulation of respiration . (4)

V. **Circulation** - 1. Origin and conduction of heart beat. Cardiac cycle.
2. ECG, Blood pressure. (7)

Unit – III

VI. **Excretion** - 1. Structure of nephron & Physiology of urine formation. (4)
2. Composition of normal urine
3. Dialysis

VII. **Muscle** - 1. Ultra structure of striated muscle
2. Molecular mechanism of muscle contraction. (6)

VIII. **Nerve** - 1. Ultra structure of neuron
2. Origin and conduction of nerve impulse.
3. Synapse and synaptic transmission. (7)

Total periods. (45)

REFERENCE BOOKS –

1. General and Comparative Physiology – Hoar (Prentice Hall).
2. Animal Physiology- Nelson (Cambridge).
3. Comparative Animal Physiology – Prosser (Satish Book Enterprise).
4. Endocrinology- Hadely
5. General Endocrinology- Bagnara and Turner (W.B. Saunders)
6. Reproductive Cycle – Saidapur S. K. (Allied Publishers)
7. Reproductive Physiology – Nalbandov A. V.

PAPER – XII

ENDOCRINOLOGY, ENVIRONMENTAL BIOLOGY AND TOXICOLOGY

Unit – I

I. Endocrinology:- (14)

1. Study of endocrine glands – Anatomy , Histology and Hormones (Nature, role, regulation and disorders) with reference to the following :- Thyroid gland, parathyroid, Adrenal gland and islets of Langerhans.

Unit – II

2. Hormone receptors and Mechanism of hormonal actions (2)
3. Prostaglandins. (2)

II. Environmental Biology:-

4. Biodiversity :- (6)
   a. Definition and Scope
   b. Protection
   c. Conservation strategies
   d. Utilization
5. National parks andWild life Sanctuaries of India. (6)
   a. National parks :- Kaziranga and Sanjay Gandhi National Park.
   b. Sanctuaries :- Bharatpur and Tadoba Sanctuary.

Unit – III

6. Characteristics and faunal adaptations with references to following habitat – Freshwater, Marine water and Terrestrial (7)

III. Toxicology : (8)

7. Classification of toxicants.
8. Toxic agents and mode of action – Pesticides, Metals (Hg, Pb, Cd) and Mycotoxins.
9. Applications of Toxicology.

Total periods (45)

REFERENCE BOOKS-

1. Ecology – Odum (Amerind)
2. Limnology – Welch (McGraw Hill)
3. Introduction to Environmental Science- Y Anjaneyulu (B.S. Publications)
4. Animal Physiology – Adaptaion & Environmental- Schiemdt Nielson (Cambridge)
5. Physiology : A regulatory systems approach – Strand F. L.
(Mc Millon Publications Co.).
6. Environmental & Metabolic Animal Physiology – Prosser C.L. (Wiley – Liss Inc.).
7. Environment Physiology – Wilment P.G., Stone & Johnsion (Blackwell Science,).
8. Physiological Animal Ecology – Loan G. N. (Longman Harlog,UK)
9. Principles and methods of Toxicology – Hayes (Edited A. Wallae Hayes
Publications, Raven Press, N. Y.)
10. Medicine and Toxicology – Parekh

SEMESTER:VI

PAPER- XIII

COMPARATIVE ANATOMY OF CHORDATES

Unit – I

I**. Integument** and its derivatives. (7)
II. **Endoskeleton** –Vertebral column and appendicular skeleton (7)

Unit-II

III. **Digestive system** – Alimentary canal and associated glands. (5)
IV. **Respiratory system** - Cutaneous respiration, (5)
Gills, Lungs, Air sacs in birds
V. **Circulatory system** - Evolution of heart, aortic arches and portal systems (7)

Unit-III

VI. **Excretory system** - Evolution of kidney and its ducts. (6)
VII. **Nervous system** - Comparative anatomy of vertebrate brain. (8)

Total periods. (45)

REFERENCE BOOKS-

1. Outlines of comparative anatomy, Romer & Parsons, Central Book Depot, The Vertebrate Body (Saunders).
2. Biology of Vertebrates Walter & Sayles; (McMillan).
3. Chordate Zoology, P.S. Dhami & J. K. Dhami - R. Chand & Co., New Delhi.
4. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications, Meerut.
5. The Life of Vertebrates, 3rd Edition, 1993, J. Z. Young E. L. B.S. Oxford.
6. Chordate Zoology - E.L. Jordan, S. Chand & Co., New Delhi.
7 The Phylum Chordata - 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra.
8. Comparative Anatomy of the Vertebrates G. C. Kent.

PAPER- XIV

DEVELOPMENTAL BIOLOGY

Unit – I

I. Gametogenesis. (2)
II. Process of fertilization. (2)
III. Types of eggs and cleavages. (4)
IV. Ascidian tadpole and retrogressive metamorphosis. (2)
V. Development of frog up to three germinal layers and metamorphosis (7)

Unit – II

VI. Development of chick upto 72 hours. (15)

Unit – III

VII. Organizer - Concept and process of induction. (3)
VIII. Study of foetal membrance (3)
IX. Placenta- types and significance. (3)
X. Cloning - techniques, significance and ethical issues. (4)

Total periods. (45)

REFERENCE BOOKS –

1. An Introduction to Embryology 1981, Balinsky B.L., Saunders College,Philadelphia.
2. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.
3. Developmental Biology, 1997, 3rd Edition, Gilbert S.F. Saunder Associates Inc. U.S.A.
4. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. & Williams, R J. Saunders College, Publications, London.
5. A Text Book of Embryology, Dr. Puranik P. G., S. Chand & Co.
6. Developmental Biology, 1984, Browder L.W. , Saunders College Publicaions, U.S.A.
7. Development of Chick embryo, 1972, Lillie.
8. Developmental Biology, 1991, 3rd Edition, Sinaur Associates, Inc. U.S.A.

PAPER –XV

MOLECULAR BIOLOGY, BIOTECHNOLOGYAND BIOTECHNIQUES

Unit – I

I. Molecular Biology :

1. Replication of DNA (2)
2. DNA damage and repair mechanism (1)
3. Regulation of gene expression – Operon concept. (3)
4. Genetic code (3)
   i) Properties of genetic code.
   ii) Codon assignments
5. Protein synthesis (7)

a) Transcription -
i) Process of transcription in prokaryotes and eukaryotes.
ii) RNA polymerase.
b) Translation
i) Initiation
ii) Elongation
iii) Termination.

Unit – II

II. Biotechnology:

1. Recombinant DNAtechnology (8)
   i) Restriction enzymes, DNA ligase, DNA polymerase.
   ii) Cloning vectors.
   iii) Polymerase chain reaction.
   iv) DNA probes.
   v) Southern Blotting.
   vi) DNA fingerprinting.
2. Immunological techniques (5)
   i) Hybridoma and Monoclonal Antibody.
   ii) ELISA.

Unit – III

3. Applications of biotechnology in - (4)
   Medicine, Animal Husbandry and Agriculture.

III. Biotechniques :

1. Separation Techniques. (6)
   i) Chromatography -TLC .
   ii) Electrophoresis – Gel Electrophoresis.
2. Animal cell culture. (6)
   i) Requirement and Application
   ii) Stem cells
   iii) Tissue culture
   iv) Embryo culture.

Total periods - (45)

REFERENCE BOOKS –

1. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr. EMF, Lippincott Williams and Wilkins,Philadelphia.
2. Cell Biology, C.B. Powar, Himalaya Publication House.
3. Cell and Molecular Biology, EJ. Dupraw, Academic Press, NewYork.
4. Cell Structure and Function - A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A. N. Gallant, Saunder College, Philadelphia.
5. Molecular Biology of the Cell - 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, K. Roberts & James D. Watson, Garian Publishing, New York.
6. Elements of Biotechnology - P. K. Gupta, Rastogi Publications.
7. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.8.Concept of Genes-Pearson Edition 9.Cell and Molecular Biology

PAPER-XVI
APPLIED ZOOLOGY

Unit – I

I. Fisheries : (12)

i) Economic importance of Fin fishes.
ii) Economic importance of Lobster, Crab, Prawn, Mussel & Sepia.
iii) Pearl Culture.
iv) Fishing Crafts and Gears.
v) Fish farming –Construction and Maintenance.
vi) Maintenance of Aquarium and Aquarium fishes.

II. Economic Entomology:

i) Apiculture – a) Types and castes of honey bees. (5)
b) Honey comb.
c) Bee keeping.
d) Economic importance.

Unit-II

ii) Lac culture-a) Classification (6)
b) External morphology.
c) Life cycle.
d) Rearing.
e) Importance.

iii) Pest and its Management:- (10)
a) Crop pests: - Woolly aphid, white fly, Jassids and Grasshopper.
b) House hold pests:- Cockroach, Silverfish, Mosquito.
c) Store grain pest:- Rice mouth, Rice weevil and Flour beetle.
d) Biological control.

Unit-III

iv) Emu farming :- (3)
a) Feeds.
b) Housing.
c) Management.
d) Food value- Egg and meat.
e) Diseases

v) Vermiculture (4)
a) Species of earthworms
b) Vermiculture techniques
c) Applications

vi) Goat Farming (5)
a) Breeds
b) Feeding
c) Housing
d) Economic importance.

Total periods (45)

REFERENCE BOOKS-

8. Mollusca - Hyman.
9. Prawn and Prawn Fishery of India - Kurian.
10. Fish Culture - K. H. Alikuhni.
11. Fish Culture - Lagter.
12. Fishes of India. - Khanna.
13. Hand Book of Animal Husbandary and Dairy - Mudlyer.
14. Bee keeping in India - Sardar Sing.
15. Bee Keeping in India- M. G. Smith.
16. Poultry keeping in India - Naidu P.N.M.
17. Poultry Husbandary - M. A. Jule.
18. Poultry Husbandary - Moarthy.

PRACTICAL - I
FUNCTIONAL ANATOMY OF NON-CHORDATES, BIOSTATISTICS, BIOINFORMATICSAND MEDICAL ZOOLOGY.

Unit - I

I. Dissection and Mountings

Squilla

1. Digestive system.
2. Nervous system.
3. Mountings: Appendages, Statocyst ,

Unit - II

II. Dissection and Mountings –(Demonstration)

SEA STAR: -

1. Digestive system.
2. Water vascular system.
3. Mounting – Tube foot

III. - Lingula (Demonstration)

Mounting of Lophophore & Nephridium

IV. Dissection –(Demonstration)

Prawn - Nervous system.

Unit - III

V. Study of permanent slides of -

Sponge spicules, Spongin fibres and Zooids of Porpita.

VI. Study of Protozoans for locomotion – *Amoeba, Paramoecium, Euglena.*

VII. Study of Canal systems -

T.S. and L.S. of Sycon.

VIII. Study of -Obelia, Physalia and any four corals.

IX. Study of following -

1. Crustacean larvae-Nauplius, Zoea,and Phyllosoma.
2. Insect larvae.
3. Insect pests- any five from surrounding.
4. Echinoderm larvae.
5. Tornaria larva.
6. Bugula, Sagitta.

Unit - IV

X. Examples on Biostatistics, (Any Ten Examples)

XI. Preparation of Rectal parasites in /Rat/Cockroach.

XII. Study of Pathogens and Vectors.

Entamoeba, Plasmodium, Ascaris, Wauchereria, Mosquito, Pediculus.

XIII.Preparation of whole mounts and mouth parts of –Female anopheles, Female culex and Female aedes (Demonstration)

XIV. Examples based on bioinformatics, amino acids and nucleotide sequence.

XV. Study Tour/Excursion -

Visit to seashore/Water reservoir/Bird sanctuary/Animal sanctuary to study Animal Biodiversity. Report of tour should be submitted at the time of practical examination.

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PARCTICAL - II
COMPARATIVE ANATOMY OF CHORDATES & DEVELOPMENTAL BIOLOGY.

Unit – I

I. Dissection of brain of *Labeo*

II. Dissection of brain of rat- white / black

III. Dissection of Weberian ossicles of Labeo

Unit – II

IV. Dissection of eye muscles and nerve innervations of *Labeo* and fowl

V. Dissection of neck nerves of rat- white/black

VI. Temporary preparations of-

Scales of fishes -Placoid, cycloid and ctenoid.
Columela of fowl.
Ear ossicles of rat.

Unit – III

VII. Study of eggs -insect, Amphioxus, frog and chick.

VIII. Study of cleavage, blastula and gastrula - Amphioxus and frog.

IX. Study of Ascidian tadpole and stages of metamorphosis in frog

X. Study of whole mounts and T.S. of 13, 18, 24, 33, 48 and 72 hrs chick embryos

XI. Permanent preparation of chick embryo.

Unit – IV

XII. Study of following. ...

1) V.S. of skin of vertebrates.
2) Scales of reptiles.

3) Feathers.
4)Digestive system – *Scoliodon*, *Labeo*, frog, *Calotes*, pigeon, rat.
5) Respiratory organs of vertebrates - Gills of fishes and amphibian, reptilian, avian and mammalian lungs.
6) Hearts of vertebrates.
7) Brains of vertebrates.
8) Types of vertebrae based on centrum.
9) Pectoral and pelvic girdles of vertebrates.

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PRACTICAL - III
PHYSIOLOGY, ENDOCRINOLOGY, ENVIRONMENTAL BIOLOGY AND TOXICOLOGY.

Unit – I

I. Interpretation of ECG(any four)
II. Erythrocytes Sedimentation Rate
III. Estimation of O_2 consumption in aquatic animals by Winkler's method (Fish/ Crab).
IV. To determine the plasma volume of whole blood by centrifugation method.

Unit – II

IV. Estimation of hemoglobin.
V. Total count of R.B.C., W.B.C. and differential count.
VI. Measurement of blood pressure and heart beat under normal and stress condition.
VII. Measurement of lung capacity.
VIII. Endocrine glands (Anatomy and Histology) - Testis, Ovary, Adrenal, Thyroid, Pancreas.

Unit – III

IX. Estimation of CO2, O2, BOD and COD of water.
X. Testing of hardness of water.
XI. Study of animals in relation to their habitats.
1. Lotic - Any cat fish
2. Lentic - Any carp
3. Pelagic - Puffer fish.
4. Benthic - Lobster.
5. Grass land - Stick insect.
6. Desert - Phrynosoma.

Unit – IV

XII. Qualitative analysis of phytoplanktons and zooplanktons- any suitable ecosystem
XIII. Any suitable project to be selected by student (Two students per project) under the guidance of teacher and report is to be submitted at the time of practical examination.

PRACTICAL - IV
MOLECULAR BIOLOGY, BIOTECHNOLOGY, BIOTECHNIQUES AND APPLIED ZOOLOGY.

Unit – I

I. **Permanent preparation** - (whole mounts of -Protozoans, , Coelenterate colony, zoo-planktons, insect larvae, echinoderm larvae, crustacean larvae, fish scales, feathers-filoplume and down)

II. **Microtomy** - Preparation of permanent histological slides of organs of Rat(white or black) by HE technique.

Unit – II

III. **Histochemical techniques**:

1. AB Techniques,
2. PAS Technique

(Submission of 10 permanent slides - 5 H.E + 2 Histochemical methods + 1 Chick embryo + 2 whole mount, at the time of practical examination)

IV. **Biotechniques:**

1. Chromatography - Separation of serum proteins amino acids by paper chromatography.
2. DNA / RNA Isolation
3. Tissue culture / Embryo culture.

V. **Cytological preparations:**

1. Demonstration of DNA by Feulgen technique.
2. Meiosis in Grasshopper testis or onion bud.
3. Study of polytene chromosomes to observe puffing, in Chironomous larvae / Drosophila larvae.

VI. Study of Microbes :

1. Preparation of media and cultivation
2. Staining the microbes with Gram's staining.

Unit – III

VII. Examples in Genetics: Trihybrid ratio and Interaction of genes,

VIII. **Economic importance of** -Prawn, Lobster, Crab, Oyster, Mussel and Sepia.

IX. Economic importance of -Shark, Pomphret, Oil Sardine, Mackerel, Bombay duck, Eel, *Ophiocephalus, Catla, Rohu, Mrigal* and *Cyprinus*.

X. **Study of fish byproducts** - fish meal, fish glue, fish liver oil, fish body oil, fish manure and shagreen.

XI Study of- Fishing Crafts and Gears (Models).

Unit – IV

XII. Apiculture - Types and Castes of Bees, Honeycomb, Honey, Bee wax, Pollen basket and sting apparatus of honey bees.

XIII.Poultry Science – Emu birds- photo, Egg/Egg shell and manure.

XIV. **Lac Culture** –Economic importance of Lac

XV. Pest- Identification and control measures.

a. House hold pests-Cockroach, Silverfish.
b. Crop pests- Woolly aphid, White fly, Jassids.
c. Store grain pests- Rice moth, Rice weevil, Flour beetle.

XVI. Study Tour / Excursion.

Visit to fish farm / Apiculture centre /Goat farm / Emu farm / Poultry farm/ Vermiculture is compulsory. A report of one of the visits is to be submitted at the time of practical examination.

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Skeleton Paper for University Theory Examination.

B. Sc. III Zoology Paper IX to XVI

Time – 2 hours Total marks – 40	Marks
Q.1. Multiple choice (Eight Questions)	8
Q.2. Long answer questions (any 2)	16
A) Descriptive answer	
B) Descriptive answer	
.C) Descriptive answer	
Q.3. Short notes (any four) out of six	16

Skeleton Paper for University practical Examination.

Practical - I

Q.I: Major Dissection	12
Q.2: Temporary Mounting	6
Q.4: Identification	10
Q.5: Biostatistics example	7
Q.6: Excursion Report	5
Q,7 Viva Voce (based on excursion)	5
Q.8 Journal	5
	Total – 50

Practical –II

Q.I: Major Dissection	12
Q.2: Minor Dissection	8
Q.3: Temporary Mounting	5
Q.4: Identification	10
Q.5: Mounting of Chick embryo	10
Q.7: Journal	5
	Total – 50

Practical - III:

Q.I: Physiological experiment	10
Q.2: Hemoglobin percentage / Blood Cell counts Measurement of lung capacity	6
Q.3: Ecological experiment. (study of planktons)	4
Q.4: Ecological experiment. (Estimation)	7
Q.5: Identification	5
Q.6: Project	8
Q.7: Viva-voce Based on project work)	5
Q.8: Journal	5
	Total- 50

Practical - IV:

Q.I: Microtomy - Preparation of permanent histological slide	10
Q.2: Histochemistry	5
Q.3: Biotechnique / Cytological preparation/Gram's Staining Technique	5
Q.4: Genetic example	5
Q.5: Identification	10
Q.6: Submission of permanent slides	5
Q.7: Excursion report	5
Q.8: Journal	5
	Total – 50

B.Sc. III: Zoology Semester Pattern Equivalence to Old Syllabus Annual Pattern:

1. **Old Paper V -** Functional Anatomy of Non-chordates, Biostatistics. Bioinformatics and Medical Zoology.
   New Papers:IX- Functional Anatomy of Non-chordates and
   X- Biostatistics. Bioinformatics and Medical Zoology.

2. **Old Paper VI-** Comparative Anatomy of Chordates & Developmental Biology.
   New papers: XIII - Comparative Anatomy of Chordates and
   XIV-Developmental Biology

3. **Old Paper VII** - Physiology, Endocrinology, Environmental Biology and Toxicology.
   New Papers: XI – Physiology and
   XII-Endocrinology, EnvironmentalBiology and Toxicology

4. **Old Paper VIII** - Molecular Biology, Biotechnology,Biotechniques and Applied Zoology.
   New Papers: XV -Molecular Biology, Biotechnology,Biotechniques and
   XVI- Applied Zoology.