

B.SC. ZOOLOGY

THEORY PAPER – III

ANIMAL PHYSIOLOGY, GENETICS & EVOLUTION

120 hrs  
(4 hrs/week)

UNIT I

- 1.0. Physiology of Digestion 7 hours
- 1.1 Definition of digestion and types of digestion – extra and intracellular.
  - 1.2 Digestion of Carbohydrates, proteins, lipids and cellulose digestion.
  - 1.3 Absorption and assimilation of digested food materials.
  - 1.4 Gastrointestinal hormones – control of digestion.
- 2.0. Physiology of respiration 8 hours
- 2.1 Types of respiration – external and internal respiration.
  - 2.2 Structure of mammalian lungs and gaseous exchange.
  - 2.3 Transport of oxygen – formation of oxyhaemoglobin and affinity of haemoglobin for Oxygen, Oxygen dissociation curves.
  - 2.4 Transport of CO<sub>2</sub> – Chloride shift, Bohr effect.
  - 2.5 Cellular respiration – Main steps of glycolysis, Krebs's cycle, electron transport, Oxidative phosphorylation and ATP production (Chemosmotic theory).
- 3.0. Physiology of Circulation 7 hours
- 3.1 Open and closed circulation.
  - 3.2 Structure of mammalian heart and its working mechanism – Heartbeat and cardiac cycle. Myogenic and neurogenic hearts.
  - 3.3 Regulation of heart rate – Tachycardia and Bradycardia.
- 4.0. Physiology of Excretion 8 hours
- 4.1 Definition of excretion.
  - 4.2 Forms of nitrogenous waste material and their formation: classification of animals on the basis of excretory products.
  - 4.3 Gross organization of mammalian excretory system and structure of kidney.
  - 4.4 Structure and function of Nephron – Counter current mechanism.

## UNIT II

- 1.0. Physiology of muscle contraction 7 hours
- 1.1 General structure and types of muscles.
  - 1.2 Ultra structure of skeletal muscle.
  - 1.3 Sliding filament mechanism of muscle contraction.
  - 1.4 Chemical changes during muscle contraction – role of calcium, ATP utilization and its replenishment.
- 2.0 Physiology of nerve impulse 8 hours
- 2.1 Structure of nerve cell.
  - 2.2 Nature of nerve impulse – resting potential and action potential. Properties of nerve impulse – threshold value, refractory period, all or none response.
  - 2.3 Conduction of nerve impulse along an axon – local circuit theory and salutatory conduction theory.
  - 2.4 Structure of synapse, mechanism of synaptic transmission – electrical and chemical transmissions.
- 3.0. Physiology of Endocrine system 8 hours
- 3.1 Relationship between hypothalamus and pituitary gland.
  - 3.2 Hormones of hypothalamus.
  - 3.3 Hormones of Adenohypophysis and Neurohypophysis.
  - 3.4 Hormones of pineal gland, thyroid gland, parathyroid, thymus, adrenal and pancreas.
  - 3.5 Endocrine control of mammalian reproduction – Male and female hormones – Hormonal control of menstrual cycle in humans
- 4.0. Physiology of Homeostasis
- 4.1 Concept of homeostasis and its basic working mechanism.
  - 4.2 Mechanism of Homeostasis – giving three illustration viz., Hormonal control of glucose levels, Water and ionic regulation by freshwater and marine animals and temperature regulation in man.

## UNIT III

### Genetics

Mendel's laws – Law of segregation and independent assortment; Genetic interactions – Incomplete dominance, codominance and epistasis. 3 hours

Identification of DNA as the genetic material – Griffith's experiment and Hershey – Chase experiment. 4 hours

Central dogma of molecular biology – Brief account of DNA replication (Semi-conservative method), Replication fork (Continuous and discontinuous synthesis); Transcription – Brief account initiation, elongation and termination in eukaryotes; Translation; Genetic code; gene regulation as exemplified by lac operon. 8 hours

Human karyotyping, Barr bodies and Lyon hypothesis and Amniocentesis chromosomal disorders – Autosomal and sex chromosomes 5 hours

### Organic Evolution:

Genetic basis of Evolution, Gene pool and gene frequencies, Hardy-Weinberg's Law, Force of destabilization, natural selection, genetic drift, Mutation, Isolation and Migration. 8 hours

Speciation – Allopatry and sympatry. 2 hours

## PRACTICAL PAPER - III

90 hrs  
(3hrs/week)

### ANIMAL PHYSIOLOGY

1. Identification of carbohydrates, proteins and lipids.
2. Unit Oxygen Consumption in an aquatic animal (fish or crab)
3. Quantitative analysis of excretory products.
4. Demonstration of salivary amylase

### GENETICS

5. A, B, O blood group identification
6. Problems based on Blood grouping.
7. Karyotyping of human chromosomes (Human karyotype figure on paper should be cut in to different sets of chromosomes and students are asked to arrange them in an order and comment on the idiogram)
8. Identification of genetic syndromes given on charts.
9. Problems based on Mendelian inheritance (at least one problem for each for the laws of segregation and law of independent assortment).

### REFERENCE BOOKS

1. 'Essentials of Animal Physiology' by S. C. Rastogi.'
2. 'Animal Physiology' by H. C. Nigam.
3. 'Biology' by Campbell & Reece.
4. 'Animal Physiology' – Agarwal, R.A. Srivastava, Kaushal, Anil and Kumar.
5. 'Animal Physiology and Biochemistry' by Dr. B. Annadurai.
6. 'Principles of Animal Physiology' by Christopher D. Moyes, Patricia M Schulte.
7. 'Biology: The Science of Life' by R. A. Wallace, G. P. Sanders & R. J. Ferl.
8. 'Biology: Concepts and Applications' by Starr
9. 'Genetics' Vol-I. by C. B. Powar., Himalaya Publishing House Pvt. Ltd.
10. 'Genetics' by Strickberger.
11. 'Genetics' by P. K. Gupta.
12. 'Cell Biology, Genetics, Evolution and Ecology' by P. S. Varma and V. K. Agrawal; S. Chand and Company.
13. 'Principles of Genetics' by S. B. Basu and M. Hossain.
14. 'Principles of Genetics' by Gardner, Simmons & Smustard.
15. 'Principles of Genetics' by H. Robert & Tamasin.
16. 'Genetics' by P. S. Verma & V. K. Agarwal.
17. 'Organic Evolution' by M. P. Arora & Chandrakanta.
18. 'Organic Evolution' by N. Arumugam.
19. 'Animal nutrition' by P. Mc Donald, R. A. Edwards, J. F. D. Greenhalgh, C. A. Morgan.

B.SC. ZOOLOGY

THEORY PAPER – IV

APPLIED ZOOLOGY

120 hrs  
(4 hrs/week)

UNIT I

1.0. Fisheries and Aquaculture

1.1. Capture fisheries – Introduction	1 hour
1.2. Types of fisheries, Fishery resources from Freshwater, Brackish water and Marine habitats.	2 hours
1.3. Finfish and shell fisheries.	2 hours
1.4. Fishing gears and fishing crafts.	2 hours
1.5. Freshwater, Brackish water and Mariculture.	5 hours
1.6. Site selection criteria.	2 hours
1.7. Aquaculture systems.	3 hours
1.8. Induced breeding.	2 hours
1.9. Hatchery design and Management	2 hours
1.10. Larval rearing – Nursery ponds, rearing and grow out ponds	2 hours
1.11. Shrimp and Prawn culture	2 hours
1.12. Hatchery systems, Seed transport, common diseases and control	2 hours
1.13. Post-harvest technology	1 hour
1.14. Preservation and processing – Freezing, solar drying, Canning, salting smoking, By product of fish cool mineral	2 hours

UNIT II

2.0. Clinical Science

2.1. Hematology 8 hours

- 2.1.1. Blood composition and functions
- 2.1.2. Blood groups and transfusion problems
- 2.1.3. Blood diseases – Anemia, Leukemia, Leucocytosis, Leucopaenia
- 2.1.4. Biopsy and autopsy – Clinical importance.

2.2 Immunology 12 hours

- 2.2.1. Types of immunity – Innate and acquired

- 2.2.2. Antigens – Haptens and epitopes and their properties
- 2.2.3. Structure and biological properties of human immunoglobulin G (IgG)
- 2.2.4. Hypersensitivity – immediate and delayed

### 2.3. Important Human Parasites

10 hours

- 2.3.1. Blood parasites (structure and Clinical significance of Plasmodium).
- 2.3.2. Intestinal parasites – Structure and clinical significance Entamoeba, Giardia, Taenia solim, Ancylostoma, Enterobius

## UNIT –III

### 3.0. Animal Biotechnology:

1. Animal Biotechnology: Scope of Biotechnology, Cloning vectors – Characteristics of vectors, Plasmids. 8 hours
2. Gene Cloning – Enzymatic cleavage of DNA, Restriction enzymes (Endonucleases) and Ligation 10 hours
3. Transgenesis and Production of transgenic animals (Fish and Goat). 6 hours
4. Application of Stem Cell technology in cell based therapy (Diabetes and Parkinson's diseases ) 6 hours

## PARCTICAL PAPER – IV

90 hrs  
(3 hrs/week)

### FISHERIES AND AQUACULTURE

- 1.0. Identification of important Freshwater and Marine edible fishes (Minimum 10)
- 2.0. Identification of important edible prawns (Minimum 5)

### FIELD WORK:

Field work is compulsory. Field trip to local fisheries / aquaculture unit is to be conducted and certified field note book should be submitted at the time of practical examination.

### CLINICAL SCIENCE:

- 1.0. Identification of the following protozoan parasites.

- a) *Entamoeba histolytica*
- b) *Giardia intestinalis*
- c) *Balantidium coli*
- d) *Trypanosoma gambiense*
- e) *Plasmodium* – Any two stages

- 2.0. Identification of the following helminth parasites.

- a) *Taenia solium*
- b) *Ascaris* (Male and female)
- c) *Enterobius vermicularis*
- d) *Dracanculus medinensis*
- e) *Ancylostoma duodenale*

- 3.0. Blood cell counting – RBC and WBC

- 4.0. Estimation of Haemoglobin (Sahi's Method)

### ANIMAL BIOTECHNOLOGY:

- 1.0. Identification of vectors (charts or photographs)

- 5.0. Identification of Genetic disorders (charts or photographs)

Identification of transgenic animals (charts or photographs)

## REFERENCE BOOKS

1. 'Immunology' 5<sup>th</sup> edition, 2003, - R. A. Goldsby, T. J. Kindt, B. A. Osborne and J. Kuby. W. H. Freeman and Company, Newyork.
2. 'Essentials of Immunology' – Ivanriots.
3. 'A text book of Immunology and Immunotechnology' by B. Annadurai, S. Chand Publicatins.
4. 'Principles of Immunology' N.V. Shastri., Himalaya Publishing hOuse Pvt. Ltd.
5. 'Genetic Engineering' by Mohan P. Arora., Himalayan Publishers
6. 'Practical Immunology' – Talwar.
7. 'Introduction to basic Molecular Biology Techniques' by G. R. Naik, Himalaya Publishing House Pvt. Ltd.
8. 'Immunology' – I. Kannan.
9. 'NMS Immunology' – Richard M. Hyde.
10. 'Text book of Immunology' – C. V. Rao.
11. 'Biology' – Campbell and Reece.
12. 'Medical Zoology' – Sobti.
13. 'Parasitology' – Chandler
14. 'Elements of Biotechnology' – P. K. Gupta.
15. 'Genomics and Biotechnology' – P. K. Gupta.
16. 'Molecular Biotechnology' – Glick and Pasternak.
17. 'The Fishes of India' – Francis Day. Vol – I & II. William dawson & Sons Ltd, 1958.
18. 'General and Applied Ichthyology' (Fish and Fisheries) S. K. Gupta and P. C. Gupta., S. Chand Publishers
19. 'Fish and fisheries of India' – V. G. Jhingran, Hindustan publishing company., 1985
20. Aquaculture productivity – V. R. P. Sinha and H. C. Siaslara Oxford IBH, 1991.
21. Advances in aquaculture – T. V. R. Pillay and M. A. Dill., Fishing news Books Ltd., 1979.



Faculty of Science  
B.Sc. III yr (Practical Examination 2010)  
Paper III: (Animal Physiology, Genetics & Evolution)  
Subject : Zoology (New Syllabus)

Question Bank

Time: 3 hrs

Marks: 50

Note: Submit the write up of procedure for questions I & II before start of the experiments.

QI. Identify the Unknown samples A, B & C by performing the mentioned test. Write brief procedure and report your results. 5+15+5 = 25

1. Molisch Test, Biuret Test, Nessler's Test.
2. Fehling Test, Millon's Test, Test for Uric acid.
3. Test for Urea, Test for sulphur containing amino acid and Molisch Test.
4. Benedicts test, Biuret test, sudan IV dye.
5. Tests for Urea, Uric acid and Ammonia.
6. Picric acid test, Biuret test, sudan Black B-test.
7. Estimate unit oxygen consumption in crab.
8. Perform a test for demonstration of salivary amylase
9. Molisch test, Biuret test and Iodine test.
10. Biuret test, Test for Ammonia & Fehling test
11. Iodine test, Millon's test and Nessler's reagent
12. Fehling test, Millon test and test for Uric acid
13. Millon's Test, Benedicts Test, Nessler's Test
14. Xanthoprotein test, Molisch test, Sudan dye test
15. Benedicts test, Nessler's test and Iodine test
16. Biuret test, Picric acid test and Nessler's test
17. Test for Urea, test of sulphur containing amino acid and test for reducing sugar
18. Test for tyrosine containing amino acid test, test for non reducing sugar and test for Uric acid

QII. Genetics Experiments

8+2 = 10

19. Report your blood group by performing a suitable test and comment on your result
20. Karyotyping of human chromosomes (Human karyotype figure on paper should be cut in to different sets of chromosomes and students are asked to arrange them in an order and comment on the idiogram)
21. Identification of genetic syndromes given on charts

QIII. Problems on blood grouping.

5

22. What will be the phenotype, as to blood groups, of offsprings of parents of the following genotypes for blood groups: a)  $I^A i \times I^B i$       b)  $I^A I^B \times I^B i$ ;      c)  $I^B i \times I^B i$ .

23. One parent is group A and the other group B, but all four groups are represented among the children. Determine the genotype of parents.
24. Both parents are group A, but three-fourths (3/4) of the children belong to group A and one fourth to group O. Determine the genotype of parents.

QIV. Problems on monohybrid ratios and dihybrid ratios.

5

25. If a plant homozygous for tall is crossed with one homozygous for dwarf, what will be the appearance of the  $F_1$ ; of the  $F_2$ ; of the offspring of a cross of  $F_1$  with its tall parent; with its dwarf parent?
26. Let the allele for tall be represented by T and the allele for dwarfness by t. what will be the gametes produced by the parents and the height of the offspring (tall or dwarf) from each of the following crosses: a) Tt X tt      b) TT X Tt      c) Tt X Tt
27. A certain polled bull is bred to three cows. With cow A, which is horned, a polled calf is produced; with cow B, also horned, a horned calf is produced; with cow C, which is polled, a horned calf is produced. What are the genotypes of the four parents, and what further offspring, in proportions would you expect from these matings? In cattle, the polled or hornless condition P is dominant over the horned, P.
28. Assume that a wild-type female *Drosophila*, BB SS, with normal gray body and red-coloured eyes is mated with a mutant-type male, bbss, with black-body colour and sepia-coloured eyes. By following the general directions, determine the  $F_1$  genotype. After mating  $F_1$  X  $F_1$ , what classes of flies may be expected in the  $F_2$  generation?
29. A student mated a wild-type female *Drosophila*, PrPrEE with normal red coloured eyes and normal gray body a mutant-type male fly, prpree, with purple coloured eyes and ebony body. The males and females of the  $F_1$  generation were all normal wild flies with red eyes and gray body. By mating  $F_1$  males to the  $F_1$  females, and  $F_2$  generation was obtained which consisted of 96 wild-type flies with red eyes and gray body, 38 files with purple eyes and gray body, 34 files with red eyes and ebony body, and 12 flies with purple eyes and ebony body. Explain the genetical and biological principles basic to these results.
30. When a wild-type female *Drosophila*, VVSS, with normal long wings and normal red eyes is mated to a mutant type male fly vvss, with (short) vestigial wings and (brown) sepia-eye colour, the  $F_1$  generation consists of normal flies. A student in the laboratory mated the three  $F_1$  females of this cross to an  $F_1$  male and counted 223 wild-type flies with normal long wings and red eyes, 70 flies with normal red eyes and vestigial wings 73 flies with normal long wings and sepia eyes, and 24 flies with vestigial wings and sepia eyes. Explain the genetics of this cross with emphasis on the free assortment of genes.

QV. Record

5

Faculty of Science  
B.Sc. III yr (Practical Examination 2010)  
Zoology New Syllabus  
Paper III: (Animal Physiology, Genetics & Evolution)  
Model Question Paper

Time: 3 hours

Marks: 50

Note: Submit the write up of procedure for questions I & II before start of the experiments

QI	-	3	-	(25 marks)
QII	-	19	-	(10 marks)
QIII	-	22	-	(5 marks)
QIV	-	26	-	(5 marks)
QV	-	Record	-	(5 marks)

Faculty of Science  
B.Sc. III yr (Practical Examination 2010)  
Paper IV: (Fisheries and Aquaculture, Clinical Science and Animal Biotechnology)  
Subject : Zoology (New Syllabus)

Question Bank

Time: 3 hrs

Marks: 50

Note: Submit the write up of procedure for question I before start of the experiments.

QI. Haematology

10+3 = 13

1. Enumerate total leucocytes in the given blood sample. Write brief procedure and comment on your results.
2. Find out the total Red blood cell count in the blood sample provided to you. Write brief procedure and comment on your results.
3. Estimate the amount of percent haemoglobin in the blood. Give a write up on method of estimation and add a note on significance of your findings.
4. Determine the amount of haemoglobin in grams present in the blood sample provided to you. Give brief working procedure and comment on your results.

QII. Identify any four parasites (two from protozoans and two from helminthes) from the given slides. Identification, Classification, diagram and description carries ½ mark each.  
(2x4 = 8)

5. Entameoba histolytica
6. Giardia intestinalis
7. Balantidium coli
8. Trypanosana gambiense
9. Plasmodium – any one stage
10. Taenia solium
11. Male Ascaris
12. Female Ascaris
13. Entrobilus vermicularis
14. Drancanculus medinensis
15. Ancylostoma duodenale

III. Identify classify and give reasons for identification of the following four fishes and two prawns  
(6 x 3 = 18)

Fishes:

16. Labeo rohita
17. Catla catla
18. Cirrhina mrigala
19. Cyprinus carpio
20. Ctenopharyngodon idella

21. Hypophthalmichthys molitrix
22. Channa striatus
23. Channa punctatus
24. Clarias batrachus
25. Heteropneustes fossilis
26. Chanos chanos
27. Mugil cephalus
28. Lates calcarifer
29. Liza persia
30. Stromateus niger
31. Oreochromis mossambicus
32. Wallago attu
33. Etroplus suratensis
34. Ompok bimaculatus
35. Amblypharyngodon mola

Prawns:

36. Macrobrachium rosenbergii
37. Macrobrachium molcolmsonii
38. Penaeus monodon
39. Penaeus indicus
40. Penaeus semisulcatus
41. Metapenaeus affinis
42. Metapenaeus brevicomis
43. Metapenaeus dobsoni

IV. Identify chart /diagram one from section A and one from section B. write a note on their biotechnological significance (2x3 = 6)

A.

44. Plasmid insertion
45. Bacteriophage
46. Down's syndrome
47. Klinefelter's syndrome
48. Turner syndrome

B.

49. Dolly
50. Tracy
51. Solman fish
52. Chimeras
53. Construction of transgenic mouse.

V. Record

(5 marks)

Faculty of Science  
B.Sc. III yr (Practical Examination 2010)  
Zoology(New Syllabus)  
Paper IV: (Fisheries and Aquaculture, Clinical Science and Animal Biotechnology)  
Model Question Paper

Time: 3 hrs

Marks: 50

QI	-	1	-	(13 marks)
QII	-	5, 6, 10, 11	-	(8 marks)
QIII	-	16, 17, 18, 19, 36, 39	-	(18 marks)
QIV	-	A) 44          b) 49	-	(6 marks)
QV	-	Record	-	(5 marks)

Faculty of Science  
B.Sc. III yr (Practical Examination 2010)  
Zoology(New Syllabus)  
Paper IV: (Fisheries and Aquaculture, Clinical Science and Animal Biotechnology)  
Model Question Paper

Time: 3 hrs

Marks: 50

QI	-	2	-	(13 marks)
QII	-	3, 4, 11, 12	-	(8 marks)
QIII	-	19, 20, 22, 24, 25, 26, 42, 43	-	(18 marks)
QIV	-	A) 45          b) 50	-	(6 marks)
QV	-	Record	-	(5 marks)