RAICHUR UNIVERSITY, RAICHUR

Regulations and Syllabus

for

P.G.DEPARTMENT OF STUDIES IN ZOOLOGY

(I-IV Semesters)

(Under Choice Based Credit System)

w.e.f.
(2023-24 onwards)

1. The CBCS syllabus for the M.Sc. Zoology course was drafted after several deliberations and discussions and placed in the Meeting of the Board of Studies in Zoology for approval and implementation from the academic year 2023- 24 and onwards (copy enclosed).

2. The course structure: The student desirous for M.Sc. Degree in Zoology, shall complete the required credits as mentioned in the course structure. The Department also offers OET paper in II and III Semester with 2 credits for each paper for students of other subjects. The details of HCT, SCT, OET and HCP, SCP courses of I, II, III and IV Semester, Credits, Teaching hours, Exam hours, Internal and Semester end examinations marks and Total marks are given in the course structure table.

3. Each candidate shall undertake compulsory **"Study Tour" or "Field Visit"** so as to study animal biodiversity in nature or visit to different Museum, Animal Houses, National Parks, Wild Life Sanctuaries, Biosphere Reserves and other important institutions working on Animal Research. The duration of the tour shall be maximum of up to 5days. The study tour shall be undertaken compulsory during III (Third) Semester of M.Sc. Course. Candidates have to submit the detailed tour report at the time of SCP: 3.1a or SCP: 3.1b, which carries 5 marks.

M.Sc. Zoology Course Structure

(Semester, Course Code, Course title, Credits, Teaching, practical Hrs. Examination Hrs. and Marks)

Semester	Course Code & Title	No. of Credit Points	Teaching Hrs /Week	Exam. Hrs.	Internal Assessment Marks	Semester End Examination Marks	Total Marks
I	HCT 1.1:Biosystematics	04	04	03	20	80	100
	HCT 1.2:Biology of Non-chordates and Chordates	04	04	03	20	80	100
	HCT 1.3:Evolutionary Biology	04	04	03	20	80	100
	SCT 1.1a: Applied Zoology **OR** SCT 1.1b: Computer applications and Bioinformatics	04	04	03	20	80	100
	HCP 1.1: Practical based on HCT 1.1	02	04	03	10	40	50
	HCP 1.2: Practical based on HCT 1.2	02	04	03	10	40	50
	HCP 1.3: Practical based on HCT 1.3	02	04	03	10	40	50
	SCP 1.1a: Practical based on SCT 1.1a **OR** SCP 1.1b: Practical based on SCT 1.1b	02	04	03	10	40	50
II	HCT 2.1: Genetics and Biostatistics	04	04	03	20	80	100
	HCT 2.2: Molecular Cell Biology	04	04	03	20	80	100
	HCT 2.3: Parasitology	04	04	03	20	80	100
	SCT 2.1a: Immunology **OR** SCT 2.1b: Biochemistry	04	04	03	20	80	100
	OET 2.1a: Economic Zoology **OR** OET 2.1b: Animal Behaviour	02	02	02	10	40	50
	HCP 2.1: Practical based on HCT 2.1	02	04	03	10	40	50
	HCP 2.2: Practical based on HCT 2.2	02	04	03	10	40	50
	HCP 2.3: Practical based on HCT 2.3	02	04	03	10	40	50
	SCP 2.1a: Practical based on SCT 2.1a **OR** SCP 2.1b: Practical based on SCT 2.1b	02	04	03	10	40	50
III	HCT 3.1: Developmental Biology	04	04	03	20	80	100
	HCT 3.2: Animal Physiology	04	04	03	20	80	100
	HCT 3.3: Ethology	04	04	03	20	80	100
	SCT 3.1a: Wild life Biology and Conservation **OR** SCT 3.1b: Entomology	04	04	03	20	80	100
	OET 3.1a: Reproduction and Development **OR** OET 3.1b: Diversity of Animals	02	02	02	10	40	50
	HCP 3.1: Practical based on HCT 3.1	02	04	03	10	40	50
	HCP 3.2: Practical based on HCT 3.2	02	04	03	10	40	50
	HCP 3.3: Practical based on HCT 3.3	02	04	03	10	40	50
	SCP 3.1a: Practical based on SCT 3.1a **OR** SCP 3.1b: Practical based on SCT 3.1b	02	04	03	10	40	50
IV	HCT 4.1: Endocrinology and Reproductive Biology	04	04	03	20	80	100
	HCT 4.2: Environmental Biology	04	04	03	20	80	100
	SCT 4.1a: Tools and Techniques in Biology **OR** SCT 4.1b: Histology and Histochemistry	04	04	03	20	80	100
	HCP 4.1: Practical based on HCT 4.1	02	04	03	10	40	50
	HCP 4.2: Practical based on HCT 4.2	02	04	03	10	40	50
	SCP 4.1a: Practical based on SCT 4.1a **OR** SCP 4.1b: Practical based on SCT 4.1b	02	04	03	10	40	50
	HCT 4.3: Project Work /Internship	06	06	03	20	130	150
	Total Marks (I to IV Semester) 2500 Credits =106						

HC: Hard Core; SC: Soft Core   OE: Open Elective T: Theory P: Prcaticals

Mandatory Skills: I -Semester- Communication Skill -**2 Credits;**

II- Semester- Computer Skill- **2 Credits;**

III-Semester-Personality Development Skill- **2 Credits**

SEMESTER- I

HCT- 1.1: BIOSYSTEMATICS

Total: 64 Hrs

Unit I: **16 Hrs**

Science of Systematic Zoology

Concept of Biosystematics, Historical review of taxonomic philosophies, Stages in taxonomy, Tasks of taxonomy, Strategies of taxonomic studies, Systematics as a profession.

Species concept, Types of species and speciation:

Historical prospective of species concepts (typological, nominalist, biological) polytypic and monotypic species, ring species. Intraspecific groups (Variety, morphs, geographical subspecies, temporal subspecies, Race, clines) Models and mechanisms of speciation- sympatric, allopatric , stasipatric

Unit II: **16 Hrs**

Taxonomic Collection and post collection processes

Collection: Purpose, Value, Scope of collection, Content of Collection, significance of museum collections, legal aspects of collecting animals. Preparation and packaging of specimen for posting

Preservation - methods, taxidermy, factors responsible for the deterioration of museum specimens. Curating of collections- museum collection policy, Preparation of material for study, Housing & Cataloging, Exchangeable and expendable materials, loans

Identification: Systematic process of sorting & labelling, Procedure of Identification; Identifications services.

Unit III: **16 Hrs**

Trends and approaches in taxonomy

Morphological- General structures, anatomy, special structures, embryological &   Cytogenetic, Ecological – Habitats & hosts, food, parasitism, seasonal variations. Behavioural – Ethological isolating mechanisms courtship, behavioural patterns Biochemical - Serological, proteins, metabolic factors. Molecular – Major rRNA genes, Cytochrome b, Cytochome C, Cytochrome C Oxidase & Other conserved sequences. Numerical approaches.
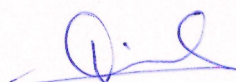
Unit IV: **16 Hrs**

Classification and Phylogenetic analysis

Components of classification; Procedure of Classification (Phenetic, Cladistic, inferring relationship by similarities), Presentation of classification - Linnaean/Taxonomic hierarchy, possible ways of constructing a phylogenetic tree. Phylogenetic analysis- Purpose, terminology, methods of phylogenetic analysis (Phonetic method, dendrogram method, pairwise distance; cladistics method, parsimony, maximum likelihood) phylogenetic lineages.

Application of Zoological Nomenclature

Taxonomic Keys and their significance, taxonomic publications, International rules of nomenclature – Historical and contemporary situation; International Code of Zoological Nomenclature (ICZN); DNA bar coding, the taxonomic bottle neck, digitization of taxonomic data/ bioinformatics
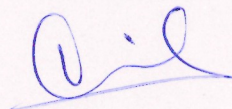
HCP-1.1: PRACTICAL COURSE IN BIOSYSTEMATICS BASED ON HCT-1.1

1. Identification and Classification of specimens from Phylum Protozoa to Phylum Echinodermata
2. Identification and classification of specimens of Protochordates
3. Identification and classification of specimens from Fishes to Mammals
4. Identification of venomous and non-venomous snakes
5. Biodiversity of Mollusca, Crustaceans, Fishes along the Coast of Karwar
6. Biodiversity of Amphibians, Reptiles, Birds and Butterflies from Western Ghats
7. Biodiversity of Reptiles from Western Ghats
8. Estimation of Biodiversity of few animals in the Western Ghats
9. Cluster analysis by using suitable example
10. Morphometric and meristic measurement of fishes
11. Construction of different types of Taxonomic key for the identification of animals
12. Construction of phylogenetic trees by taking suitable examples
13. Animal preservation techniques (Physical and chemical methods)
14. Taxidermy – Stuffing of small animals
15. Statistical Applications in Biosystematics
16. Any other practical depending on feasibility.

REFERENCE BOOKS RECOMMENDED:

1. Principles of Systematic Zoology, Mayr, E.& P. D. Ashlock (1991) 2nd Edition, McGraw-Hill, Inc.
2. Principles of Animal Taxonomy-G.G.Simpson-Columbia University Press, New York 1961
3. Theory And Practice of Animal Taxonomy -V C Kapoor, SOxfod IBH Co. Pvt. Ltd. New Delhi, 1998
4. Book of Indian Animals By Daniel Prater, Bombay Natural History Society
5. Statistics for Biology, 3rd Edition, Campbell, R.C. Cambridge University Press, 1989
6. Biostatistics Zar
7. Statistical Methods in Biology By Bailey N.T.J. 3rd Edition, Cambridge University Press, 1994
8. Intoduction to Biostatistics, Forthofer R.N. & Lee E.S. Academic Press New York 1995.
9. The Insects: Structure and Function 4th edition, Chapman R.F. Cambridge University Press, 1998
10. The Insects: An Outline of Entomology 2nd Edition, Gullan P.J. & Cranstan P.S. Blackwell Science, 2000
11. Biodiversity: Measurment & Estimation By Hawkswoth D.L., Chapman & Hall 1995
12. Collection & Preservation of Animals By Jairajpuri M.S. Zoological Survey of India 1990
13. Biodiversity : Principles & Consevation Kumar & Asija Agobios (India) 2000

HCT-1.2: BIOLOGY OF NON-CHORDATES AND CHORDATES

Total: 64 Hrs

A. Biology of Non-chordates:

Unit I: 16 hrs

Body plan, movement, feeding and respiration:

Body plan: Evolution and significance of bilateral symmetry, coelom, metamerism; protostomia and deuterostomia.

Movement: Amoeboid, flagellar and ciliary movements; hydrostatic movement; locomotion in terrestrial arthropods.

Feeding: Microphagy; filter feeding in annelida, arthropoda and mollusca. macrophagy: cnidaria and platyhelminthes. feeding patterns in insects.

Respiration: Respiratory organs of invertebrates; gills, book gills, rectal gills, respiratory tree, book lungs and tracheal system. Mechanism of respiration.

Unit II: 16 hrs

Excretion, nervous system, reproduction and larval forms and minor phyla:

Excretion: Excretory organs of invertebrates; flame cells, nephridia, coelomoducts and malphigian tubules. Mechanism of excretion.

Nervous system: Mechanoreception, chemoreception and photoreception. Primitive nervous system in Cnidaria and Echinodermata; Advanced nervous system in Arthropoda and Mollusca.

Reproduction: Patterns of reproduction; Asexual and sexual reproduction.

Larval forms: Evolution and significance of trochophore larva, nauplius larva, dipleurula larva.

Phylogeny and systematic position of Ctenophora, Entoprocta and Ectoprocta.

B. Biology of Chordates:

Unit III: 16 hrs

Phylogeny and systematic position, origin, evolution and adaptive radiation:

Phylogeny and systematic position of Urochordata and Cephalochordata. General organization; Retrogressive metamorphosis.

Origin, evolution and adaptive radiation in Pisces, Amphibia, Reptilia and Aves.

Unit IV: 16 hrs

Adaptive radiation and endoskeleton of mammals, comparative anatomy and adaptations:

Origin and evolution of monotremes, marsupials and placentals. Dentition in mammals.

Endoskeleton: Overview of skull, axial skeleton, appendicular skeleton.

Comparative anatomy: Integument and its derivatives; Heart and aortic arches in anamniotes and amniotes; Anatomy of brain; Kidney in vertebrates.

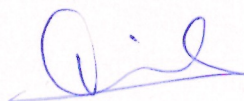Adaptations: Aerial and terrestrial; Mechanism of flight in birds.

HCP 1.2: PRACTICAL COURSE IN BIOLOGY OF NON-CHORDATES AND CHORDATES BASED ON HCT-1.2

A. Practical Course in Biology of Non-Chordates

1. Biology of Earthworm
   a) Study of External Features of Earthworm b) Study of Digestive System of Earthworm
   c) Study of Nervous System of Earthworm d) Mounting of Setae, Ovary, blood glands and Nephridia
2. Biology of Prawn
   a) Study of External features b) Dissection of Digestive system
   c) Dissection of Nervous System d) Mounting of Appendages
3. Study of external features of Star fish
   a) Study of Oral and Aboral view of Star fish b) Study of Water Vascular System of Star fish
4. Study of
   a) Protostome larval forms b) Deuterostome larval forms
5. Mounting of Malphigian tubules from Insects
6. Study of locomotion in
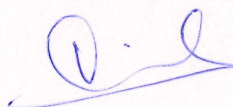   a) Amoeboid b) Ciliary c) Flagellary d) Movement by leech

B. Practical Course in Biology of Chordates

7. Biology of Scoliodon
   a) Study of External Features of Scoliodon
   b) Study of Digestive System of Scoliodon
   c) Study of Male Urogenital system of Scoliodon
   d) Study of Female Urogenital system of Scoliodon
   e) Study of Cranial Nerves of Scoliodon
   f) Study of Placoid Scales and Ampulla of Lorenzini
   g) Study of Brain of Scoliodon
   h) Study of membranous labyrinth
8. Biology of Rat
   a) Study of External features
   b) Study of circulatory system
   c) Study of Male Reproductive system
   d) Study of Female Reproductive system
   e) Study of Brain
9. Study and mounting of scales from bony fishes
10. Comparative anatomy of heart, brain, integument & its derivatives, aortic arches, urogenital system,
11. Osteology of frog, birds and rat
12. Any other practical's depending upon feasibility

REFERENCE BOOKS RECOMMENDED:

1. Invertebrate Structure and Function E J W Barrington ELBS 1971
2. Text Book of Invertebrate Zoology 7th Edition Vol. I Marshall A J and Williams W D.
3. An Introduction to Invertebrates: Studies in Biology Moore J. Cambridge University Press
4. Invertebrates Hyman Vol I to V
5. Kerkut S.A. & Gilbert Comparative Insect Physiology, Biochemistry and Pharmacology. Pergman Press New York
6. Invertebrate Zoology 2nd Edition Robert D Barness Saunders Publication 1968
7. Vertebrate palaeontology By Alfred Romer Chicago University Press
8. The Vertebrate Body 3rd edition by Alfread Sherwood Romer. Pvt. Ltd. Vakils, Feffer & Simon Pvt Ltd.
9. Life of Vertebrates 3rd edition Young J Z. Oxford University Press
10. Vertebrates Comparative anatomy, Function & Evolution By Kenneth Kardong TATA McGraw – Hill Publication
11. Evolution of Vertebrates by Colbert E H Willey New York
12. Book of Indian Animals By S.H. Prater BNHS Oxford Press
13. Book of Indian Amphibians and Reptiles, J.C. Daniel, BNHS Oxford Press
14. Marine Mammals of India. Kumaran Sathasivam, BNHS Oxford Press
15. Studies on the Structure and Development of Vertebrates. Goodrich E.S. McMillan Company London
16. Fish and Fisheries of India Jhingran V G Hindustan Publication New Delhi

HCT-1.3: EVOLUTIONARY BIOLOGY

Total: 64Hrs

Unit I: **16 Hrs**

Introduction
Overview of evolutionary thoughts
Theories of Evolution
Contributions of Lamark and Lamarkism; Contribution of Charles Darwin, Alfred Russel Wallace and Thomas Malthus – Theory, Postulates and Evidences for Natural selection. Natural selection in action –Industrial melanism; Darwin's Finches, Experimental evidences of Natural selection – Endler's guppies; concept of inclusive fitness.

Unit II: **16 Hrs**

Population and Evolutionary Genetics
Gene frequencies in Mendelian Populations, Hardy- Weinberg Law of genetic equilibrium and its applications, Conditions for the maintainance of genetic equilibrium, Factors operating against Hardy-Weinberg Law, Concept of gene pool. Inbreeding; Measurement of inbreeding -inbreeding coefficient, Panmictic index, Assortative and Disruptive mating, Heterosis- Mechanisms and examples.
Elemental Forces of Evolution
Mutations and types of mutation; selection and types of selection; Random genetic drift; migration.

Unit III: **16 Hrs**

Polymorphism
Chromosome polymorphism, allozyme polymorphism and DNA polymorphism - Adaptive genetic polymorphism; Balanced polymorphism; Genetic co-adaption and linkage disequilibrium.
Molecular Phylogenetics
Molecular phylogenetics (Kinds of molecular data used in phylogenetic analysis,
Phylogenetic considerations based on nucleotide and amino acid data); Molecular clock; Neutral theory of evolution and evolution random walk, chromosome phylogeny in Drosophila

Unit IV: **16 Hrs**

Concept of Species and Speciation
Isolating mechanisms (Geographic isolation; Reproductive isolation): Models of speciation– Allopatric, sympatric and stasipatric. Mechanism of Speciation.

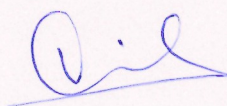**Impact of Darwin's thoughts in understanding human health and disease**
Proximate Vs Ultimate causes of disease; Design defects; Evolution of Defense Mechanisms; allergy; Evolution of antibiotic / pesticide resistance

HCP 1.3: PRACTICAL COURSE IN EVOLUTIONARY BIOLOGY BASED ON HCT-1.3

1. Evidence for principle of organic evolution – Homologous structure
2. Evidence for principle of organic evolution – Serial Homology
3. Evidence for principle of organic evolution – Analogous structures
4. Embryological evidences in favour of evolution
5. Study of Vestigial organs
6. Study of Fossils
7. Study of Living fossils and Connecting links
8. Determination of genotypic frequency from observed phenotypic frequencies in a population by application of Hardy – Weinberg Principle
9. Application of Hardy – Weinberg principle to determine the allelic frequency in blood group in man
10. Experiment to elucidate the principle of over reproduction that leads to struggle for existence
11. Study to elucidate that every individual is unique variations are universal
12. Experiment to demonstrate How natural selection operates
13. Modification of structure for new function that have lost its original function
14. Any other practical's depending on the feasibility

REFERENCE BOOKS RECOMMENDED:

1. Origin of Species By Charles Darwin
2. Descent of Man By Charles Darwin
3. Genetics and the Origin of Species. Columbia. Dobzhansky Th. (1964)
4. Evolution. Surjeet Publication. Dobzhansky Th. (1976)
5. Evolutionary Analysis. Prentice Hall Freeman S. and Jon C. Herron (1998)
6. Evolutionary Biology. Sinauer. Futuyma D. J. (1998)
7. Principles of Population Genetics. Sinauer Hartl D. L. and A. G. Clark (1989 & 1997)
8. The Neutral Theory of Molecular Evolution. Kimura M. (1984)
9. Fundamentals of Molecular Evolution. Sinauer. Li Wen-Hsiung and Dan Graur (1991)
10. Animal Species and Evolution. Belknap Press. Mayr E. (1966)
11. Evolution. Blackwell Publication. Ridley M. (1993)
12. Modes of Speciation. Freeman White M. J. D. (1978)
13. Animal Behaviour: An Evolutionary Approach. Al Cock.
14. Evolution. Jones and Bartlett. Strickberger M. W. (2000)

SCT-1.1a: APPLIED ZOOLOGY

Total: 64 Hrs

Unit I: 16 Hrs
Apiculture:

Apiculture: Life cycle, foraging and colony organization in different species; Bee keeping practices in India. Composition and uses of honey; Bee products; Lac insect- life cycle.

Sericulture:

Classification of silkworms based on moultinism, voltinism and geographical distribution; Popular silkworm breeds and hybrids. Life cycle of *Bombyx mori;* Diseases and pests of silkworm: protozoan, bacterial, viral and fungal diseases (mode of infection, transmission, prevention and control measures). Cultivation and uses of Lac.

Unit II: 16 Hrs
Fisheries:

Definition, Scope and Status of fish culture; Techniques of culturing fishes: Composite fish culture; Induced breeding. Ornamental fishes; Shell fishes (Prawn and pearl culture).Fish seed technology: Natural collection, bund breeding, induced breeding, seed transportation.

Transgenic fishes; Super males; Cryopreservation of gametes.

Fish farm management: Management of Hatcheries, Nurseries, Rearing ponds, and Stocking ponds.

Preservation and processing of fish and fish by-products. Diseases of fishes and their control: protozoan, fungi, bacterial and viral.

Unit III: 16 Hrs
Poultry:

Indigenous and Exotic Poultry Breeds. Techniques and methods of breeding; Poultry products; Nutritive value of egg and meat. Poultry diseases: Viral, bacterial, fungal, protozoan and Helminth diseases and their control, vaccines for infections.

Dairy science:

Indigenous and Exotic breeds. Principles and methods of breeding. Modern trends in breeding dairy animals. Dairy products: Processing, preservation and marketing of milk and milk products. Nutritive value of milk. Dairy pathology: Viral, bacterial and parasitic (Endo-Ecto) infections. Vaccination and control of diseases.

Unit IV: 16 Hrs
Vermiculture:

Life cycle of earthworm; Establishment of vermiculture unit; Earthworm as a tool for conversion of waste material into vermicompost; Types of earthworm; Earthworm as Fish and Poultry feed; Vermiwash.

Insect Pest Management:

Crop pests: Life cycle and damaged caused by pests of cotton, sorghum, pulses and fruits. Household pests; Integrated Pest Management. Mass multiplication of bio-control agents.

SCP 1.1a: PRACTICAL COURSE IN APPLIED ZOOLOGY BASED ON SCT-1.1a

1. Vermitechnology: Study of Digestive system in Earthworm.
2. Vermitechnology: Mounting of setae, blood glands, nephridia and ovary of Earthworm.
3. Apiculture: Bee keeping appliances: Study of digestive system in Honey bee.
4. Apiculture: Mounting of poison apparatus, pollen basket, pollen brush, wax glands and mouth parts of Honey bee.
5. Insect pest management: Study of agricultural and horticultural pests and bio control agents.
6. Fisheries: Economically important freshwater fishes: (*Catla catla, Labio rohita, Cirrhinus mrigala, Cyprinus carpio, Wallago attu, Clarius batrachus, Mystus seengala and Channa punctatus).*
7. Fisheries: Marine fishes: Sardine, Mackerel, Trygon, Scoliodon, Bombay duck and Pomfret). Shell fishes: Prawn, Pearl oyster and Sepia.
9. Silkworm Biology: Life cycle of *Bombyx mori.* Study of digestive system of larva. Mounting of silk gland and spiracles.
10. Study of Silkworm pathogens
11. Study of lac insect and their products
12. Poultry: Study of Different breeds: Study of Ecto and endo parasites. (Mode of infection, prevention and control measures).
13. Any other practical's depending on feasibility

REFERENCE BOOKS RECOMMENDED:

1. Sathe T.V. Vermiculture & Organic farming
2. Smyth JD Animal Parasitology. Cambridge University Press 1996
3. Chapman RF Insects – Structure and Function IV Edition Cambridge University Press
4. Imms AD General Text Book of Entomology. Vol I & II Champman & Hall London
5. Jhingran VG. Fish and Fisheries of India. Hindustan Publishing Corporation New Delhi
6. Mishra RC Prospectives in Indian Apiculture Allied Scientific Publication
7. Pedigo LP Entomology and Pest Management IV Edition Prentice – Hall Publication
8. Srivastava KP Text book of Applied Entomology Vol I & II Kalyani Publication
9. Von Embden HF Pest Control 2nd Edition Cambridge University Press
10. Alford: A textbook of Agricultural Entomology, Blackwell Science Ltd. 1999
11. Dhaliwal and Arora: Trends in Agricultural Insect Pest Management, Commonwealth Publ., New Delhi, 1994
12. Gillot: Entomology (2nd ed.) Plenum Press, New York, 1995.
13. Tazima. Y. 1958. Silkworm egg. CSB Publication, Bombay.
14. Yashimoro Tanaka. 1964. Sericology, CSB Publication, Bombay.
15. Tanaka, Y. 1953. "Genetics of the silkworm, Bombyx mori" – advances in genetics, Demerec.M.
16. (Ed), Vol.5, Academic press, New York.
17. Tazima, Y. !964. " The genetics of the Silkworm". Logos Press Ltd., London.
18. Tazima, Y. 1978. The silkworm an important laboratory tool. Kodnasha Ltd., Tokyo.
19. Govindan, R., Narayanswamy, T.K. and Devaiah,M.C. 1998. Principles of silkworm pathology. Serscientific Publishers, Bangalore.

SCT 1.1b: COMPUTER APPLICATIONS AND BIOINFORMATICS

Total: 64 Hrs

Unit I: **16 Hrs**

Computer fundamentals and organization- Computer hardwares and softwares, programming languages, operating system, input and output devices, computer memory. Word processing spread sheet calculations and database. Overview of MS office.
Computer networks, internet and its applications.

Unit II: **16 Hrs**

Introduction to Bioinformatics data and databases – Types of Biological data:- Genomic DNA, Complementary DNA, Recombinant DNA, Expressed sequence tags, Sequence-Tagged Sites, Genomic survey sequences; Primary Databases:- GenBank, EMBL, DDBJ; Composite Databases:- NRDB, UniProt; Literature Databases:- Open access and open sources, PubMed, PLoS, Biomed Central, NAR databases; Bioinformatic Resources:- NCBI, EBI, ExPASy, RCSB.

Unit III: **16 Hrs**

Bioinformatics Database search engines – Text-based search engines (Entrez, DBGET / LinkDB). Sequence similarity based search engines (BLAST and FASTA). Motif-based search engines (ScanProsite and eMOTIF). Structure similarity based search engines (Combinatorial Extension, VAST and DALI). Proteomics tools:- ExPASy server, EMBOSS.

Genome Databases – Eukaryotic genomes with special reference to model organisms:- Yeast(SGD), Drosophila (FlyBase), C.elegans (WormBase), Rat, Mouse, Human (OMIM / OMIA)etc.

Unit III: **16 Hrs**
Sequence Databases – Nucleotide sequence Databases:- GenBank, EMBL, DDBJ; Protein sequences Databases:- Swiss-Prot, TrEMBL, UniProt, UniProtKB, UniParc, UniRef, UniMES; Sequence motifsDatabases:- Prosite, ProDom, Pfam, InterPro, Gene Ontology; Sequence file formats:- GenBank, FASTA, PIR, ALN/ClustalW2.

SCP-1.1b: PRACTICAL'S COURSE IN COMPUTER APPLICATIONS AND BIOINFORMATICS BASED ON SCT-1.1b

A: COMPUTER APPLICATIONS IN BIOLOGY

1. Introduction to Computer and Components of the computer
2. Central Processing Unit and Mother Board
3. Input devices: a) Key board;   b) Mouse;   c) Scanner
4. Output devices: a) Printer;   b) Monitor;
5. Storage devices:a) Hard Disk; b) Floppy Disk; c) Compact Disk ; d) Modem;
   e) Pen Drive; f) USB
6. Microsoft Paint
7. Microsoft Office- a) MS Word ; b) MS Excel ; c) MS Power Point
8. Computer interfacing with Equipment-a) Scanning (MRI);   b) Microscope (Computer Camera)
9. Access to Internet: a) E-Mail ; b) Creating an E-Mail Account ; c) Internet Browsing ;
   d) Search Engines

B: BIOINFORMATICS

10.Bioinformatics Resources: NCBI, EBI, DDBJ, RCSB, ExPASy
11. Database search engines: Entrez, DBGET
12. Open access bibliographic resources and literature databases
a. PubMed b. BioMed Central c. Public Library of Sciences (PloS) d. CiteXplore.
13. Bioinformatics Resources at the species level
a. ICTV Database b. AVIS c. Viral genomes at NCBI
14. Sequence databases: a. Nucleic acid sequence databases: GenBank, EMBL, DDBJ;
b. Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL, UniParc;
c. Repositories for high throughput genomic sequences: EST, STS, GSS.
d. Genome Databases at NCBI, EBI, TIGR, SANGER.
15. Structure Databases: PDB, NDB, PubChem, ChemBank, FSSP, DSSP
16. Derived Databases: InterPro, Prosite, Pfam, ProDom
17. Sequence file formats: GenBank, FASTA
18. Protein and nucleic acid properties: Proteomics tools at the ExPASy server, EMBOSS
19. Any other experiments depending on feasibility

REFERENCE BOOKS RECOMMENDED:

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004
2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999
4. Snedecor D.W. and Cochran W.G. 1967. Statistical Methods. Ed. VI. Oxford and IBH Publishing Co., New Delhi.
5. Robert R. Sokal & James F. Rohlf. 1994. Biometry- The Principles and Practice of Statistics in Biological Research. 3rd ed. W. H. Freeman & Company publishers.
6. Samuel, M.L., 1991.Statistics for Life Sciences, Dellen Publishing Co, San Francisco.
7. Arthur M. Lesk, 2002. Introduction to Bioinformatics, Oxford University Press, New York
8. Satish Jain, O level made simple: Information Technology, BPB publications
9.Young, S. S. Computerized data acquisition & Analysis is for life Sciences: A Hands-on guide. Cambridge University Press, 2001.