

Appendix to UO No Acad/C2/1308/2007 Dated 18/8/2007

KANNUR UNIVERSITY

SYLLABUS

B.Sc. DEGREE COURSE

ZOOLOGY

(2007- ADMISSION ONWARDS)

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INTRODUCTION

A major restructuring of the existing syllabus of Zoology (Main), Zoology (Sub), Physiology (Sub.) and Biological Techniques (Sub) had been made to cope with the advancement in Biological sciences and to enable the student to acquire capabilities to meet the challenges of the emerging scenario. The prime objective of restructuring is to take care of the fast paced development in the knowledge of the subject.

The elective paper had been dropped based on the general understanding that partial specialisation holds no good at UG level and it brings out no outcome at all. Instead, a new paper **Bio-chemistry, Bio-physics, Biometry and Bio-informatics** is being introduced which will promote a multidisciplinary profile and enhance competitiveness when students go for higher level of education. Selective portions of erstwhile Economic Zoology section had been included in Paper I & II and the contents modified accordingly.

B.Sc. ZOOLOGY (MAIN) – THEORY & PRACTICAL

Distribution of Hours

Year	THEORY	Distribution of hours		
		Theory	Practical	
I	Paper-1-Taxonomy and Animal Diversity -I	2	2	
II	Paper-II- Taxonomy and Animal Diversity - II	3	2	
III	Paper-III-Cell biology, Genetics, Molecular biology and Biotechnology	17		
	Paper-IV- Environmental biology, Ethology, Evolution and Zoogeography			
	Paper-V- Physiology and Developmental biology			
	Paper-VI- Biochemistry, Biophysics, Biometry and Bioinformatics			
	PRACTICAL			
	Practical-I-Anatomy and Animal diversity		8	
	Practical II- Physiology, Ecology, Cytology, Genetics and Embryology			
Practical-III- Biochemistry, Biophysics and Biometry				

SCHEME OF EXAMINATION

Year	Total Hrs.	Details of Paper		Duration of Exam	Marks		Total
		Theory	Practical		External	Internal	
I	80	Paper-I ,Tax. & Anim. Diversity-I		3 hrs	50	10	60
II	90	Paper-II ,Tax. & Anim. Diversity-II		3 hrs	50	10	60
III	120	Paper-III , Cell biol., Gen., Mol. Biol.&Bio-tech.		3 hrs	50	10	60
	120	Paper-IV , Env. Biol., Ethol., Evol.& Zoogeography.		3hrs	50	10	60
	120	Paper-V , Physiol. & Dev. Biol.		3 hrs	50	10	60
	120	Paper-VI , Bio Che., Bio Phy., Biometry & Bio-Informatics.		3hrs	50	10	60
			Practical-I	3 hrs	50	5	55
			Practical-II	3 hrs	50	5	55
			Practical-III	4 hrs	50	5	55
			Records	-	3x5=15	3x10=30	45
			Project	-	5	10	15
			Field Work	-	-	5	5
			Viva	-	10	-	10
				TOTAL	480	120	600

General Regulations for B.Sc. Zoology Course

For main subject there should be six theory papers and three practical papers. Group Project, Field Work and Viva Voce are also part of the Curriculum. Both for theory and practicals, students are to be evaluated through external and internal examinations and assessments. Out of total 600 marks, 480 marks will be based on external evaluation and 120 marks based on internal evaluation.

Attendance

75% of attendance (paper-wise) is compulsory for theory as well as practicals to make a student eligible for appearing for the examination.

Seminars, Self study and Assignments

Seminars, Self study and Assignments by the students are part of the Curriculum and they are to be considered for internal assessment. Performance of students in all these activities is to be critically assessed and marks should be awarded strictly according to the merit, taking into account the content, presentation and the amount of efforts put in. The concerned teachers may assign seminar and assignment topics to the students from the syllabus. Portions assigned for seminar should be limited to the maximum of 10% of the total teaching hours for each paper

Tests

A minimum of two tests (2x2=4 marks) are compulsory in each theory paper.

Performance of students may be evaluated as per the split up given below.

80% and above-4 marks

70 to 79% -3.5

60 to 69% -3.0

50 to 59% -2.5

40 to 49% -2.0

30 to 39% -1.5

Below 29% -1.0

Project

A project is to be taken up and report submitted on any topic based on theory papers. The main objective of the project work is to inculcate an aptitude for investigation among the students and to create a scientific temperament in them. It is also intended to bring about an orientation and basic training in research methodology.

A maximum of 10 students comprising a batch may take up a single project. Each student has to submit a report independently. Students are free to take up project work independently subject to the approval by the supervising teacher. Supervising teacher shall certify the report. The Head of the Dept. also has to certify that the project work once taken up is not repeated. The project is to be valued externally and internally. The internal evaluation should be based on individual effort in- a) collecting literature, b) conducting the work and c) preparing the report.

Field study

The students have to do a minimum of 5 days field study, preferably distributed in the Ist, IInd, & IIIrd years. Field study must be related to places of biological interest. They are expected to visit at least two research Research Institutes/ Wildlife sanctuaries/ Zoological Museums/ Zoos/ ecosystems/ local areas of biological activity of academic interest. The results of field studies must be recorded in the form of a field work report. The report is to be valued internally.

(If a student could't attend the scheduled field work due to unavoidable reasons viz. illness/ other genuine reasons, he/she should produce a medical certificate issued by a qualified Medical Practitioner for those days/ produce convincing proof for abstention. He/she should take up a field study on some other dates independently and submit a report.)

Records

For each practical examination record is compulsory. With out certified records, project report and field work report candidates are not permitted to appear for the practical examination. Each record must be submitted on the concerned day of examination. The project report and field work report should be submitted on the third day of examination, ie Practical Paper-III.

The practical records and project report are to be valued internally and externally and the field work report internally.

Viva-voce

A viva based on all practical papers and project work is part of evaluation. Viva is part of Paper-III Practical examination.

Pass minimum

Not less than 35% of the total marks with not less than 30% for theory and 30% for practicals.

ie. Aggregate - 210 marks

Separate minimum for Theory - 108

Separate minimum for Practicals - 72

Criteria for Internal Assessment for each Theory paper

- | | |
|-------------------------------|---|
| 1) Unit tests (min- 2 tests) | - 4 marks |
| 2) Seminar | - 2 marks |
| 3) Assignment | - 2 marks |
| 4) Regularity | - 2 (90% above- 2 marks
80-89% - 1.5 marks
75-79% - 1 |

Criteria for Internal Assessment for Practicals

- | | |
|---------------------------------|------------|
| 1) Record (3 records) 3x10 | - 30 marks |
| 2) Performance (paper wise) 3x5 | - 15 |
| 3) Project | - 10 |
| 4) Field work | - 5 |

**ZOOLOGY MAIN
GENERAL PLAN OF QUESTION PAPERS
THEORY – PAPER I & II
TAXONOMY AND ANIMAL DIVERSITY**

Time : 3hrs

Max.Marks :50

- | | | |
|----|---|---------|
| 1. | Essay question based on type study(Answer any one out of three) | 1x8 =8 |
| 2. | Essay question based on general topics(Answer any one out of three) | 1x8 =8 |
| 3. | Short essay(Answer any two out of four) | 2x4 =8 |
| 4. | Short notes on diversity(Answer any three out of six) | 3x3 =9 |
| 5. | Objective / understanding type in one or two sentences or in words
(Answer any five out of eight) | 5x2 =10 |
| 6. | Answer in one or two words/Match the following
(Answer any seven out of ten) | 7x1 =7 |

PAPER III

**CELL BIOLOGY ,GENETICS, MOLECULAR BIOLOGY
AND BIOTECHNOLOGY**

Time :3 hrs

Max. marks :50

Section A Cell Biology (16 marks)

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|----|---|-------------|
| 1. | Essay (Answer any one out of two) | 1x8=8 marks |
| 2. | Short essay (Answer any one out of two) | 1x4=4marks |
| 3. | Objective/ Understanding type in one or two sentences
(Answer any two out of four) | 2x2=4 marks |

Section B Genetics (20 marks)

- | | | |
|----|---|-------------|
| 4. | Essay (Answer any one out of two) | 1x8=8 marks |
| 5. | Short essay (Answer any one out of two) | 1x4=4 marks |
| 6. | Objective/ Understanding type in one or two sentences
(Answer any four out of six) | 4x2=8 marks |

Section C Molecular biology and Biotechnology (14 marks)

7. Essay (Answer any one out of two) 1x8=8 marks
8. Objective/ Understanding type in one or two sentences 3x2=6 marks
(Answer any three out of five)

PAPER—IV**ENVIRONMENTAL BIOLOGY, ETHOLOGY, EVOLUTION AND ZOOGEOGRAPHY****Time-3 hours****Max. marks-50**

Section-Environmental Biology

1. Answer any one out of two (essay) 1x8= 8 marks
2. Answer any two out of four (short essays) 2x4=8 marks
3. Answer any five out of seven 5x2=10 marks

Section- Ethology

1. Answer any one out of two 1x2=2 marks
2. Answer any four out of six 4x1=4 marks

Section- Evolution

1. Answer any one out of two 1x4=4 marks
2. Answer any four out of six 4x2=8 marks

Section-Zoogeography

1. Answer any two out of three 2x2=4 marks
2. Answer any two out of four 2x1=2 marks

PAPER-V**PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY****Section-Physiology (28 marks)**

- | | |
|--|--------------|
| 1. Essay (any one out of two) | 1x8=8 marks |
| 2. Short essay (any three out of five) | 3x4=12 marks |
| 3. Short notes (any two out of four) | 2x2=4 marks |
| 4. Objective/ understanding type questions | 4x1=4 marks |

Section- Developmental Biology (22 marks)

- | | |
|--|-------------|
| 1. Essay (any one out of two) | 1x8=8 marks |
| 2. Short answer (any two out of four) | 2x3=6 marks |
| 3. Short notes (any two out of four) | 2x2=4 marks |
| 4. Objective/ understanding type questions | 4x1=4 marks |

**PAPER-VI-BIOCHEMISTRY, BIOPHYSICS, BIOMETRY AND
BIOINFORMATICS**

Section A: Biochemistry

- | | |
|---|-----------------|
| 1. Essay (answer any one out of two) | 1 x 8 = 8 Marks |
| 2. Short Essay (answer any one out of two) | 1 x 4 = 4 Marks |
| 3. Short questions (answer any four out of six) | 3 x 2 = 6 Marks |
| 4. Objective type | 4 x 1 = 4 Marks |

Section B: Biophysics

- | | |
|--|-----------------|
| 1. Short essay (answer any two out of three) | 1 x 4 = 4 Marks |
| 2. Short questions (answer any two out of three) | 2 x 2 = 4 Marks |
| 3. Objective type | 2 x 1 = 2 Marks |

Section C: Biometry

- | | |
|--|-----------------|
| 1. Short essay (answer any one out of two) | 1 x 4 = 4 Marks |
| 2. Short questions (answer any two out of three) | 2 x 2 = 4 Marks |
| 3. Objective type | 2 x 1 = 2 Marks |

Section D: Bioinformatics

- | | |
|--|---------------|
| 1. Short essay (answer any one out of two) | 1x4 = 4 Marks |
| 2. Short questions (answer any two out of three) | 2x2 = 4 Marks |

III B.Sc. ZOOLOGY**GENERAL PATTERN OF PRACTICAL EXAMINATION****PRACTICAL-I****Time-3 hours (Max. Marks-55)**

- | | |
|--|----------|
| 1. Major Dissection (with display) | 25marks |
| 2. Minor Dissection / Mounting (with or without diagram) | 10 marks |
| 3. Spot Items (5x3) | 15 marks |
| 4. Record | 5 marks |

PRACTICAL-II**Time-3 hours (Max. Marks 55)**

- | | |
|---------------------|----------|
| 1. Major Experiment | 20 marks |
| 2. Minor Experiment | 10 marks |
| 3. Genetics Problem | 5 marks |
| 4. Spot Items (5x3) | 15 marks |
| 5. Record | 5 marks |

PRACTICAL-III**Time-4 hours (Max. Marks-70)**

1. Major Experiment	20 marks
2. Minor Experiment	10 marks
3. Statistics Problem	8 marks
4. Spot Item (4x3)	12 marks
5. Record	5 marks
6. Project	5 marks
7. Viva	10 marks

NOTE : Major and minor experiments should be from different branches.

Procedure should be submitted before the experiment

Viva should be based on all practicals and project.

B.Sc.ZOOLOGY MAIN – SYLLABUS – THEORY**Paper I- Taxonomy and Animal Diversity I. Total : 85hrs.****Unit. 1.** Taxonomy.

Definition, Principles, Procedures and rules of taxonomy- a brief account: (Hierarchy, Taxon, Phenon, Catogary), Linneon Hierarchy, Systematics: Importance of systematics in Biology, Zoological nomenclature: ICZN, Rules of nomenclature in brief, concept of species and sub-species. 3 hrs.

Unit II. R.H. Wittakar's Five Kingdom System of Classification of living world. Brief outline classification of Protista (amoeboid protests, ciliate protests, flagellate protests and spore forming protests). Mention the protozoan Phyla of Kingdom Protista (Salient features of each Phylum in brief)

Phylum : Rhizopoda. eg: Elphidium.

Phylum : Actinopoda	eg:	Actinophrys.
Phylum : Dinophyta	eg:	Noctiluca.
Phylum : Parabasila.	eg:	Trichonympha.
Phylum : Metamonada.	eg:	Giardia.
Phylum : Kinetoplasta.	eg;	Trypanosoma.
Phylum : Cryptophyta.	eg.	Cryptomonas.
Phylum : Opalinata.	eg.	Opalina.
Phylum : Ciliophora.	eg.	Paramecium.
Phylum : Apicomplexa.	eg.	Babesia.
Phylum : Microsporidia.	eg.	Nosema.

General Topic: Reproduction in protists.

Economic Importance: Morphology, life history, pathogenicity mode of infection and Prophylactic measures of Plasmodium vivax and Entamoeba histolytica 10 hrs.

Unit III. Classification of Animalia (Animal Kingdoms)

Concept of Metazoa: Salient features of Metazoa, Branches of Metazoa- Mesozoa, Parazoa and Eumetazoa. Diploblastica & Triploblastica. Cellular, tissue level and organ system level of organization. Acoelomate, pseudocoelomate and coelomate series. Enterocoely and schizocoely. Protostomia and Deuterostomia. Distribution of symmetry within the animal kingdom. 3 hrs.

Unit. IV : Study of animal diversity, structure and function based on types given under each phylum. Phylum should be classified down to classes with examples except otherwise mentioned.

Phylum Mesozoa : General characters. Eg. Dicyema. 1 hr.

Phylum . Porifera : General characters. Histology and canal system of sponges on the basis of an Asconoid sponge, a Syconoid sponge and a Leuconoid sponge. A brief account of gemmule formation and sponge larvae. 3 hrs.

Phylum Cnidaria : General characters. Classification up to classes.

Eg: Obelia, Physalia, Velella, Aurelia, Metridium, Fungia, Tubipora, Madrepora and Pennatula.

General topic : Polymorphism in Coelenterates . Coral and coral reefs. 4 hrs.

Phylum: Ctenophora. : General characters . eg. Pleurobrachia. 1 hr.

Phylum: Platyhelminthes : General characters and classification.

Eg. Planaria, Shistosoma, Taenia solium and Taenia saginata.

Economic importance: Morphology, life cycle and pathogenicity of Fasciola hepatica.

2 hrs

Phylum Aschelminthes : General characters.

Class : Nematoda. Distinctive features.

Economic importance : Morphology, life history, pathogenicity and prophylactic measures of Ascais, Ancylostoma, Enterobius and Wuchereria. 4. hrs

Minor Phyla : General characters of each phylum with examples.

Phylum: Phoronida . eg. Phoronis. (Actinotrocha larva)

Phylum : Bryozoa. Eg. Bugula.

Phylum : Chaetognatha. Eg. Sagitta.

Phylum : Sipunculoidea. Eg. Sipunculus.

Phylum : Echiuroidea. Eg. Bonellia. 4 hrs

Phylum Annelida : General characters and classification.

Type : Earthworm.

Eg. Aphrodite. Nereis, Chaetopterus, Sabella, Hirudinaria.

General topic : Asexual reproduction in Polychaetes. 8 hrs.

Phylum : Arthropoda.: General characters and classification.

Type : Penaeus. (Life history and larval forms expected)

Eg: Peripatus, Lepas, Sacculina, Eupagurus, Scolopendra, Lepisma, Carasius,

Belostoma, Dragon fly' Limulus.

General topic : Mouth parts of Insects.

Economic importance :

1. Useful insects : Honey bees- Apiculture and its scope, different species of Apis, social life, and adaptations and brief account of diseases and enemies.

Bombyx mori- Brief account of rearing, mounting ,cocoon harvesting and sorting . Muscardine disease, Pebrine disease, Ujifly.

2. Pests of agricultural crops: Mention the stage of pest damage and control measures of the following- *Leptocorisa acuta*, *Spodoptera mauritia*, *Oryctes rhinoceros*,

Rhinophorus ferrugineus, *Opisina arnosella* and *Plocoderus ferrugineus*.

3. Prawn culture : Cultivable species of prawns in India , induced breeding. 22 hrs

Phylum : Mollusca : General characters and classification.

Type : Pila.

Eg. *Chiton*, *Dentalium*, *Perna*, *Aplysia*, *Octopus*, *Nautilus*, *Patella*, *Teredo*, *Lamellidens*.

General topic : Economic importance of molluscs. 8 hrs.

Phylum : Echinodermata: General characters and classification.

Type : *Asterias*

Eg. *Ophiothrix*, *Holothuria*, *Antedon*, *Echinus*.

General topic: Larval forms in Echinoderms. 5. hrs

Phylum : Hemichordata: Salient features.

Eg. *Balanoglossus* (External morphology) *Tornaria* larva and its affinities. 2 hrs.

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PAPER II - TAXONOMY AND ANIMAL DIVERSITY II

Total :90 hrs.

1.Introduction (1hr.)

Chordata: Characters and classification of subphyla with salient features of each phylum.

2. Subphylum: Cephalochordata (4 hrs.)

General characters and systematic position.

Type: Amphioxus. Mention affinities.

3. Subphylum: Urochordata (5 hrs.)

A brief account of Ascidia. Retrogressive metamorphosis to be mentioned.

Classification up to classes with examples. Salpa, Doliolum, Botryllus, Pyrosoma, Appendicularia.

4. Subphylum: Vertebrata

A brief classification enumerating only the salient features of each taxonomic division with examples.

5. Division: Agnatha (2hr.)

Class : Cyclostomata – salient features.

Eg. Petromyzon, significance of Ammocoetus larva

Division : Gnathostomata.

6. Super class :Pisces (16 hrs.)

a)Class: Placodermi. Eg. Climateus (mention only name)

b)Class: Chondrichthyes

Subclass : Selachi. Type: Scoliodon.

Eg. Chilosyllium, Stegostoma, Pristis, Trygon, Narcine.

c) Class ; Holocephali Eg. Chimera

d) Class: Osteichthyes

Subclass : Choanichthyes

Order: Dipnoi.-Lung fishes like Neoceratodus, Protopterus,

Lepidosiren- brief note on affinities and distribution.

Subclass : Actinopterygi

Super order : Chondrostei. Eg. Acipenser-brief note.

Super order : Holostei Eg. Lepidosteus – brief note.

Super order : Teleostei. Eg. Sardinella, Rastrelliger, Trichiurus, Cynoglossus, Parastromateus, Cybium, Belone, Syngnathus, Anguilla, Harpadon, Tuna, Etroplus, Mugil, Channa, Anabas, Wallago, Catla, Cirrhinus, Labeo, Hippocampus, Hemirhamphus, Exocoetus, Tetradon, Ostracion, Saccobranchus, Clarius, Pterois, Echeneis, Larvivorous fishes like Gambusia, Aplocheilus (mention adaptation features and special characters).

General Topics:

1. Migration of fishes.
2. Accessory respiratory organs in fishes (Evolution of air bladder to be mentioned).
3. Characteristics of common edible fishes and their significance.
(Atleast eight fishes with their scientific names.)

Superclass : Tetrapoda

7. Class : Amphibia (10hrs.)

Order : Anura

Type : Rana hexadactyla. Eg. Bufo, Hyla, Rhacophorus.

Order : Urodela. Eg. Sirenia, Triton, Proteus, Amblystoma- Axolotl larva. Mention neoteny.

Order : Apoda

Ichthyophis, Uraeotyphlus.

General topic : Parental care in Amphibia

8. Class : Reptilia (12 hrs)

Type : Calotes (Skeletal system of Varanus instead of Calotes)

Classification based on Temporal fossae.

Subclass : Anapsida

Order : Chelonia- General characters of turtles and tortoises.

Eg. Testudo, Trionyx, Chelone, Chrysemys.

Subclass : Parapsida (extinct) –Mention general characters – fish like reptiles.

Subclass : Synapsida (extinct)Mammal like reptiles- Mention general characters only.

Subclass : Diapsida

Superorder : Lepidosauria

Order : Rhynchocephalia – Sphenodon – salient features – living fossil

Order : Squamata

Superorder : Lacertilia

Eg: Draco, Chamaeleon, Hemidactylus, Mabuya, Moloch, Phrynosoma, Heloderma, Uromastix, Ophisaurus, Iguana.

Suborder : Ophidia

Poisonous snakes – Naja, Ophiophagus, Vipera, Bungarus, Ancistrum, Crotalus, Enhydrina. Coral snake.

Non-poisonous snakes- Typhlops, Ptyas, Natrix, Dryophis, Python.

Superorder : Archosauria

Briefly describe the general characters of Dinosaurs.

Order : Crocodilia- General characters.

Eg. Crocodilus, Alligator, Gavialis.

General Topics:

1. Poison apparatus of snakes (Mention biting mechanism).
2. Symptoms of snake venom (Mention identification of snake bites), Anti venom, First aid treatment of snake bite.
3. Identification of poisonous snakes using key.

9. Class : Aves (16 hrs.)

Type : Pigeon (Skull not expected)

Subclass : Archaeornithes .Archaeopteryx – Evolutionary significance.

Subclass : Neornithes.

Superorder : Palaeognathae (General Characters).

Eg: Ostrich, Rhea, Emu, Cassowary, Kiwi, Tinamous.

Superorder : Impennae (General Characters)

Eg: Penguins – Aquatic adaptations. Mention Emperor Penguins.

Superorder : Neognathae – Common birds of Kerala. Crow (jungle and house), Crow pheasant, Magpie robin, Treepie (Dendrocitta), Eudynamys, Passer (House sparrow), Barnowl, Pavo (peafowl), Ardea (grey heron), Milvus (kite) Pseudogyps (Vulture), Common Kingfisher, Cattle egret, Pelican, Waterhen, Small greenbee eater, Woodpecker, Parrot (Psittacula), Great Indian Hornbill (Buceros).

Extinct Forms : Passenger pigeon, Dodo, Pink-headed duck. Reasons for Extinction.

Rediscovery- Jerdon's courser.

General topics :

1. Migration of Birds.
2. Flight adaptations of Birds.
3. Essay on indigenous and exotic breeds of poultry. Any six breeds (fowl, duck, geese, swans, turkey and guinea fowl)

10. Class : Mammalia (24 hrs.)

Type : Oryctolagus.

Subclass : Prototheria – General characters.

Eg : Ornithorhynchus, Echidna.

Subclass : Metatheria – General characters.

Eg: Didelphis, Macropus, Perameles.

Subclass : Eutheria – Brief account of examples.

Order : Insectivora. Eg: Paraechinus, Suncus.

Order : Chiroptera. Eg: Vampyrus, Pteropus, Pipistrellus.

Order : Dermoptera. Eg: Galeopithecus.

Order : Primates.

Eg: Lemurs, Tarsiers, Loris, Macaca sp., Gorilla,

Pongo, Anthropopithecus, Hylobates, Homo.

Order : Carnivora.

Eg: Seal, Walrus, Panthera sp., Felis sp., Herpestes, Cheetah, Vivericula,

Paradoxurus, Hyena, Melursus, Lutra, Canis pallipes, Vulpes bengalensis.

Order : Cetacea

Eg: Sperm whales, Baleen whales, Killer whales, Doltpins.

Order : Perissidactyla

Eg: Equus, Zebra, Tapirus, Rhiniceros.

Order : Artiodactyla.

Eg: Camelus, Hippopotamus, Bison, Hemitragus, Spotted deer, Sambar deer, Barking deer, Musk deer, Dancing deer of Manipur, Antelopes of India.

Order : Proboscida. Eg : Indian and African Elephants- General characters , Mention Mammoth.

Order : Hyracoida. Eg: Procavia.

Order : Rodentia.

Eg: Funambulus, Rattus rattus, Hystrix, Cavia, Bandicota malabarica, Hydoes.

Order : Lagomorpha.

Eg: Rabbits and Hares.

Order : Edentata.

Eg: Sloths, Armadillos, Myrmecophaga.

Order : Pholidota

Eg: Manis.

General Topics.

1. Aquatic mammals and their adaptations.
2. Dentition in mammals.(adaptations related to food should be stressed.)
3. Mammals of Kerala forest (Monkeys, Elephants, Leopard, two small cats, two deer sp., Gaur, Tahr)
4. Two breeds of cattle, sheep or goat and pig each, with their scientific names and economic importance.

Note : Type study should be based on external morphology, integumentary system and exoskeleton, endoskeleton, alimentary canal and associated glands , food and feeding, respiratory system-method of respiration, blood vascular system – structure and working of heart, major arteries and veins, nervous system-structure of brain and spinal cord, cranial nerves, structure and functions of major sense organs, excretory system-structure of kidney and its working mechanism and reproductive system-general structure and method of reproduction.

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13. Norman - History of Fishes

14. Romer - Vertebrate Zoology
15. W.H.O.Hoar - Comparative Animal Physiology
16. Alikunni K.H. - Fish culture in India- ICAR New
Delhi.
17. Sing P. & Moore N.E. - Live stock & Poultry production
(Prentice Hall)
18. Sukhia & Upadhyaya - Economic Zoology (Rastogi)
19. Kurien C.V & Sebastian W- Prawn and Prawn Fisheries
20. Stickney R.R. - Principles of Warm Water
Aquaculture.

PAPER III
CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY
AND BIOTECHNOLOGY

Total : 112 hrs.

PART A- CELL BIOLOGY (40 hours)

Unit I: Introduction

Cell theory and its modern concept. Mycoplasma, virus, viroids, and virions. Prokaryotes and eukaryotes, general organization of bacteria. (3 hrs)

Unit II: Histological techniques

Preparation of whole mounts. Fixation and its aims, fixatives (formalin, ethanol, Bouins fluid, Carnoy's fluid,) staining: common histological stains –haematoxylin, eosin, carmine. Vital stains-neutral red, Janus green, methylene blue. blood cell stains-Wright's stain, Leishman's stain(3hrs)

Unit III Cell structure and functions

1. Protoplasm-Physical properties.
2. Plasma membrane-Structure (fluid mosaic model), mention Robertson's unit membrane concept. Plasma membrane modifications (microvilli, desmosomes, gap junctions,

- plasmadesmata) transmembrane transport (passive, active and vesicular transport)
3. Cytoskeleton: Brief account of cytoplasmic microtubules and micro filaments
 4. Endoplasmic reticulum: structure and functions
 5. Ribosomes: structure and composition of prokaryotic and eukaryotic ribosomes, biogenesis of ribosomes, functions of ribosomes. mention monosomes and poly somes
 6. Golgi bodies: structure and functions (cellular secretion in detail)
 7. Lysosomes: structure and functions,(cellular digestion in detail) polymorphism GERL concept
 8. Microbodies; Peroxisomes and glyoxysomes
 9. Mitochondria: structure and chemical composition- Bioenergetics including respiratory chain and electron transport (Brief account only- details of steps not required) mitochondrial DNA, RNA and ribosome - Biogenesis
 9. Interphase nucleus: nuclear envelope, pore complex, Nucleolus, Nucleoplasm- structure and functions.
 - 10 chromosomes: Physical and chemical structure, chromatin- heterochromatin and euchromatin, Nucleosomes and histones. Structure and functions of Polytene and Lamp brush chromosomes- mention puffs and bands, Endomitosis. (26hrs)

Unit 1V Cell division

Mitosis, meiosis- (detailed description), comparison and contrast, cell cycle- G1, S, G2 and M phases, spermatogenesis and Oogenesis. (6hrs)

Unit V Cancer

Benign and malignant tumours, types of cancer- characteristics of cancer cells, carcinogens, hypothesis about cancer, mutation, viral and defective immunity(2 hours)

PART B-GENETICS (47 hrs)

Unit I Introduction

Scope and importance of Genetics,

Short account of alleles(wild type and mutant), homozygosity and heterozygosity, genotype and phenotype ,back cross and test cross. (3hrs)

Unit II Interaction of genes

Allelic and non allelic interactions-incomplete dominance, codominance,epistasis, duplicate genes, poly genes(skin colour inheritance in man) (one problem from each type) modifying genes, lethal genes, atavism, pleiotropism. (8hrs)

Unit III Multiple allelism

Definition, coat colour in rabbits,genetics of ABO blood groups and Rh factor, mention other blood groups such as Bombay blood group,M,N,and MN-erythroblastosis foetalis,- problems from blood groups. (4hrs)

Unit IV Linkage and crossing over

Linkage-definition,linkagegroups,complete and incomplete linkage(Morgans experiment in *Drosophila*) crossing over-disruption of linkage through crossing over and recombination,factors affecting crossing over,significance of crossing over,linkage maps and mapping of chromosomes. (5Hrs)

Unit V Sex determination

Autosomes and Sex chromosomes, chromosome theory of sex determination, chromosomal mechanism of sex determination(XX-XY,XX-XO,ZZ-ZW)-Role of Y chromosome in humans, mention TDF, genic balance theory of Bridges, Barr bodies-Lyon hypothesis ,sex determination in honey bees, gynandromorphism, hormonal and environmental influence on sex determination. (6hrs)

Unit VI Sex linked inheritance

Sex linked genes, sex linked inheritance-X – linked inheritance –criss cross inheritance, (egs.white eye in *Drosophila*,colour blindness in man).Y-linked inheritance in man with egs. (3 hrs)

Unit VII Mutation

Definition-mutation theory of DeVries-different types of mutations, gene mutation-its molecular basis,chromosomal aberrations-structural(deletion,addition, inversion and translocation),numerical(euploidy and aneuploidy) ,mutagens,natural and induced mutations-significance of mutations. (7hrs)

Unit VIII Cytoplasmic or extranuclear inheritance

Definition and general characters-egs. Shell coiling in *Limnea*,kappa particles in *Paramecium*. (3hrs)

Unit IX Human genetics

1. Normal chromosome complement in human beings.
2. Autosomal anomalies and disorders-Down, Patau, Edward and Cri-du chat syndromes. Mention sickle cell anaemia as a single gene disorder
3. Sex chromosomal anomalies and disorders-Turner and Klinefelter syndromes
4. Biochemical gene mutations and disorders-albinism, PKU, alkaptonuria
5. Sex linked mutations-haemophilia, colour blindness
6. Polygenic traits-cleft lip-palate and hydrocephali
7. Prenatal diagnosis(amniocentesis)
8. Genetic counseling
9. Eugenics, Euthenics and Euphenics. (8hrs)

PART-C MOLECULAR BIOLOGY AND BIOTECHNOLOGY (25hrs)

1. The concept of genes (1hr)
2. Genetic material-definition, experiments to prove DNA as genetic material-Griffiths transformation experiments, Avery and co-workers experiments, and Hershey and Chase experiment (3hrs)
3. DNA replication- semiconservative method; experiment by Messelson and Stahl (2hrs)
4. Gene action-Central dogma of molecular biology-reverse transcription by retroviruses ,eg.HIV One gene one enzyme hypothesis, one gene one polypeptide hypothesis (2hr)
5. Genetic code and its features (1hr)
6. Concept of cistron, split genes, overlapping genes, jumping genes(brief account only) (2hrs)
7. Protein synthesis-transcription and processing of mRNA, translation-different steps. (3hrs)
8. Regulation of gene action- operon concept-Lac operon (2hrs)
9. Role of genes in development-gene modulation (1hr)
10. Definition and scope of biotechnology and genetic engineering (1hr)
11. Recombinant DNA technology and gene cloning-enzymes in rDNA technology

- slicing, splicing and cloning of genes, vectors (plasmid and phage vectors), gene transfer (4hrs)
12. Brief notes on : somatic cell hybridization, hybridoma technology, and monoclonal antibodies (1hr)
13. Brief notes on: Southern blot, Northern blot, Western blot ,DNA fingerprinting (1hr)
14. Practical applications and suspected hazards of biotechnology and genetic Engineering (1hr)

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1. De –Robertis : Cell and molecular biology- Holt saunders
2. Geise : Cell physiology-Holt saunders
3. Powar : Cell biology –Himalaya publishing house
4. Sterm and Nancy : The biology of cells –Wiley Eastern.
5. Karp : Cell biology- Mcgrew Kills.
6. Goodenough : Genetics- Holt saunders
7. Strickberger : Genetics -Mac Million.
8. Ahuvalia : Genetics- Wiely Estern
9. Sarin : Genetics-TMH
10. Gardner, Simmon and Sunstad : Principles of genetics –John Wiely& Sons
11. Swanson : Cytogenetics
12. Friedfelder : Molecular biology – Narosa Pub. House.
13. M. Moosad : The Biological manipulation Life- Fergemen Press
14. Lewin : Genes –Oxford Uty.Press
15. Old and Primrosa : Principles of genetics-JohnWiley&Sons.
16. MC Cusic :Human genetics-Prentice Hall
17. Kingsman&Kingsman : Genetic engineering –Blackwell Scientific
18. G.J.Stine : The new human genetics –W.L. Brown
19. P.K.Gupta : Cell and molecular biology- Rastogi Publications
20. K. Vijayakumaran Nair & M. Jayaprakash : Cell Biology, Genetics and molecular Biology – Academica
21. Norman S. Cohn : Elements of Cytology.

PAPER-IV
ENVIRONMENTAL BIOLOGY, ETHOLOGY, EVOLUTION
AND ZOOGEOGRAPHY

Environmental Biology (113 Hrs)

Unit I Environment and the Concept of Ecosystem

Environmental factors

Abiotic factors- Electromagnetic spectrum, visible light, temperature, soil, water, air.

Biotic factors- Autotrophs, phagotrophs and saprotrophs

Ecosystem interaction and inter-relationship between biotic and abiotic factors- the cybernetic nature and the stability of the ecosystem

Forest as an ecosystem (8 hrs)

Unit II Ecosystem energetics

Concept of productivity- food chain, food web, trophic levels- trophic structure, Ecological pyramids- energy flow in the ecosystem- models ; energy based classification of the ecosystem . (8 hrs)

Unit-III Biogeochemical cycles

Basic types of biogeochemical cycles: Gaseous cycle-carbon and nitrogen cycles, sedimentary cycle, recycling pathways and recycle index.

(4 hrs)

Unit IV Limiting Factors

Basic concepts- Leibig's law of minimum- Shelford's law of tolerance, combined concept of limiting factors.

Light and temperature as limiting factors. (4hrs)

Unit-V Population ecology

Properties of population- density, natality, mortality, age distribution, biotic potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation (5 hrs)

Unit-VI Community ecology

Definition and characters-species diversity; stratification; dominance; ecotone and edge effect; ecological indicators; community periodicity. Ecological succession-basic types of succession; processes in succession. (4 hrs)

Unit-VII Population Interaction

Interspecific association: Positive and negative interaction; Mutualism, commensalisms, parasitism predation, competition allelopathy. (4 hrs)

Unit-VIII Habitat Ecology

Biosphere- classification: Lithosphere, Hydrosphere and Atmosphere

Physical features, fauna and their adaptations of

- 1) Aquatic ecosystems: fresh water- lentic and lotic habitat
- 2) Marine-pelagic and benthic; estuaries.
- 3) Terrestrial ecology: Biomes- forest, desert, grass land, tundra, savanna, alpine and cave biomes. (8 hrs)

Unit-IX Biodiversity and its Conservation

Definition- scope; levels of biodiversity; global biodiversity; tropical biodiversity; economics of biodiversity, global biodiversity hot spots.

Impact of green, white and blue revolution on biodiversity

Wild life management and conservation: Principles of conservation.

Economic use of energy and energy audit

Deforestation and consequences; Threatened and endangered species, conservation of forest and wild life, social forestry.

Sustainable development- Earth Summit at Rio de Janeiro and World Summit at Johannesburg. (6 hrs)

Unit-X Environmental Laws

Brief mentioning of the objectives and features of the following laws: Wild life protection Act 1972; The Water (prevention and control of pollution) Act 1974, 1977, 1988; The Forest (conservation) Act 1980; Environment (protection) Act 1986; Patents Act 1970 and its amendments; Brief mentioning of GATT, WTO, TRIPs, and biopatenting

(4 hrs)

Unit-XI Global Environmental Issues

Pollution: Air pollution; Water pollution; Noise pollution; Radioactive pollution; Solid waste pollution, Pesticide pollution

Ozone depletion; Green house effect; Global warming; Montreal protocol, Kyoto protocol

Acid rains; hazardous waste management- oil spills, oil depletion

Depletion of biological diversity

Impact of sand mining on the ecosystems..

Importance of Mangroves in coastal ecosystems (8 hrs)

ETHOLOGY (10 hrs)

History and scope of ethology.

Motivation: models of motivation (Lorenz's psycho-hydraulic model and Deutsch's model.)

Neural mechanisms in behaviour: role of hypothalamus and other brain centres, hormones and behaviour.

Learning: types of learning; habituation, conditioned reflex; latent learning, insight learning, imprinting.

Sociobiology: social groups- merits and demerits; properties of organized societies; insect societies; social groups in mammals; social stress.

Pheromones and chemical communication; Human pheromones. (10 hrs)

EVOLUTION (30 hrs)

Unit-I : Origin of life on earth- Theories, Modern approaches- Oparin concept, Urey-Miller expt. (2 hrs)

Unit-II : Evidences of organic evolution- morphological and anatomical, physiological and biochemical, embryological, palaeontological. (6 hrs)

Unit-III : History of life on earth- Geological time scale, Fossils, fossilization, fossil dating, significance of fossils. (4 hrs)

Unit-IV : Theories of organic evolution- Lamarck's theory, its criticism (Weisman's germ plasm theory) Darwin's theory of natural selection (mention the contributions of Wallace), Mutation theory. (5 hrs)

Unit-V : Modern concept of organic evolution-Neo Darwinism. Genetic basis of variation, Hardy –Weinberg equilibrium genetic drift, natural selection (brief account of the observation of *Mimulus lewisii*) Role of mutation in evolution, Pre-adaptation.

(6 hrs)

Unit-VI : Nature of evolution- isolation and isolating mechanisms, species, (definition and characters) speciation-sympatric speciation and allopatric speciation. Adaptive radiation with special reference to Darwin's finches, (4 hrs)

Unit-VII : Evolution of Man- brief accounts of *Paranthropus*, *Proanthropus*, *Prohomo*, *Dryopithecus*, *Ramapithecus*, *Australopithecus*, Neanderthal man, cromagnon man and modern man. (3 hrs)

ZOOGEOGRAPHY (10 hrs)

Unit-I Animal Distribution

Geographic distribution of animals-cosmopolitan distribution; discontinuous distribution; bipolar distribution and isolated distribution

Factors affecting animal distribution; barriers to animal distribution- physical, and biological barriers. (3 hrs)

Unit-II Zoogeographical Realms

Only brief account of each realm is expected,. Mention the areas included, brief account of the physical features and fauna: Palaearctic region, Australian region, Ethiopian region, Nearctic region, Oriental region and Neotropical region. Biogeographical classification of India: Western Ghats, Eastern Ghats and Himalayas. (6 hrs)

Unit-III Insular Fauna

Brief account of Oceanic islands and Continental islands (with one example each)

(1 hr)

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Marvel and Hamilton. Mechanism of Behavior.

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Stebbins G.L. 1977. Process of Organic Evolution, Prentic Hall Inc.

Volpe E.P. 1985, Understanding Evolution. Ind. Repr. Universal Book Stall, New Delhi.

PAPER V- PHYSIOLOGY & DEVELOPMENTAL BIOLOGY (113 hrs)

SECTION A- PHYSIOLOGY 63 hrs

NUTRITION – Undernutrition, PEM, deficiency of Vitamin, iron, Calcium and Iodine. Overnutrition, Obesity and weight control, food adulteration, defects of modern food habits (importance of fibers in food), Nutrition during pregnancy, breast feeding, anorexia acidity and ulcers, flatulence, fasting and its significances.

5hrs

RESPIRATION – Gaseous exchange in lungs and the factors affecting, transport of respiratory gases through blood, oxy-hemoglobin curve, Bohr effect, reverse Bohr effect. Neural (voluntary and automatic) and chemical control (mention the role of carotid and aortic bodies) of respiration. Respiratory disturbances- mention apnoea, dyspnoea,

arterial hypoxia, hypo- and hypercapnia, asphyxia. Smoking and its physiological effects. Artificial respiration. 6hrs

CIRCULATION – Blood clotting mechanism – intrinsic and extrinsic pathways, clotting factors, factors of anti clotting mechanism Blood groups (ABO & Rh), blood transfusion (safety and security problems), mention haemostasis, haemolysis jaundice, haemopoiesis, thrombosis. ESR. Electrical and mechanical properties of heart muscle, pace maker and conducting system of mammalian heart, myocardial infarction, atherosclerosis. ECG. Lymphatic system, formation and flow of lymph.

6hrs

EXCRETION- Urea cycle (in detail), histology of nephron, juxtaglomerular apparatus, mechanism of urine formation, counter current multiplier theory, hormonal control of urine formation, composition of urine(normal and abnormal). Mention nephrosis, uremia, proteinuria, kidney stones. Haemo dialysis and peritoneal dialysis.

5hrs

MUSCLE PHYSIOLOGY- EM structure of myofibrils and myofilaments, sarcotubular system, contractile proteins, electrical, chemical and morphological changes and ionic fluxes during contraction of striated muscle fibre. Electrophysiology of muscle, threshold and spike potentials, latent and refractory periods, simple muscle twitch, tetany, fatigue, Cori cycle, rigor mortis.

6hrs

NEUROPHYSIOLOGY- Myelinated and non myelinated nerve fibres, regeneration of fibres, neurotrophins, synapses, neuro-muscular junction. Initiation and propagation of nerve impulse, saltatory transmission, synaptic transmission, neurotransmitters, role of dopamine and serotonin. Brief notes on EEG, MRI.

6hrs

SENSORY PHYSIOLOGY- Retinal structure, visual pigments in rods and cones. Photochemistry of vision. Physiological basis of colour vision. Colour blindness. Visual

acuity and Snellen's test. Organ of Corti, physiology of hearing, deafness, hearing tests, gustation.

5hrs

BIOLUMINESCENCE AND BIOELECTRICITY- Biochemistry of bioluminescence, biological importance, bioelectric organ in ray fish.

2hrs

ENDOCRINOLOGY- Major endocrine organs (detail) in man and their functions. GI hormones and their functions. Feedback regulation of hormone release- positive and negative Concepts of neuro secretion- hypothalamus-hypophysial interactions; hypothalamus releasing and inhibiting hormones/factors. Hormonal control of: (a) gametogenesis in male and female, (b) pregnancy and lactation.

9hrs

IMMUNOLOGY –Types of immunity- innate (non specific and specific), acquired; active and passive immunity, humoral and cell mediated immunity. Immune system- Lymphocytes, lymphoid tissues and organs (lymph nodes, spleen, bone marrow, thymus, and mucosa associated lymphoid tissues). Antibodies- basic structure, functions and classes of immunoglobulins. Antigen-antibody reaction (brief account), agglutinin and precipitation, complement system Immunodeficiency-

9hrs

REPRODUCTION -Structure of testis and ovary, semen production and ovulation, mention Graffian follicle, corpus haemorrhagicum, corpus luteum and corpus albicans. Menstrual cycle and the hormonal control. Menopause.

4hrs

SECTION B- DEVELOPMENTAL BIOLOGY**50 hrs****PARTHENOGENESIS**

2hrs

EGG, CLEAVAGE AND BLASTULATION- Types of egg, classification based on amount and distribution of yolk, egg membranes, mosaic and regulative eggs. Cleavage types- radial (star fish), spiral (*Planocera* – cell lineage studies-), holoblastic equal (*Branchiostoma*), and unequal(frog), meroblastic discoidal (chick), and superficial (insect). Blastula formation, types of blastula- coelo-, stereo-, and discoblastulae and blastocyst. Influence of yolk on cleavage.

4hrs

CELL DIFFERENTIATION & GENE ACTION DURING DEVELOPMENT – Cell differentiation- totipotency and pluripotency of embryonic cells, dedifferentiation and redifferentiation in embryonic development, controlled gene expression during development, homeotic genes, Hox genes in vertebrates.

4hrs

DEVELOPMENT OF AMPHIOXUS – Structure of egg, fertilization, Cleavage, blastulation, gastrulation. Brief account of development of neural tube, notochord, mesoderm, coelome, and gut.

5hrs

DEVELOPMENT OF FROG – Structure of egg, fertilization, Cleavage, blastulation, importance of grey crescent, gastrulation, closure of blastopore, yolk plug stage, neurulation, formation of notochord, mesoderm and coelome. Organogeny of brain, eye, heart and aortic arches. Hormonal control of amphibian metamorphosis

8hrs

DEVELOPMENT OF CHICK – Structure of egg, fertilization, Cleavage, blastulation, gastrulation, Development up to 48hrs. with salient features of 18hrs, 24hrs, and 33hrs of incubation. Development and functions of extra embryonic membranes.

10hrs

DEVELOPMENT OF MAN – Structure of ovum and sperm, cleavage, blastocyst formation, implantation. development and functions of foetal membranes. Brief account on pregnancy, gestation, parturition and lactation.

4hrs

PLACENTA – functions and different types based on type of foetal membranes involved, nature of contact, distribution of chorionic villi and histological intimacy.

2hrs

EXPERIMENTAL EMBRYOLOGY

1. Vital staining, marking with carbon particles, radio active tracers, fate of blastomeres and construction of fate maps.
2. Spemann's constriction and fusion experiments – potency of cleaving nuclei.
3. Transplantation experiments involving dorsal lip and optic cup during metamorphosis of frog's tadpole.
4. Inductive interaction in development – primary organizers and induction with special reference to amphibian development.
5. Exogastrulation in frog blastula, removal of egg membranes, independent, dependent and progressive differentiation.
6. Embryonic stem cells and stem cell research.
7. Prenatal diagnosis- amniocentesis, female foeticide, chorionic villus sampling, ultra sound scanning.
8. Cloning experiments in animals – consequence of human cloning.

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PHYSIOLOGY

1. C.C. Chatterjee : Human Physiology, Vol I & II Medical Allied Agency
2. Eckert & Randall : Animal Physiology, Mechanism and Adaptations , CBS
3. Joshi : Nutrition and Dietetics , Tata Mc. Graw Hill
4. Prosser & Brown : Comparative Animal Physiology

5. Guyton : Text Book of Medical Physiology Saunders
6. Best and Taylor : Physiological Basis of Medical Practice
7. Mackenna & Callander: Illustrated Physiology, Churchill Livingstone
9. Chakrabarti, Ghosh & : Human Physiology, The New Book Stall Schana.

DEVELOPMENTAL BIOLOGY

1. Pattern : Foundations of Embryology
2. Balinsky : Introduction to Embryology
3. Mc. Even : Vertebrate Embryology
4. Raven : Development Physiology
5. Roberts Rugh : Frog Reproduction & Development. TMH Edn.
6. P.S. Verma & : Chordate Embryology S. Chand & Co.
V.K. Agarawall.
7. Bradely M. Pattern & : Foundations of Embryology
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K. Vijayakumaran Nair

PAPER – VI: BIOCHEMISTRY, BIOPHYSICS, BIOMETRY AND BIOINFORMATICS

SECTION – A : BIOCHEMISTRY (50 Hours)

Unit -1: Biochemistry and the living state – mention micro, macro and trace elements – biological significance. -2 Hours

Unit – 2: Water – molecular structure – dipolar nature – dissociation of water – concept of pH – buffers – Handerson Hassel Bach equation - 3 Hours

Unit -3: Macromolecules:

(a) Carbohydrate – structure and classification – mono, di and polysaccharide – trioses, tetroses, pentoses, hexoses, aldo and keto sugars, homo and hetero polysaccharides – biological functions.

(b) Proteins – structure and classification of amino acids – classification based on functions – structural levels of proteins – biological importance of protein and aminoacids.

(c) Lipids – structure and classification – simple lipids, waxes, phospholipids, glycolipids, steroids and prostaglandins – biological importance of lipids.

(d) Nucleic acids and Nucleotides – structure of nitrogen bases – nucleosides, nucleotides, structure of DNA , different forms DNA, different types of RNA , dinucleotides – NAD, NADP, FAD, ATP, cyclic AMP.

– 20 Hours

Unit – 4; Enzymes and hormones: Nomenclature, classification, concept of active sites, mechanism of enzyme action, effect of pH, substrate concentration, temperature and activators, enzyme inhibition, concept of free energy, kinetic theory, Michaelio-Menten equation, isozymes and coenzymes. Classification of hormones based on chemical nature and mechanism of hormonal action.

– 7 Hours

Unit – 5: Metabolism: Basal metabolism, BMR- method of calculation; Factors effecting metabolism; Energy metabolism, Carbohydrate metabolism – glycolysis, glycogenolysis, glycogenesis, gluconeogenesis; Protein metabolism – deamination, transamination, decarboxylation, transmethylaton; Lipid metabolism – oxidation of glycerol and fatty acids; Biosynthesis of fatty acids and triglycerides; Kreb's cycle, electron transport and oxidative phosphorylation. - 18 Hours

SECTION B: BIOPHYSICS (22 Hours)

Unit – 1: Tools and Techniques: (Principle, working methodology and applications).

- (a) Microscopy – Light microscope (use of oil immersion objective), Phase contrast microscope, Fluorescent microscope, Electron microscope (TEM & SEM);
- .
- (b) Camera lucida and micrometry.
- (c) Chromatography- paper and column chromatography – principle and applications
- (d) Electrophoresis – paper and gel electrophoresis
- (e) X-ray crystallography
- (f) Autoradiography
- (g) pH – meter
- (h) Spectrophotometer
- (i) Microtome
- (j) Kymograph
- (k) Centrifuge – different types of centrifuge – different types of centrifugation –
Cell fractionation.

- 17 Hours

Unit 2: Radiation Biology – units of radiation – ionizing and non-ionizing radiations – radioisotopes – applications – biological effects of radiations. – 3 Hours

Unit 3: Immunological techniques – immunodiffusion – immunoelectrophoresis – ELISA – RIA (Basic principle and uses only) – 2 Hours

SECTION C: BIOMETRY (20 Hours)

Unit 1: Collection, Sampling and Tabulation of Biological data. – 3 Hours

Unit 2: Diagrammatic representation of data – line and bar diagrams – histograms – frequency polygon and pie diagrams. – 3 Hours

Unit 3: Measures of central tendency – mean, median and mode. – 4 Hours

Unit 4: Measures of dispersion – mean deviation and standard deviation. – 4 Hours

Unit 5: Test of significance – Basic concept – levels of significance – Chi-square test – Goodness of fit. – 3 Hours

Unit 6: Correlation and regression – definition – positive and negative correlation – regression analysis – regression lines – regression equation. – 3 Hours

SECTION D: BIOINFORMATICS (20 HOURS)

Unit 1: Introduction: scope and importance of bioinformatics. – 3 Hours

Unit 2 : The internet basics- important search engines – e-mail - 2 Hours

Unit 3: Biological data bases - 3Hours

Unit 4: Bioinformatic tools - 3 Hours

Unit 5: Genomics - 3 Hours

Unit 6: Proteomics - 3 Hours

Unit 7: Sequence alignment - 3 Hours

References:

1. Lehninger, Biochemistry , Kalyani Publications
2. Stryer, Biochemistry, W.H Freeman and Co., Newyork
3. Awapara J, Introduction to Biological chemistry, Prentice-Hall of India
4. Cohn E E and Stumpf P K, outlines of Biochemistry, Wiley Eastern
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11. Lewis A I, Biostatistics, Reinhold Pub.Corporation.
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B.Sc. ZOOLOGY (MAIN) PRACTICALS

PRACTICAL – I : Anatomy and Animal Diversity

1. Identification

Students are expected to identify the animals by their scientific names. The number of animals to be identified and drawn with notes are given in the bracket. Give importance to the locally available specimens as far as possible.

Protozoa (3), Porifera (2), Cnidaria (4), Platyhelminthes including parasitic forms (2), Nematoda including parasitic form (2), Annelida (3), Arthropoda including pests and beneficial insects (8), Mollusca (5), Echinodermata (4), Minor Phyla (2).

Prochordata (2), Pisces including food fishes (8), Amphibia (4), Reptilia (6), Aves (beak and feet modifications of any three birds), Mammals (2).

2. Histology – Any five items of the following

Hydra T.S., Fasciola T.S., Ascaris T.S. male and female, Neries T.S., Planaria T.S., Leech T.S., earthworm .S., Amphioxus T.S. through pharynx, Amphioxus T.S. through intestine.

3. Osteology – Sketches of any ten items

Frog – skull bones, vertebrae and girdles

Lizard – Skull and girdles(Varanus)

Bird – Neck vertebra, pectoral girdle with sternum, pelvic girdle with synsacrum

Rabbit – skull and vertebrae(lumbar, atlas, axis), scapula, coracoid, pelvic girdle

4. Mounting

Plant bug – mouth parts

Honey Bee – mouth parts

Panaeus – appendages

Earthworm – setae

Neries – parapodium

Scoliodon – placoid scale

Frog – brain

5. Dissections

Earthworm – Nervous System(major)

Cockroach – Nervous System(major)

Cockroach – Female Reproductive System(minor)

Cockroach – Salivary Apparatus(minor)

Paenaeus – Nervous System(major)

Frog – Arterial system(major)

Frog – 10th Cranial Nerves(major)

PRACTICAL – II : Physiology, Ecology, Cytology, Genetics and Embryology

I Physiology

- i) Determination of human blood group – A, B, AB and O and Rh+ and Rh- (minor)
- ii) Blood smear preparation – identification of WBC (minor)
- iii) Determination of haemoglobin content of blood (minor)
- iv) Total RBC count using Haemocytometer (demon.)
- v) Total WBC count using Haemocytometer (demon.)
- vi) Differential WBC count (demon)
- vii) Detection of normal and abnormal constituents of urine (major)
- viii) Effect of temperature on the rate of heart beat of frog (demon.)
- ix) Estimation of sugar liberated due to amylolytic activity in relation to substrate concentration. (maj.)
- x) Demonstration of invertase activity (in vitro) in the digestive tract of Cockroach / hepatopancreas of crab (Min.)

- xi) Effect of lipase collected from the digestive tract of Cockroach / hepatopancreas on fat (Maj.)

II Ecology

- i) Detection of dissolved oxygen – Winklers method – calculation based on equivalent weight (major)
- ii) Detection of carbon dioxide and water (major)
- iii) Qualitative analysis of fresh water or marine plankton (major)
- iv) Analysis of soil fauna (minor)

III Cytology and Genetics

- i) Onion root tip squash to identify and study different stages of mitosis
- ii) Grass hopper testis squash to identify and study different stages of meiosis (demo.)
- iii) Drosophila salivary gland chromosome preparation to study giant chromosome (demon.)
- iv) Simple problems based on gene interaction, linkage and multiple alleles in animals

IV Embryology (Note: students are expected to know the developmental stages, identify with labeled sketches and notes of the following)

- i) Frog blastula T.S.
- ii) Frog gastrula T.S.
- iii) Frog neurula V.S.
- iv) Chick embryo – 18hrs, 24hrs, 33hrs and 48hrs
- v) Mammalian foetus

Practical III - Biochemistry, Biophysics and Biometry

A. Biochemistry and Biophysics

1. Qualitative Analysis.

- a) Reactions of carbohydrates – (i) General tests – Molisch's test; (ii) Tests for monosaccharides – Benedict's test, Fehling's test, Moore's test (glucose), Rapid furfural test and Seliwanoff's test (fructose), Cupric sulphate test, Barfoed's test; (iii) Tests for non reducing disaccharides – Hydrolysis and tests for monosaccharide; (iv) Test for starch – Lugol's iodine test.
- b) Reactions of protein – Ninhydrin test, Nitric acid test, Xanthoproteic test, Biurete test, Millon-Nasse test, Sakaguchi's test, Sodium nitroprusside test.
- c) Reactions of lipid – Solubility test, Spot test, Acrolein test, Emulsification test, Saponification test, Sudan III & IV test.
- d) Qualitative analysis of unknown samples.

2. Estimation of protein – Biuret method.

3. Preparation of percentage, normal and molar solutions.

4. Preparation of buffer solutions- acetate buffer/citrate buffer

5. Measurement of pH using pH paper and pH meter-minor

6. Centrifugation – cell fractionation and separation of nuclei

7. Colorimetry – (a) Preparation of standard curve and estimate the concentration of solute in an unknown sample, (b) Determination of absorption maxima-minor

8. Chromatography – Determination of R_f value of amino acid and identification of amino acid.

9. Gel electrophoresis – demonstration.

10. Microscopy- Examination and study of parts of compound microscope, Camera lucida and its uses; micrometry- Calibration of microscope using stage and ocular micrometers, measurement of microscopic objects-minor

11. Microtomy – Study of microtome and its parts; Preparation of paraffin blocks and slides (demonstration)

12. Histochemical study (protein/carbohydrate) – demonstration.

B. Biometry

1. Preparation of Bar diagram, pie diagram and histogram-minor
2. Calculation of mean, median and mode; mean deviation and standard deviation-minor
3. Preparation of bar and, pie diagram, histogram and frequency polygon using computer.
4. Calculation of mean, median and mode, mean deviation, standard deviation using computer-minor

Sd/-

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