SUBJECT - ZOOLOGY
SYLLABUS

B.Sc. I (Semester I)

LIFE AND DIVERSITY OF NON-CHORDATA

UNIT- I

1. Classification of Non-Chordata.
2. Phylum Protozoa: General characters.
3. Type study: Plasmodium vivax: Structure, Life-cycle.
4. Parasitic protozoan and human diseases': Malaria, Amoebiasis,Trypanosomiasis, Leishmaniasis .

UNIT-II

1. Phylum Porifera: General Characters.
2. Type study: Scypha: Habits and habitat, External features, cell types, spicules & Structure and significances of canal system
3. Phylum Coelenterata: General Characters,
4. Type study: Metridium: Habits and habitat, External features, Gastro-vascular cavity, Mesenteries, Reproduction.

UNIT-III

1. Phylum Platyhelminthes: General Characters.
2. Type study: Fasciola hepatica: Habits and habitat, External features, Digestive, Excretory, Reproductive system and Life cycle.
3. Phylum Aschelminthes: General Characters.
4. Type study, Ascaris lumbricoides: Habits and habitat, External features, Digestive,Excretory Reproductive system and Life cycle.

UNIT-IV:

1. Phylum Annelida: General Characters.
2. Type study: Leech: External features, Digestive, Excretory and Reproductive system.
3. Phylum Arthropoda: General Characters
4. Type study: Cockroach: Habits and habitat, External features,Digestive system, Respiratory system Reproductive system.

UNIT-V

1. Phylum Mollusca: General Characters.
2. Type study: Pila globosa: Habits and habitat, External features (Shell and Body), Digestive, Respiratory And Reproductive system.
3. Phylum Echinodermata: General Characters.
4. Type study: Asterias: Habits and habitat, External features, Digestive system, Water vascular system,

UNIT-VI

1.Phylum Hemichordates: General Characters, Body organization of Balanoglossus, Affinities of Balanoglossus with non-Chordata, and Chordata.

2. Corals, coral-reefs.
3. Parasitic adaptations in Helminthes: Morphological and physiological
4. Larval forms and their significance: Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria,

Practical

Two practical per week each of 3 period's durations. The Examination shall be of 4 hrs duration and of 50 marks.

I-Life and diversity of non-chordata

1. Observation, Classification up to classes and sketching of the following animals, (Specimens or Models)

Phylum Protozoa: *Plasmodium* trophozoite, *Euglena, Entamoeba histolytica.*
Phylum Porifera: Sycon, Bath sponge, *Euplectella.*
Phylum Coelenterata: *Obelia, Aurelia, Tubipora.*
Phylum Helminthes: *Taenia, Ascaris* (male & female).
Phylum Annelida: Nereis, Earthworm, Leech,
Phylum Arthropoda: Prawn, *Limulus, Aranea, Scolopendra, Julus,*Moth, Mosquito.
Phylum Mollusca: Chiton, Pila, Dentalium, Unio, Octopus.
Phylum Echinodermata: *Antedon, Holothuria, , Echinus,* Sea star,Brittle star
Phylum Hemichordata: *Balanoglossus*

2. Study of Permanent slides

L.S.Sycon, nematocyst, Ascaris egg, T.S. Ascaris through gonads,T.S.Leech through crop, Compound eye of insect, Radula, Gill lamila and Osphradium of *Pila*, Scolex and Gravid Proglottid of *Taenia*.

3. Anatomical Study through Computer Aided Techniques, Video Clipping Models, Photographs and other available resources :

a) Leech/Earthworm: Alimentary canal, Reproductive system, Nervous system,
b) Grasshopper/Cockroach: digestive system, Nervous system, Reproductive system
c) Culture of *Paramoecium and Volvox* (To be given to all students)

4. Mountings

a) Mosquito (Aedes, Culex and Anopheles) : wings, legs, mouth parts
b) Housefly: Mouth parts, legs, wings
c) *Paramoecium and Volvox*

Distribution of Marks during Practical Examination: Time : 4 hrs.

i) Identification and comments on spots (1-8) - 4 specimens, 4 slides	12 Marks
ii) Labelling of Anatomical diagrams provided (Two)	10 Marks
iii) Permanent stained micro preparation	08 Marks
iv) Study tour diary - …….....	04 Marks
v) Permanent stained micro preparation Submitted by examinee…….	04 Marks
vi) Certified class record - ……	05 Marks
vii) Check list of 20 locally available invertebrate fauna……	02 Marks
viii) Viva- voce ……..	05 Marks
Total: - …….	50 Marks

Note:

1) One or two short excursion / study tours are compulsory for observation of animals in their natural habitat.
2) Candidates shall be required to produce at the practical examination the following.
· Practical record book duly signed by the teacher in charge and Certified by the Head of the department as bonafide work of the Candidate.
· Five permanent stained micro preparations.
· Study tour report and field diary duly signed by the teacher.

Reference Books Recommended (All latest editions):

1) Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
2) Ayyar, E.K. and T.N.Ananthakrishnan, Manual of Zoology Vol.I (Invertebrata),

Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
3) Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
4) Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi – 110051.
5) Waterman, Allyn J. etal., Chordate structure and Function, Mac Millan and Co Newyork.
6) S.N.Prasad : Text Book of Invertebrate Zoology.
7) Vishwanathan : Invertebrate Zoology.
8) Majpuria : Invertebrate Zoology.
9) Dhami and Dhami : Non-chordate Zoology.
10) Baini Prasad: Indian Zoological memoir. Pila.
11) R.L.Kotpal : Modern Text Book of Invertebrate Zoology.
12) Malviya M.K. Invertebrate Zoology, by Rajdhool publications.
13) S.S.Lal, Practical Zoology, Invertebrate.
14) Bhamrah H.S.and Kavita Juneja A text book of Invertebrate Zoology, Anmol Publication Pvt. Ltd,. New Delhi.
15) Verma and Agarwal Practical Zoology, Invertebrate
16) - Barnes R.D. Invertebrate Zoology -(W.B. Saunders Co.)
17) P.G.Puranik and Thakur, Invertebrate Zoology.

B.Sc.I (Semester II)

There shall be following paper and practical for B.Sc.Part-I Semester Two examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory Sessions and 25 practical sessions during the complete semester). There shall be one compulsory paper of 3hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which, 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Marks
1) Paper-II: Cell and Developmental Biology
Theory (Written) ……. 80
Internal assessments ….. 20
2) Practical: ……. 50

Total : 150 Marks

CELL AND DEVELOPMENTAL BIOLOGY

UNIT- 1.
1 General organization of Prokaryote and Eukaryote Cell.
2. Ultra structure and functions of, Plasma membrane
3. Ultra structure types and functions of, Endoplasmic reticulum

UNIT-II:
1. Ultra structure and functions of, Golgi complex
2. Ultra structure and functions of Ribosome
3. Ultra structure and functions of Mitochondria.
4. Ultra structure and functions of Lysosomes.

UNIT-III:
1. Ultra structure and functions of nucleus and nucleolus.
2. Chromosome and its general organization.
3. Structure of Polytene and Lamp brush Chromosome.

UNIT-IV:

1. Mitosis and its significance
2. Meiosis and its significance.
3. Gametogenesis: Spermatogenesis and oogenesis
4. Fertilization: Types of fertilization, Mechanism of fertilization,

UNIT V:

1. Cleavage, and development up to coelome formation in amphioxus
2. Cleavage, Blastulation and gastrulation up to the formation of three germ layers in Frog, Fate map.
3. Cleavage, Blastulation and gastrulation up to the formation of three germ layers in chick.
4. Extra embryonic membranes in chick: Development and significance.

UNIT-VI:

1. Placentation in mammals; Types and Functions of Placenta.
2. Parthenogenesis: Types and, Significance,
3. Regeneration in invertebrates and vertebrates.
4. Elementary idea of, sources, types and use of Stem cells.

Practical

I) Cell Biology: -

1. Use, care and maintenance of microscope.
2. Bacterial Culture, Gram staining.
3. Permeability tests using erythrocytes.
4. Preparation of Polytene chromosome in Chirnomous or Drosophila larva.
5. Preparation of various stages of mitosis in Onion root tip.
6. Preparation of various stages of meiosis in insect's testis.

II) Developmental Biology.

1. Study of stages of Gametogenesis in rat/frog, (Permanent Stained Slides)
2. Study of different of types animal eggs
3. Study of developmental stages (Life Cycle) of Cockroach, Housefly, mosquito, Butterfly, Moth, Frog (Any Four).
4. Sperm in physiological saline using phase contrast optics.
5. Demonstration of developing chick through available resources.
6. Developmental stages of frog: Cleavage, blastula, gastrula, neurula, and tadpoles through available resources.
7. Permanent slides of chick embryos at 24, 36, 48, 72 hrs of incubation.
8. Study of different types of placentas with suitable histological slides or visual diagrams

Distribution of Marks during Practical Examination: Time: 4 hrs.

i) Identification and comments on spots	
(1-8) 4Cytological, 4 Embryological	16 Marks
ii) Cytological Preparation	10 Marks
iii) Comments on given Life Cycle	10 Marks
iv) Certified class record -	05 Marks
v) Submission of photographs of any three crop pests	04 Marks
viii) Viva- voce	05 Marks

	Total: - 50 Marks

Reference Books Recommended (All latest editions):

1) C.B.Pawar ;Cell Biology:
2) Alberts Bray, Lewis, Raff, Roberts and Watman Molecular Biology of the cell (Garland)
3) Balinsky, An introduction to Embryology, (CBS College Publishers)
4) Grant: Biology of developing system (Halt, Reihart and Winston.)

5) Gilbert: Developmental Biology (Sinauer)
6) Puranik P. G., A Text Book of Embryology S. Chand & Co.
7) Browder L.W. Erickson C.A. & Williams Developmental Biology,
1992 3rd edition, R J. Saunders //. College, Publications, London
8) Tyagi, Verma and Agrawal: Chordate embryology.
9) Dr.R.A.Malu, et.al Text Book of Cell Biology and Developmental
Biology - Shivneri ….. Publishers, Amravati.
10) Korak Kanti Chaki, Gautam Kundu, and Supriti Sarkar: Introducation
to General Zoology Vol. 1 and Vol.2
11) De Robertis Cell and Molecular biology

List of necessary Equipments / Apparatus required for the Zoology Practical.

1. Compound Microscope - 16
2. Dissecting Microscope - 16
3. Dissection Box - 02
4. Dissecting Trays - 25
6. Phase contrast microscope - 01
7. Computer set with LCD.
8. Glass aquarias - 3
9. Dissection Accessories.
10 Scale reader
11 Hot air ovens.
12 Weighing Balance (Single Pan Balance)
13. Refrigerator

B.Sc. II (Semester III)

There shall be the following paper and practical for B.Sc. Part-II Semester III examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25practical sessions during the complete semester). There shall be one compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1) Paper-I:

Life and diversity of Chordata and concepts of evolution

Marks Allotted

Written examination……. 80

Internal assessment…….. 20

2) Practical: 50

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Total: …….. 150 Marks
Paper -3 S-Zoology
LIFE AND DIVERSITY OF CHORDATA AND CONCEPT OF EVOLUTION

Unit I:

Phylum Chordata: Origin of Chordata.

Protochordates: –

Type study: Amphioxus: Habits and habitat, External Characters - Digestive system and feeding, Excretory organs, gonads- Affinities of Amphioxus.

Affinities of Agnatha:

Series Pisces:
Type study: Scoliodon sarrokawah (Dogfish) – Habits and habitat, External Characters, Digestive system: alimentary canal and digestive glands, Respiratory system: respiratory organ and mechanism of respiration, circulatory System: Structure and working of Heart, major arteries and veins, Lateral line receptors, Migration in fishes-Types, causes and significance.

Unit II:

Class Amphibia:
Type Study – Rana tigerina, Habits and habitat, external, characters. Respiratory organs- Circulatory system; Structure of Heart, major arteries and veins, urinogenital system.. Parental care in amphibia.

Class Reptilia:
Type study- Calotes versicolor- Habits and habitat, External characters,
circulatory system- Structure of Heart, major arteries and veins. Urinogenital system,
snake venom and anti-venom,

Unit III:

Class Aves:
Type study: Pigeon-Columba livia Habits and habitat, External characters, Respiratory system, urinogenital system. Flight adaptations, Migration in birds.

Class Mammalia:
Primitive mammals: salient features of Prototheria and Metatheria, Morphology of mammalian endocrine glands.
Aquatic mammals.

Unit IV:

Evolution: Meaning and scope,
Indirect Evidences of evolution: Evidences of organic evolution- morphological and anatomical, physiological and biochemical, embryological.
Direct evidences of evolution: Paleontological evidences: Fossils and fossilization: petrified fossils dead and preserve bodies cast and moulds, trails and foot prints, condition for
fossilizations. –, Radioactive carbon dating of fossils -
Living fossils. Importance of fossil record. Evidences from connecting links- Peripatus and Archaeopteryx.

Unit. V:

Evolutionary Processes: Natural selection: Darwinism. Lamarckinsm.
Speciation - definition of species –mode of speciation – Allopatric and Sympatric speciation.
Modern concept of organic evolution-Neo Darwinism.
Population Genetic: Hardy –Weinberg equilibrium, Gene pool, Gene frequency, Genetic drift, Convergent, Divergent and Parallel evolution, Coevolution

Unit VI:

Adaptive radiations in mammals.
Evolution of Man- brief accounts of Parapithecus, Dryopithecus, Ramapithicus, Australopithecus, Homocreatus Neanderthal man, Cro-Magnon man and modern man.
Evolution of heart, aortic arches, and urinogenital systems of vertebrates
Animal Adaptation: Desert aquatic and terrestrial.

REFERENCE BOOKS:

1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Times Mirror/Mosby College Publication. St. Louis. 1065 pp.
2. A life of Vertebrate – K.Z.Young, ELBS Oxford University Press.
3. A Text Book of Chordates – H.S.Bharmah and Kavita Juneja.
4. Modern Text Book of Zoology Vertebrate – R.L.Kotpal, Rastogi Publication Meerut.
5. A Text Book of Chordates – A .Thangamani, S, Prasannakumas, L.M.Narayanan and
6. Arunmugam Saras Publication, Nagercoil.
7. A Text Book of Chordate Zoology – R.C.Dalela –Jaiprakashnath Publication Meerut.
8. Chordate Zoology – E.L.Jordan and P.S.Verma, S.Chand and Company New Delhi.
9. A Text book of Practical Zoology Vertebrate – S.S.Lal, Rastogi. Publication, Meeru
10. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
11. Chordate Zoology and Elements of Animal Physiology, Jordan, E.K.and P.S. Verma, 1995. 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
12. Zoology of Chordates, Nigam, H.C., 1983. Vishal Publications, Jalandhar - 144 008, 942.
13. The Phylum Chordata, Newman, H.H., 1981. Satish Book Enterprise,Agra - 282 003, 477 pp.
14. Text Book of Zoology, Vol. II (Chordata), Parker and Haswell, 1964.A.Z.T,B.S. Publishers and Distributors, New Delhi – 110 051, 952 pp
15. Chordate Structure and Function, Waterman, Allyn J. et al., 1971.
16. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition – New Haven, Tale University Press.
17. Colbert, E.H. 1969 - Evolution of Vertebrates, Wiley, New York.
18. Mayr, Ernst, 1973 - Animal Species and Evolution. The Belknap Press of Harvard University, Cambridge.
19. Dobzansky, T. 1976 - Genetics and the Origin of Species. Oxford and TBH Publishing Co. New Delhi.
20. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
21. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
22. Life, Origin, Evolution and Adaption (2002) - Sanjib Chattopadhyay. Books and Allied (p) Ltd.
23. P.S.Verma & V.K.Agrawal.(2008) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology –S. Chand Publications.
24. Dhabade. D.S. I. A. Raja. R.A>Gulhane. A.P.Charjan. A.K.Patki., And P.S.Patil.,.A Text Book of Evolution: Sanket Publicatin. Washim
25. Zoology for Degree Students, Prof.Dr.V.K.Agrawal.

Practical

Two practical per week of 3 periods duration. Examination shall be of 5 Hrs duration and of 50 marks.

A) Taxonomy of Chordata:
1. General characters and classification of Phylum Chordata:
2. General characters and Classification up to orders of the following chordates or as per the availability in the laboratory from the major orders, (Specimens or Models):
Protochordata: Herdmania, Doliolum Salpa, Amphioxus.
Agnatha: Petromyzon, Myxine.
Pisces: Scoliodon, Torpedo, Acipenser, Exocoetus. Hippocampus
Amphibia: Ichthyophis, Salamander, Bufo, Hyla.
Reptilia: Varanus, Phrynosoma, Chameleon, Cobra, krait, Russell's viper, Typhlops, Hydrophis
Aves: Duck, Woodpecker, Kingfisher, Parrot.
Mammalia: Mongoose, Squirrel. Manis. Bat., monkey,

B) Anatomical Study through Computer Aided Techniques, Video Clipping Models, Photographs and other available resources :
1.Frog : Viscera, Digestive system, male reproductive system and female reproductive system .
2. Rat\Mouse\Rabbit - Digestive system, Arterial system, Venous system ,.Reproductive system.

C) Slides of hair impression of different locally available mammals.

D) Osteology. Fowl , Rabbit (excluding loose bones of skull).

D) Evolution:

1. Study of fossils, and living fossils.
2. Study of Evidences of evolution.
i) Analogous and Homologous organs.
ii) Connecting links (Peripatus, Archaeopteryx, Echidna,Duck bill platypus)
iii) Embryological evidences
3. Application of Hardyweinberg`s law
4. Study of Mesozoic Reptiles (By Models/Charts).
5. Mimicry, coloration in animals through available examples in the laboratory.
6. Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

E) Histological Slides :- Amphloxus, Frog, Rat
Slides :
Amphioxus : T.S, Oral hood, Pharynx, Tail
Frog :- T.S. lung, Stomoch, Kidney, Intestine,

DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION.

1.Labelling of Anatomical diagrams provided (at least two)	10
2. Slide of hair impression	05
3. Spotting. (Specimens, Slides, bones, fossil)	10
4. Practical on evolution -	10
5. Class record duly signed by teacher in charge and certified by H.O.D.....	05
6. Viva – Voce	05
7. Submission of check list of twenty five locally available vertebrates.	05

Total Marks: 50

B.Sc. II (Semester IV)

There shall be the following paper and practical for B.Sc. Part-II Semester IV examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions) during the complete semester. There shall be one compulsory theory paper of 3 hours duration the semester, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1) Paper-I: Marks Allotted
Advanced Genetics and Animal Ecology.
Written examination…….. 80
Internal assessment ……. 20
2) Practical: 50

Total: …….. 150 Marks

ZOOLOGY Paper 4 S
ADVANCED GENETICS AND ANIMAL ECOLOGY

UNIT I:

Concept of genes.
Mendel`s laws of hereditary – Monohybrid – Laws of dominance, law of segregation. Dihybrid cross – Law of independent assortment. Interactions of genes: , Supplementary factor, complementary factor, duplicates factor, inhibitory factors, and lethal factors – dominant and recessive.

UNIT II:

Linkage - Types of linkage, linkage group, arrangement of linked genes, and significance of linkage.
Crossing over – Mitotic and meiotic crossing over, Mechanism of crossing over,

theories of crossing over – Darlington's theory, breakage and exchange theory, and copy choice theory. Types of crossing over – Single, double and multiple crossing overs. Factors affecting crossing over, Significance of crossing over.
Multiple alleles: Multiple alleles in relation to eye color in Drosophila.Blood group in man, Erythroblastosis foetalis

UNIT III:

Sex determination: Autosomes and sex chromosomes, Sex determination in animals, Chromosomal Theory. Genic Balance Theory. Environmentally and hormonally controlled sex determination, Gynandromorphs. Genetic disorders; Sickle cell anemia, , Huntington's chorea. Diabetes mellitus. Non-disjunction: Turner's syndrome, Klinefelter 's syndrome, Down's syndrome.Edwrd`s Syndrome,
Biochemical genetics: Cystic fibrosis, Phenylketonuria, Albinism, Alkaptonuria, Goiters, cretinism.
Sex linked genetic disorders and their inheritance in man; Hemophilia and color blindness.

UNIT IV:

Genetic Screening and parental diagnosis: - Parental, Carrier, Predictive, CVS (Chorionic Villous Sampling), Amniocentesis, Gene probe and DNA analysis. Genes in Human Heredity: - Inheritance of eye color. Skin color.
Recessive genes and consanguineous marriages Genetic counseling: - Risk of marriages in affected family. Birth control measures (male and female).
Kinds of twins: - Identical, Fraternal, Siamese twins. .Significance of twins study

UNIT V:

Ecology: concept and scope:
Abiotic factors:
Water: Properties, water problem in terrestrial and aquatic habitat. Temperature: Temperature range, Temperature tolerance, Effects of temperature on animals. Homeotherms, poikilotherms. Dormancy, hibernation, aestivation & diapauses.
Light: Spectral distribution, Biological effects of light on aquatic and
terrestrial animals: Reproduction, Metamorphosis, pigmentation, vision, photo kinesis, phototropism, photoperiodism, migration.
Biotic factors:
Intra specific and interspecific associations, Predation, parasitism, Antagonism. , commensalisms, mutualism, competition, (Gauze's Principle).

UNIT VI:

Ecosystem: Relationship between habitat and ecological niche - Autotrophic and heterotrophic producer, consumer - trophic level - energy flow in an ecosystem - food chain - food web - pyramids - Ecotypes. Homeostasis of ecosystem.
Terrestrial ecosystem: Classification and Biomes, Aquatic ecosystem: Fresh water ecosystem-Lentic and lotic ecosystem, Marine ecosystem: Characteristics, salinity, temperature - pressure, zonation and stratification
Estuarine ecology:
Characteristics types, fauna and their adaptations.

REFERENCE BOOKS:

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – P.S.Verma & V.K.Agrawal.
2. Principles of Genetics – S.K.Jain
3. Genetics – P.K.Gupta
4. Applied Genetics – C.Pmmanuol.
5. Genetics: M.W.Strickberger, New York.
6. Principles of Genetics: Sinnot, Dunn and Dobzansky.
7. Principles of Genetics: Edidon Gardner.
8. Genetics. Verma, P.S. and V.K. Agarwal.. S.Chand & co. New Delhi
9. Gene VI .Lewin, B. 1998. Wiley Eastern Ltd., New Delhi.
10. Human Genetics. Rothwell, N.V.1979. Prentice Hall of India, New Delhi

Practical

Two practical per week of 3 periods duration. Examination shall be of 5 Hrs. duration and of 50 marks.

A) Genetic experiments:
1. Recording of Mendelian traits in man.
2. Detection of monohybrid and dihybrid cross with the help of plastic beads.
3. Culturing Drosophila using standard methods. Drosophila – male and female identification, Mutant forms (from pictures)
4. Demonstration of bar bodies.
5. Preparation of human Karyotypes from Xerox pictures.
6. Photo slides for, Turner's syndrome, Klinefelter's syndrome, Down's syndrome
7. Detection of syndrome from chromosome spread picture.
8. Study of following human genetic traits and application of Hardy- Weinberg Principle to them – Baldness, length of index and ring Finger, attached and free earlobes, rolling of tongue, PTC taste. Other notable traits.

B) Ecology
1. Use of pH meter for estimation of pH in soil samples, b. Use of pH meter for estimation of pH in water samples
2. Estimation of Dissolved oxygen, salinity, pH, free CO2, carbonates and bicarbonates, calcium in water samples.
3. Adaptations of aquatic and terrestrial animals based on a study of museum specimens. Such as rocky, sandy, muddy shore animals, flying and burrowing animals.
4. Study of natural ecosystem and field report of the visit.
5. Field collection methods;
6. Identification of common animals - Soil invertebrate diversity, diversity of birds and mammals in parks / botanical gardens, threats to local biodiversity.
7. Construction of a food web diagram based on a field visit.
8. Mounting of plankton.
9. Qualitative analysis of fresh water plankton

C) General: -
1. Visit to a National Park or sanctuary, and submission of report.

DISTRIBUTION OF MARKS FORPRACTICAL EXAMINATION.

1. Ecological: Estimations -/Analysis	10
2. Spotting. (2Spot from Sec.A & 3 Spot from Section B of 2 Marks each)	10
3. Micro preparation.	05
4. Genetic experiment -	10
5. Class record	05
6. Viva – Voce	05
7. Submission of study tour report.	05
Total Marks :	50

B.Sc. III (Semester V)

Theory -5 S-ZOOLOGY:
(ANIMAL PHYSIOLOGY AND ECONOMIC ZOOLOGY)
Marks Allotted

1) Written examination…….. 80
Internal assessment…..……. 20
2) Practical : 50

Total: …… 150 Marks

Paper 5 S-ZOOLOGY
(ANIMAL PHYSIOLOGY AND ECONOMIC ZOOLOGY)
Max. Marks - 100 Total Period – 75

UNIT I:

Respiration:
Structure of respiratory organs: Gills and Lungs
Mechanism of respiration: regulation of ventilation in lungs, exchange of gases at respiratory surface,
Respiratory pigments in animals: Haemoglobin, Haemocyanin, Haemerythrin, chlorocruorin
Transport of gases: O2 and CO2 transport,
Neurophysiologic control of respiration,

Circulation:
Blood: Definition and its constituents, functions of blood.
Heart: Structure of human heart, pace maker, Cardiac cycle. Blood coagulation factors, blood groups A, B, O system and Rh-factor.

UNIT II: Muscle Physiology:

Types of Muscles: striated, non-striated and cardiac muscles E.M. Structure and **Chemical** Composition of striatedmuscle, Neuromuscular junction. Mechanism of muscle contraction by Sliding filament theory
Physical and Chemical changes during muscle contraction: muscle twitch, tetanus, isometric and isotonic contraction, summation of Stimuli, all or none law, fatigue, rigor mortis.

UNIT III:

Nerve Physiology: Neuron: E.M. Structure of nuron andTypes : Myelinated and non-Myelinated nerve fibres. Conduction of Nerve impulse, Resting potential, initiation and propagation of action potential, Saltatory transmission,
Neurotransmitters (Acetylcholine, dopamine, GABA, Serotonin, Epinephrine, Nor-Epinephrine), Synapse and synaptic transmission

Chemical co-ordination: Endocrine system: Hormones and their physiological roles of- Pituitary, Thyroid, Parathyroid, Adrenal, Islets of Langerhan's,
Hormonal disorders: Dwarfism, Gigantism, Acromegaly, Goiter, Myxoedema, Cretinism, Osteoporosis,

UNIT IV:

Reproductive Physiology: Estrous and menstrual cycle, hormonal control of reproduction in males and female, Structure and physiology of mammalian Placenta.
Homeostasis and conservative regulation:
Osmoregulation and ionic regulation in aquatic animals.
Osmoregulation in terrestrial animals Ammonotelism, ureotelism and uricotelism.
Thermoregulation in Poikilotherms and Homeotherms.

UNIT V:

Agricultural Zoology: Economic importance of Insects
Beneficial insects – Spider, Mantis, Ladybugs, Damsel bug, Mealybug destroyer, Soldier beetle, Green lacewing, Syrphid fly, Tachinid fly, Ichneumon waspand Trichogramma wasp.
Harmful Insects –Stired food grain pests, their injuries and control
Pests of, – Cotton, Sugarcane and Jowar. Damage and Control
Economic importance of Rodents, Snakes, Owls and Bats.

Apiculture - Sericulture –

Unit VI:

Aquaculture
Aquaculture: definition, scope, importance and present status in India.
Fresh water fish culture: types of fish ponds:Nursary, rearing and stocking, design and construction of fish pond, fertilizers used for fish development.
Hatching Happas, Chinease Circular Hatchery, CIFE, Mumbai, hatching model, Induced breeding and hypophysation, Modern drugs used in fish breeding.
Freshwater system: monoculture, polyculture, integrated aquaculture, cage culture, pen culture.
Fish products and byproducts: Fish liver Oil, Fish body oil, Fish manure, Fishleather

Practicals:

1. Detection of blood groups in human being.
2. Differential counts of blood.
3. Estimation of hemoglobin percentage with the help of haemometer.
4. R.B.C. count.
5. W.B.C. count.
6. Preparation of haemin crystals
7. Measurement of blood pressure.
8. Action of salivary amylase on starch.
9. Qualitative detection of nitrogenous waste products (Ammonia,urea, uric acid) in given sample.
10. Demonstration of kymograph unit, Respirometer through available resources.
11. Observation and identification of Insect Pests of local crops, and predator insects.
12. Life Cycles of Honey bee, Lac insect, Silk Moth.
13. Histological Slides of major organs of Respiratory systems, circulatory system, Nervous system, Different types of Muscles, Endocrine glands, testis, ovary.
14. Study of locally available fishes, Indian major carps, Exotic carps, Common carp.

Distribution of marks for practical examination:

Time: 5 Hrs.	Marks
01. Physiological Expt.	
a) Major…….. .	10
b) Minor …….. . ……	05
02. Economic Zoology & Histology	
a) Spotting (A-F) ……	12
b) Description and Comments on Topic from Unit V and VI……	08
04. Class record duly signed by teacher charge and certified by H.O.D. …….	05
05. Study tour report. ……	05
06. Viva -voce…….	05

	Total Marks 50

REFERENCES

1. Prosser and Brown : Comparative Animal Physiology
2. Hisotlogical Slides of Respirator systems, circulatory system,Muscles, Nervous system Endocrine glands , Gonads, placentae
3. Guyton : Physiology
4. Best and Taylor : Physiological basis of Medical practice
5. C Hoar, W.S.. General and comparative Physiology. Prentice Hall of India.
6. Lehninger. L.. Biochemistry. W.H. Freeman & co.
7. Nagabushnam, R.. Animal physiology. S.Chand & co.
8. Martin, D.W. P.A. Mayes and W.W. Rodwell,.Harper's Review of Biochemistry lange Medical Publications.
9. Prosser, C.L. and F.A.Brown Comparative Animal physiology. W.B. Suanders.
10. Rama Rao, A.V.S.S.. Biochemistry. UBSPD.

11. Stryer. L. Biochemistry Wiley International
12. Verma, P.S. and V.K. Agarwal.. Animal physiology. S.Chand & co.
13. Wilson, J.A., Principles of Animal Physiology, Macmillan
14. Chatterjee, C.J; Human Physiology(Vol-I and II)
15. Economic Zoology, G.S. Shukla, V.B. Upadhyay (2006)
16. Text Book of Applied Zoology, Pradip. V Jabde (2005).
17. Mac E. Hadley: Endocrinology, Prentice Hall, International Edition, 2000

B.Sc. III (Semester VI)

There shall be the following paper and practical for B.Sc. Part-III Semester VI examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall a compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for five hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Theory -6 S-ZOOLOGY
(MOLECULAR BIOLOGY AND BIOTECHNOLOGY)
Marks Allotted
1) Written examination…….. 80
Internal assessment ……. 20
2) Practical: 50

Total: 150 Marks

Paper- 6 S-ZOOLOGY
(MOLECULAR BIOLOGY AND BIOTECHNOLOGY)
Max. Marks - 100 Total Period – 75

UNIT – I:

Genetic material-definition, Experiments to prove DNA as genetic material:Griffiths transformation experiments with bacteriophage infections, Avery and co-workers experiments, and Hershey and Chase experiment. Chemistry and types DNA(A,B,Z)Mitochondrial DNA; Chemistry, types and function of RNA: mRNA, tRNA and rRNA and Non Genetic RNA.

UNIT - II:

DNA replication: semi conservative method; experiment by Messelson and Stahl.
Concept of genes, one gene one enzyme hypothesis, one gene one Polypeptide theory.; A brief account of Concept and action of cistron, split genes, overlapping genes, jumping genes, Genetic diseases: Spinocerebellar ataxia.

UNIT–III:

Genetic code and its features, Protein synthesis transcription and processing of mRNA, translation-different steps, Gene regulation: (promoter and operator), Operon models, and Lac-operon model of E.Coli. Genetic regulation in Eukaryotes-Britten Davidson Model.

UNIT–IV:

Mutation: Definition-mutation theory of DeVries different types of mutations,molecular basis of mutation:substitution and frameshift mutations,chromosomal aberrations structural(deletion, addition, inversion and translocation),numerical (euploidy and aneuploidy). Natural and induced mutations, significance of mutations.

DNA repair process.
Polymerase chain reaction (PCR). Southern, Northern and Western blotting techniques, DNA finger printing.

UNIT – V:

Biotechnology:
Genetic Engineering: Recombinant DNA technology and gene cloning-enzymes in recombinant DNA technology, Splicing and cloning of genes, vectors (plasmid and phage vectors), gene Transfer. Somatic cell hybridization, hybridoma technology, and monoclonal antibodies. Practical applications and suspected hazards of biotechnology and genetic engineering in animals.

UNIT-VI:

Immunology: Introduction to immune system: Innate and adaptive immunity, Types and production of immune cells; Complement system.
Humoral Immunity: Antigen and haptens, Antibody: types function, and production.
Cell mediated immunity: T-cell receptors, T helper cell and lymphocyte activation
Role of cytotoxic T-cell. ELIZA Technique RIA.

Practicals:

1. Microtechnique scope and importance.
2. Preparation of fixatives - Alcohol, Acetone, Formalin, Bouin's fluid, Cornoy fluid, Formal sublimate.
3. Collection of various tissues/organs from slaughter house for micro-technique
4. Preparation of Alcoholic grades, dehydration and clearing of tissues
5. Use and care of Oven
6. Embedding and block making, trimming of block.
7. Use and Care of different types of Microtome.
8. Honing and stropping Knives
9. Section cutting and spreading,
10. Preparation of various stains -Borax carmine Acetocarmin, Aceto-orcein, Haematoxyline, eosin.
11. Staining of the sections, (Double Staining), mounting.
12.Camera Lucida. Use and Drawings
13.Oculomicrometer scale/ similar micro-measurements use
14. Introduction to models of PCR, Southern blotting through available resources.
15.Vital Staining of mitochondria by using Janus, Green B stain.
16. Extraction of DNA by using salt, detergent and enzymes from natural sources from any animal tissue / plant material
17. Study of Operon models through available resources.
18. Application of DNA finger printing through available resources.

Distribution of marks for practical examination:

Time: 5 Hrs. Marks

01 Microtechnique.

a) Trimming and Section cutting of the Paraffin blocks …….	05
b) Spreading of ribbons……	05
c) Staining of the given slide ……	10
c) Use of camera Lucida/ Ocular micrometer scales ……..	05
02. Any one practical based on Sr.14 to 18 of the practical list ……	10
03. Permanent slides submitted by the examinee (5 Slides)……	05
04. Class record duly signed by teacher incharge and certified By H.O.D……..	05
05. Viva - voce …….	05

Total Marks	50

REFERENCES

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2. Goodenough, U. Genetics. Saunders Coolege Publishing International, New York.

3. Klug, W.S. and M.R.Cummings. Concepts in Genetics; Charles E.Merrill Publishing Co. London.
4. Kumar, H.D. Molecular biology and biotechnology. Vikas Publishing House, New Delhi.
5. Lewin, B.. Gene VI . Wiley Eastern Ltd., New Delhi.
6. Rothwell, N.V. Human Genetics. Prentice Hall of India, New Delhi.
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13. Dubey, R.C.1995. Text book of Biotechnology. S.Chand & Co.
14. Glick, B.R. J.J. and Pastermak. 1998. Molecular Biotechnology. SSM Press, Washington.
15. Gupta, P.K. Elements of Biotechnology. Rastogi Publications, Meerut.
16. Jogdand, S.N. Advances in Biotechnology. Himalaya Publishing, New Delhi.
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