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DETAILED SYLLABUS

FOR

DISTANCE EDUCATION

B.Sc. (Zoology)

(SEMESTER SYSTEM)

B.Sc. Zoology

Scheme of B.Sc. I

Semester – Important						
Sr. No.		**Paper**	**Marks**		**Periods/ Week**	**Exam. Duration**
1.			Internal Assessment*	External Marks		
2.	Paper I	Life and Diversity from Protozoa to Porifera and Cell Biology – I	**40**	**60**	4	3 hrs.
3.	Paper II	Life and Diversity from Coelentrata to Helminthes and Cell Biology – II	**40**	**60**	4	3 hrs.
Semester – II						
4.	Paper I	Life and Diversity from Annelida to Arthropoda and Genetics – I	**40**	**60**	4	3 hrs.
5.	Paper II	Life and Diversity from Molluska to Hemichordata and Genetics – II	**40**	**60**	4	3 hrs.
6.	Paper III	Practical	**40**	**60**	8	6 hrs. (Two Session) Morning & Evening
Total Semester I & II			200	300		

ANNEXURE-IV

B.SC. PART – I

GUIDELINES / INSTRUCTIONS FOR PRACTICAL (PAPER – III)

Max. Marks : 60 Time allowed : 6 Hours
Int. Assessment : 40

Note : Following exercises will be set in the examination as per marks assigned for each.

	Exercise	**Marks allotted**
1.	Dissection – One (Exposition, labeled diagram)	12
2.	Permanent Slide Preparation - one (Staining, identification, sketch)	06
3.	Museum specimens – eight (identification and classification)	24 (8x3)
4.	Ecological note – One specimen	04
5.	Permanent slides – Two (identification with reasons)	08 (2 x 4)
6.	Preparation of chromosome slide (root tip / gasshopper testis)	08
7.	Invertebrate collection and report	10 (5+5)
8.	Practical record and slides	08
9.	Viva-voce	10

Scheme of B.Sc. II (Zoology)

Semester – III					
Sr. No.		**Paper**	**Marks**		**Exam. Duration**
			Internal Assessment*	External Marks	
1.	Paper I	Life and Diversity of Chordates-I	**40**	**60**	3 hrs.
2.	Paper II	Mammalian Physiology – I	**40**	**60**	3 hrs.
Semester – IV					
3.	Paper I	Life and Diversity of Chordates-II	**40**	**60**	3 hrs.
4.	Paper II	Mammalian Physiology – II	**40**	**60**	3 hrs.
5.	Paper III	Practical	**40**	**60**	6 hrs. (Two Session) Morning & Evening
Total Semester III & IV			200	300	

*** 60 percent on the basis of result/ marks obtained in college test and 40 per cent on the basis of attendance of the students by the respective college / Institute.**

SYLLABUS

B.Sc. Part-II (Semester III & IV)

SEMESTER - III

Paper-I : Life and Diversity of Chordates – I

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

Functional morphology of the types included with special emphasis on the adaptations to their modes of life and environment. General characters and classification of all phyla upto orders with examples emphasizing their biodiversity, economic importance and conservation measures where required.

1. **Chordates:** Origin and Evolutionary tree.
2. **Protochordates:** Systematic position, distribution, ecology, morphology and affinities
   Urochordata: *Herdmania* – type study
   Cephalochordata; *Amphioxus* – type study

SECTION – B

3. **Cyclostomes:** Type study of *Petromyzon.*
4. **Pisces:** Scales & Fins, Parental care in fishes, fish migration.
   Types study of Labeo

SEMESTER - III

Paper-II : Mammalian Physiology – I

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. Introduction, Classification, Structure, function and general properties of proteins, carbohydrates and lipids.

2 Nomenclature, Classification and mechanisms of enzyme action.

3. Transport through biomembranes (Active and Passive), buffers

SECTION – B

4. **Nutrition:** Nutritional components; Carbohydrates, fats, lipids, Vitamins and Minerals. Types of nutrition & feeding, Digestion of dietary constituents, viz. lipids, proteins, carbohydrates & nucleic acids; symbiotic digestion. Absorption of nutrients & assimilation; control of enzyme secretion.

5. **Muscles:** Types of muscles, ultra-structure of skeletal muscle. Bio-chemical and physical events during muscle contraction; single muscle twitch, tetanus, muscle fatigue muscle, tone, oxygen debt., Cori's cycle, single unit smooth muscles, their physical and functional properties.

6. **Bones:** Structure and types, classification, bone growth and resorption, effect of ageing on Skeletal system and bone disorders.

SEMESTER - IV

Paper-I : Life and Diversity of Chordates – II

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. **Amphibia:** Origin, Evolutionary tree. Type study of frog (*Rana tigrina*), Parental Care in Amphibia
2. **Reptilia:** Type study of Lizard (Hemidactylus), Origin, Evolutionary tree. Extinct reptiles; Poisonous and non-poisonous snakes; Poison apparatus in snakes.

SECTION – B

3. **Aves:** Type study of Pigeon (*Columba livia*); Flight adaptation, Principles of aerodynamics in Bird flight, migration in birds.
4. **Mammals:** Classification, type study of Rat; Adaptive radiations of mammals dentition.

Note: Type study includes detailed study of various systems of the animal.

SEMESTER - IV

Paper-II : Mammalian Physiology – II

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. **Circulation:** Origin, conduction and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, fluid pressure and flow pressure in closed and open circulatory system; Composition and functions of blood & lymph; Mechanism of coagulation of blood, coagulation factors; anticoagulants, haempoiesis

2 **Respiration:** Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of hemoglobin, Bohr's effect, Haburger's phenomenon (Chloride shift), control / regulation of respiration.

3. **Excretion:** Patterns of excretory products viz. Amonotelic, ureotlic uricotelic, ornithine cycle (Kreb's – Henseleit cycle) for urea formation in liver. Urine formation, counter-current mechanism of urine concentration, osmoregulation, micturition.

SECTION – B

4. **Neural Integration:** Nature, origin and propagation of nerve impulse alongwith meddullated & non-medullated nerve fibre, conduction of nerve impulse across synapse.

5. **Chemical integration of Endocrinology:** Structure and mechanism of hormone action; physiology of hypothalamus, pituitary, thyroid, parathyroid, adrenal, pancreas and gonads.

6. **Reproduction:** Spermatogenesis, Capacitation of spermatozoa, ovulation, formation of corpus luteum, oestrous-anoestrous cycle, Menstrual cycle in human; fertilization, implantation and gestation.

B.Sc. Part-II

Paper-III : PRACTICAL

Max. Marks: 100
Time allowed:

1. Classification upto orders, habit, habitats, external characters and economic importance (if any) of the following animals:-

Protochordata : *Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura,* and *Amphioxus.*

Cyclostomata : *Myxine, Petromyzon* and *Ammocoetus larva.*

Chondrichthyes: *Zygaena, Pristis, Narcine* (electric ray), *Trygon, Rhinobatus, Raja* and *Chimaera.*

Osteichthyes : *Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostraczion, Tetradon, Echinus, Lophius, Solea* and *Polypterus.* Any of the Lung Fishes.

Amphibia : *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotie larva, Alytes, Bufo, Rana.*

Raptilia : *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise).

Aves : *Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto* and *Alcedo, Halcyon*

Mammalia : *Ornithorphynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Telix, Panthera, Canis, Herpestes, Capra, Pteropus*

2. Examine and dissect the following animals:

Herdmania	:	General anatomy
Labeo (locally available fish)	:	Digestive and reproductive systems: cranial nerves, Ear ossicle
Hemidactylus	:	Digestive, arterial, venous and urinogenital systems.
Rat	:	Digestive, arterial, venous and urinogenital systems.

3. Study of the skeleton of *Scoliodon, Labeo, Rana* (Frog), *Varanus,* Pigeon or Gallus and *Orcyctolagus/*rat, Palates of birds, skulls of dog & rabbit.
4. Study of the following prepared slides:

   Tornaria larva, T.S. *Amphioxus* (through different regionds). Oikopleura, Histology of rat (compound tissues), different types of scales.
5. Make permanent stained preparations of the following:

   Salpa, Specules, and Pharynx of *Herdmania, Amphioxus,* Cycloid scales, Zoological excursion and its report is compulsory in the practical examination.

PHYSIOLOGY PRACTICALS:

1. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
2. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.
3. Estimation of abnormal constituents of urine (Albumin, sugar, ketonebodies).
4. Use of Kymograph unity & respirometer.
5. Haematein crystal preparation.
6. Estimation of Hb.
7. DLC of Man/RBC count/WBC count.

B.Sc. Part-II

Paper-III:

Guidelines/instructions for practical

Max. Marks: 60 Time allowed: 6 Hours
Int. Assessment : 40 (2 Sessions)

Note : Following exercises will be set in the examination as per marks assigned for each.

1.	Dissection – One (exposition, labeled diagram)	:	12
2.	Temporary mounting – One (staining, identification, sketch)	:	05
3.	Museum specimens – five (identification, classification)	:	15
4.	Ecological note – one specimen	:	05
5.	Permanent slides – Three (identification with reasons)	:	09
6.	Bone – Two pieces (Identification & sketch)	:	10
7.	Physiology (Two exercises)	:	10
8.	Field excursion and report	:	08
9.	Practical record & slides	:	08
10.	Viva-voce	:	08

Scheme of B.Sc. III (Zoology)

Semester – V					
Sr. No.		**Paper**	**Marks**		**Exam. Duration**
			Internal Assessment*	External Marks	
6.	Paper I	Environmental Biology	25	75	3 hrs.
7.	Paper II	Evolution of Developmental Biology	25	75	3 hrs.
Semester – VI					
8.	Paper I	Aquaculture and Pest Management-I	25	75	3 hrs.
9.	Paper II	Aquaculture and Pest Management-II	25	75	3 hrs.
10.	Paper III	Practical	25	75	6 hrs. (Two Session) Morning & Evening
Total Semester V & VI			125	375	

SYLLABUS

B.Sc. Part-III (Semester V & VI)

(SEMESTER – V)

Paper-I : Environmental Biology

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. **Basic concepts of ecology:** Definition, significance. Concepts of habitat and ecological niche.
2. **Factors affecting environment:** Abiotic factors (light-intensity, quality and duration), temperature, humidity, topography; edaphic factors; Biotic factors.
3. Introduction to major ecosystems of the world.
4. **Ecosystem:** Concept, components, properties and functions; Ecological energetics and energy flow-food chain, food web, trophic structure; ecological pyramids concept of productivity.
5. **Biogeochemical cycles:** Concept, reservoir pool, gaseous cycles and sedimentary cycles.

SECTION – B

6. **Population:** Growth and regulation.
7. Concept of biodiversity and conservation of natural resources.
8. Migration in fishes and birds.
9. Parental care in animals.
10. **Population interactions:** Competition, predation, parasitism, commensalisms and mutualism.
11. **Environmental Pollution:** Air, water, soil and management strategies.

SEMESTER - V

Paper-II : Evolution and Developmental Biology

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. Origin of life.
2 Concept and evidences of organic evolution.
3 Theories of organic evolution.
4. Concept of micro, macro-and mega-evolution.
5. Concept of species.
6. Phylogeny of horse.
7. Evolution of man.

SECTION – B

8. Historical perspectives, aims and scope of developmental biology.
9. Generalized structure of mammalian ovum & sperm, spermatogenesis and Oogenesis, fertilization, parthenogenesis, different types of eggs and patterns of cleavage.
10. Process of blastulation and fate-map construction in frog and chick.
11. Gastrulation in frog and chick upto the formation of three germinal layers.
12. Elementary knowledge of primary organizers.
13. Elementary knowledge of extra embryonic membranes.
14. Concepts of competence, determination and differentiation.
15. Concept of regeneration.

SEMESTER - VI

Paper-I : Aquaculture and Pest Management-I

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

3. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
4. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. **Introduction to world fisheries:** Production, utilization and demand.
2. **Fresh Water fishes of India:** River system, reservoir, pond, tank fisheries; captive and culture fisheries, cold water fisheries.
3. Fishing crafts and gears.
4. Fin fishes, Crustaceans, Molluscs and their culture.

SECTION – B

Study of important insect pests of crops and vegetables :

5 **Sugarcane:**

(a) Sugarcane leaf-hopper (*Pyrilla perpusilla)*
(b) Sugarcane Whitefly (*Aleurolobus barodensis)*
(c) Sugarcane top borer (*Sciropophaga nivella)*
(d) Sugarcane root borer (*Emmalocera depresella)*
(e) Gurdaspur borer *(Bissetia steniellus)*

With their systematic position, habits and nature of damage caused. Life cycle and control of *Pyrilla perpusilla* only.

6 **Cotton:**

(a) Pink bollworm *(Pestinophora gossypfolla)*
(b) Red cotton bug *(Dysdercus Cingulatus)*
(c) Cotton grey weevil *(Myllocerus undecimpustulatus)*
(d) Cotton Jassid *(Amrasca devastans)*

With their systematic position, habits and nature of damage caused. Life cycle and control of *Pectinophore gossypiella.*

7 **Wheat:**

Wheat stem borer (*Sesamia inferens*) with its systematics position, habits, nature of damage caused. Life cycle and control.

8 **Paddy:**

(a) Gundhi bug *(Leptocorisa acuta)*
(b) Rice grasshopper *(Hieroglyphus banian)*
(c) Rice stem borer *(Scirpophaga incertullus)*
(d) Rice Hispa *(Diceladispa armigera)*

With their systematic position, habits and nature of damage caused. Life cycle and control of *Loptocorisa acuta.*

9 **Vegetables**

(a) *Raphidopalpa faveicollis* – The Red pumpkin beetle.
(b) *Dacus cucurbitas* – The pumpkin fruit fly.
(c) *Tetranychus tecarius* – The vegetable mite.
(d) *Epilachna* – The Hadda beetle.

Their systematics position, habits and nature of damage caused. Life cycle and control of *Aulacophora faveicollis.*

SEMESTER - VI

Paper-II : Aquaculture and Pest Management-II

External Marks: 60 **Time allotted: 3 Hours**
Internal Assessment : 40

Note : Nine questions are to be set in all and the candidates are required to attempt five questions including the compulsory question

1. Question 1 is compulsory consisting of 10 parts (1.5 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidates are required to attempt four questions, two from each section.

SECTION – A

1. **Seed production:** Natural seed resources – its assessment, collection, Hatchery production.
2. **Nutrition:** Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients).
3. **Field Culture:** Ponds-running water, recycled water, cage, culture; poly culture.
4. **Culture technology:** Biotechnology, gene manipulation and cryopreservation of gametes.

SECTION – B

5 **Stored grains:**

(a) Pulse beetle (*Callosobruchus maculatus)*
(b) Rice weevil (*Sitophilus oryzae)*
(c) Wheat weevil (*Trogoderma granarium)*
(d) Rust Red Flour beetles (*Tribolium castaneum)*
(e) Lesser grain borer *(Rhizopertha dominica)*
(f) Grain & Flour moth *(Sitotroga cerealella)*

Their systematic position, habits and nature of damage caused. Life cycle and control of *Trogoderma granarium.*

6. **Insect control:** Biological control, its history, requirement and precautions and feasibility of biological agents for control.

7. **Chemical control:** History, Categories of pesticides. Important pesticides from each category to pests against which they can be used. Insect repellants and attractants.

8. Integrated pest management.
9. Important bird and rodent pests of agriculture & their management.

B.Sc. Part-III

Paper-III : PRACTICAL

Max. Marks: 60
Int. Assessment : 40
Time allowed: 6 hours
(2 sessions M&E)

1. External morphology, identification marks, nature of damage and host of the following pests:

   (i) **Sugarcane:** Sugarcane leaf-hopper, Sugarcane whitefly, Sugarcane top borer, Sugarcane root borer, Gurdaspur borer (any two).

   (ii) **Cotton:** Red Cotton bug

   (iii) **Wheat:** Wheat stem borer

   (iv) **Paddy:** Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one).

   (v) **Vegetables:** *Aulocophora faveicollis, Dacus cucurbitas, Tetranychus tecarious, Epilachna* (any three).

   (vi) **Pests of stored grains:** Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour beetle, lessergrain borer (any three).

2. Stages of life history of silk moth and honey bee.

3. Identification of *Catle, Labeo rohita, L. calbasu, Cirrhius, mrigala Puntius sarana, Channa punctatus, C. marulius. C. stariatus, Trichogaster fasciata, Mystus seenghala, M. cavasius, M. tengra, Callichrous pabola, C. bimaculatus, Wallago attu, Prawns, Crabs, Lobsters, Calms, Mussels & Oysters.*

4. Chemical analysis of pond water and soil for pH, dissolved oxygen, free CO_2 nitrates, phosphates and chlorides.

5. A study of the slides of fish parasites.

6. A study of the different types of nets, e.g., cast net, gill net, drift net and drag net.

7. A visit to lake/reservoir/fish breeding centre.
8. Adaptative modifications in feet and beaks of birds.
9. Preparation of permanent/temporary slides of developmental stages of frog/mosquito.
10. Study of permanent slides of WM of chick embryo (13-18h, 24-36h, 36-48h, 48-72h).
11. Window preparation and identification of stages of development in chick egg.
12. **Histology:** Preparation of permanent histological slides of testis, ovary, kidney, intestine, liver of rat (H and E staining).

B.Sc. PART- III

Guidelines/ Instructions for Practical (Paper-III)

Max. Marks: 60
Int. Assessment : 40
Time allowed: 6 Hours
(2 session M&E)

1.	Chemical analysis of water/soil	:	10 marks
2.	Identification and Classification of specimens (Eight)	:	16 marks
3.	Ecological note on economically important specimen (two)	:	8 marks
4.	Identification of histological and embryological slides with reasons of identification (Two); feet and beaks of birds	:	8 marks
5.	Permanent preparation of histological slides (a) Section cutting and stretching (b) Staining, mounting, (c) identification & sketch	:	18 marks (6,6,6)
6.	Field report	:	10 marks
7.	Practical note book	:	8 marks
8.	Viva-voce	:	12 marks

Note: Field report to be submitted alongwith answer books.